Transport
for NSW

Demolition and Replacement of Structures at the Oyster Farm, Woolooware Bay

Review of Environmental Factors

Prepared by APP Corporation Pty Limited and Transport for NSW

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Executive Summary

The Proposal

Transport for NSW (TfNSW) proposes to demolish and replace the existing overwater structures at "The Oyster Farm" located on Captain Cook Drive, Woolooware Bay, as shown on Figure 1 and 2. The existing structures have degraded overtime and require replacement to ensure that the existing oyster aquaculture activities can continue in an upgraded modernised facility. No change to the existing use is sought.

Amendments to the State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021, gazetted on 31 May 2022, allow for the proposal to be carried out under Section 5 of the Environmental Planning and Assessment Act 1979 as development without consent. The amendments to the SEPP under Section 11.8 do not require development consent for oyster aquaculture activities identified under clause 5.19(6) of the Sutherland Local Environmental Plan, being: oyster aquaculture on land that is within or is partially outside of a priority oyster aquaculture area.

As part of the proposed works, the following structures are to be demolished:

A. Endeavour Oysters Nursery, Cleaning & Operations Building

B. Endeavour Oysters Lunch and Gear Rooms

C. Endeavour Oysters Sundry Buildings

D. Endeavour Oysters Main Over-Water Walkway

E. Endeavour Oysters Secondary Walkways to Sundays Buildings

F. Endeavour Oysters Amenities and Store

G. Endeavour Oyster Shop and Workshop / Store

H. Previously Wetland Oysters Building

I. Previously Wetland Oysters Tank Platform

These structures are to be replaced with the new Buildings 1, 2 and 3. Each building will be supported by vertical steel piles. New raised walkways will provide access to each building. Two pontoons will also be provided, adjoining Building 2 and Building 3.

The proposed construction of new structures will be undertaken in a staged manner following commencement of demolition works to support the continued oyster aquaculture activities at the site. The new structures will replace those existing structures outlined above and will include new raised walkways connecting the structures. The proposed structures are identified as Buildings 1, 2 and 3, which will consist of steel fixed piles embedded into the seafloor. Two pontoons are also proposed that will be free-floating and attached to fixed structures.

Buildings 1 and 3 will be connected to the existing seawall and will be fixed and elevated above the water level. The technique proposed is for progressive overwater construction, which involves progressively installing piles and floor structure starting from the land and progressing out over the water. The piling equipment is to be supported by the completed piles which extends out to install the next row of piles.

The construction materials for the proposed structures consist of:

- corrugated roofing
- external and internal cladding

- fibre reinforced polymer (FRB) wager system or similar
- steel piles to be protected with corrosion protection
- all fixings of stainless steel and structural steel with protective treatments and external finished with colours that are sympathetic to the environment.

The infrastructure proposed includes all of the lead-in and service reticulation on the land site and the overwater structures to support the continued operations. New service infrastructure includes:

- Underground high and low voltage cables,
- Underground NBN cables,
- Sea water pipes.
- Potable water pipes,
- Gravity and pressure sewer pipes,
- Distribution board and main switchboard,
- Services and NBN pits,
- Ausgrid Kiosk Substation, and
- 2m Electrical Easement

The proposal would be constructed over a duration of up to twelve (12) months starting mid-2022. The proposal is staged to minimise the disruption to the current operator, who is currently located on the site.

Need for the Proposal

Oyster faming has operated from the site for several decades and TfNSW together with the Department of Primary Industries (DPI Fisheries) want to continue to support the aquaculture (Sydney Rock Oyster farming) industry at Woolooware Bay. The New South Wales oyster aquaculture industry is the state's most valuable fishery and accounts for most of the state's aquaculture production. New South Wales is Australia's largest producer of edible oysters, which is the fourth largest aquaculture industry in Australia. The strategic need for this proposal is to demolish and replace the aging site structures that are no longer fit-for-purpose to support the continued operations of the oyster farm.

The new replacement structures are of a contemporary form and materiality which will suitably support and accommodate the oyster aquaculture activities by meeting modern operational and safety standards. The modernisation of site structures, including elevated and over-water walk-ways will also provide for compliant access arrangements across the site. The Disability Inclusion Action Plan 2018–2022 is Transport for NSW's plan for delivering high quality services to all customers including those with disability, including compliance with the relevant disability standards.

Proposal objectives

The objectives of the proposal include:

- Improve working conditions for staff and ensure the upgrade complies with Work Health and Safety (WHS) requirements and the Building Code of Australia.
- Provide new high-quality infrastructure to enable all personnel access including those with a disability. The structures are to be compliant with the disability standards.
- Support the aquaculture industry in Woolooware Bay by building modern infrastructure and facilities to support the continuation of the long-established use at the site.
- Undertake the activity in an environmentally sensitive and sustainable manner to protect aquatic biodiversity and wetlands.
- Stage the activity works to minimise distribution to the existing operator at the site.

Options considered

Two concept design options were presented to stakeholders as follows:

Option 1 - Do Nothing

This option would retain the current site conditions, including the dilapidated over-water structures to support the continuation of the commercial oyster farming.

Option 2 – Demolish and Replacement of Structures

This option involves the demolition of all existing over-water structures and construction of new replacement structures (via landside) predominantly, with support from barges.

Option 2 has construction risk compared to the ongoing maintenance burden and costs associated with Option 1.

However, Option 2 was identified as the preferred option as it was considered more equitable, meets the objectives of the proposal and provides value for money.

The proposed development, being Option 2, meets the objectives of the proposal and was chosen for the following reasons:

- The proposed new structures have been purposefully designed and will be specifically constructed to support improved working conditions for staff.
- The upgrades will be made in accordance with WHS requirements and the BCA.
- The upgrades will provide new high-quality infrastructure to enable all personnel access including those with a disability.
- The provision of these new facilities will better enable the long term use of the site as an aquaculture operation.
- The structures are to be compliant with the disability standards and are to be constructed to enable disabled access.
- The proposed contemporary structures will be easily maintained and cost-effective over the long term.
- The proposed new structures will be constructed of materials sympathetic to the surrounding environment. These materials and external finishes will blend with the surrounding aquatic environment and will not be an offensive addition to the foreshore area.
- The redevelopment of the site allows for sustainably sourced materials to be used. Proceeding with this option is a better outcome than retaining the existing structures on site.

As such, this option directly aligns with the proposal objectives.

Statutory and planning framework

The proposed demolition and construction of overwater structures can be carried out under the State Environmental Planning Policy (Biodiversity and Conservation) and Sutherland Local Environmental Plan 2015.

Recent amendments to the SEPP, gazetted on May 31, 2022, under section 11.8 allow for certain types of oyster aquaculture activities in the Georges River catchment to be carried out without development consent. This amendment was introduced to eliminate an historical inconsistency between the SEPP and section 5.19(6) of the Sutherland LEP 2015, which permits development for the purposes of oyster aquaculture without development consent:

(a) on land that is wholly within a priority oyster aquaculture area, or

(b) on land that is partly within and partly outside a priority oyster aquaculture area, but only if the land outside the are is no more than 0.1 hectare in area.

In this instance, (b) applies as the proposed overwater structures and associated works are to be carried out predominantly within the mapped priority oyster aquaculture area. The works will extend beyond the mapped priority oyster aquaculture area by no more than 0.1 hectares. Accordingly, the proposal can be assessed under Division 5.1 of the Environmental Planning and Assessment Act, 1979. Development consent from Sutherland Shire Council is not required. The proposal does not trigger an approval or development consent under State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) or State Environmental Planning Policy (Precincts—Eastern Harbour City) 2021.

Community and stakeholder consultation

Consultation with the Department of Planning, Industry and Environment (DPIE) National Parks and Wildlife Services (NPWS) Department of Primary Industries (DPI) Fisheries and has been undertaken during the preparation of this REF. Consultation with Sutherland Shire Council is ongoing. Should the proposal proceed to construction, consultation with the community and stakeholders would continue throughout the construction phase.

Environment impacts

The main environmental impacts of the proposal and the safeguards and management measures to address the impacts are summarised below:

Hydrological issues, Water Quality, Waste management

The proposal involves activities that would cause physical disturbance to the seabed sediments including piling, use of barges (including jack-ups or working barges) and removal of the existing structures and associated piles. Construction works will involve the disturbance of topsoil, bulk earthworks for building up works and regrading for services and construction of the accessible ramp pavement. Additionally, the potential for contaminated sub-surface soils was identified in the Long-Term Environmental Management Plan (EMP). Accidental spills within the land site may occur from storing, handling and/or transferring the required small volumes of lubricants, solvents, fuels, oils and diesels. Construction and Environmental Management Plan (CEMP) will be prepared to mitigate the risks associated with sedimentation, soil erosion and water pollution including silt curtains and booms.

Noise and vibration

A noise and vibration impact assessment has been prepared in support of this application to predict construction impacts on nearby sensitive receivers. The proposed construction activities will result in short term noise impacts primarily arising from the demolition and piling works. Whilst the proposed construction activities would be noisy at times, further environmental safeguards and management measures are proposed to be implemented to ensure that the proposal will be acceptable in terms of noise impacts during construction. No adverse noise impacts will occur during operation.

Landscape character and visual impact

A landscape character and visual impact assessment (LCVIA) was prepared to identify the overall impact of the proposed works on the landscape character and to identify the visual changes and impacts on the site and its surroundings when viewed from key vantage points.

There will be a temporary visual impact associated with the construction through plant and equipment activity. The design is considered, the footprint of the proposed works has been carefully located within the mangroves so as to minimise visual intrusion. The existing white buildings are to be replaced with new buildings in a dark green shade, and the height, form and design of the new buildings which aid in achieving a non-intrusive built form with minimal impact on the landscape character of the setting. Apart from water views from boats, most viewpoints and properties are distant and from these the project will have negligible visual impacts, if not a slight beneficial improvement due to the use of dark colours to replace the existing light-coloured buildings, which have significantly degraded in quality.

The assessment has found that the proposal would have an acceptable impact on landscape and visual quality when viewed from Woolooware Bay and from its foreshore. It is considered that with regard to visual and landscape impacts the proposal is worthy of support.

Biodiversity

A biodiversity assessment has been completed by Alison Hunt and Associates Pty Ltd which investigates the existing coastal and marine environment within the study area to assess impacts to coastal and marine biodiversity as a result of the removal of the existing overwater structures, the construction of new structures and the operation of the proposal.

The site is situated on the southern shore of Botany Bay within Woolooware Bay and is adjacent to a number of significant areas of biodiversity conservation including Coastal Wetlands, Towra Point Nature Reserve and Ramsar wetland, Towra Point Aquatic Reserve, grey mangrove forests, coastal saltmarch and seagrass communities.

Notably, the proposed overwater structures are located within a Grey Mangrove Forest community which extends to the north, east and west of the site. No saltmarch or seagrass communities are recorded in close proximity to the site. Grey Mangrove removal is required to accommodate the proposed works. Eight (8) Grey Mangroves in total require removal, with a further 37 to be pruned/ branches tied back during the demolition and construction phase. An Arboricultural Impact Assessment Report has been prepared by Allied Tree Consultancy and specifies the tree protection methods to be utilized throughout the demolition and construction phase.

The Grey Mangrove canopy is low and dense and pneumatophores and seedlings are common. Removal of the eight Mangroves would reduce the number of Grey Mangroves across the overwater site and trimming of a further 37 trees would reduce the flowering and hence seed production from those limbs removed. Given that there are high densities of seedlings present throughout the Mangrove Forest it is likely that these trees would be replaced by seedlings already present.

There are twelve Threatened Ecological Communities (TEC) listed under the EPBC Act that are either known to occur within the locality of the overwater site and ten Endangered Ecological Communities (EEC) listed under the BC Act which are also known to occur within the Sutherland Shire local government area. There are also four Endangered Ecological Communities (EEC) which occur near the site that are relevant to the proposal being Swamp Oak Floodplain Forest, Coastal Saltmarsh, Posidonia australis seagrass meadows and The Shorebird Community occurring on the relict tidal delta sands at Taren Point.

Forty-eight fauna species listed under the EPBC, and 49 species and two endangered populations are listed under the BC Act / or FM act have been recorded within the locality of the site. Inspection of buildings and other structures for signs of fauna nesting or brooding by a fauna specialist prior to demolition. The protection of the Mangrove Forest Community should be given the highest priority. Disturbance and / or decline of this community could substantially impact the adjacent areas of high conservation value. The removal and trimming of Grey Mangrove trees should be minimised and undertaken under the direction of a qualified Level 5 Arborist as per Allied Tree Consultancy (2021) Arboricultural Assessment.

The proposal includes the removal and replacement of 35.3m2 of floating structures, with an additional 491m2 of fixed overwater structures. This is likely to alter the structure and functioning of biological communities due to shading which may disturb the growth and biomass production. However, as the works provide for the replacement of existing facilities, following the demolition and construction period, the habitat is anticipated to be reflective of the current habitat at the site. The site is predicted to remain a shallow intertidal area vegetated with Grey Mangroves, occurring across a sediment substrate.

The Biodiversity Impact Assessment notes that the removal of the decaying structures and replacement of the purpose-built facilities, including new services for water, sewer and drainage, is likely to provide an overall benefit to species within the locality.

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act 2016 or Fisheries Management Act 1994 and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required. The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the Environment Protection and Biodiversity Conservation Act 1999. A referral to the Australian Department of the Environment and Energy is not required for biodiversity matters.

Socio-economic

Upgrade of the overwater structures would generate economic benefits over the next 50 years, with the overwater structures being an attractor for investment and jobs in the area. Design of the overwater structures has also incorporated measures to decrease the maintenance required for operation. The implementation of these measures would result in cost savings for the ongoing operation proposed facility

Land transport and parking Water transport

Informal on-site parking is available for staff and visitors to the oyster farm located at the southern section of the site. The proposed development will have minimal impact upon the operation of the road network or water way in this location.

Aboriginal and Non-Aboriginal heritage

There are no known heritage items that will be impacted by the proposal. An unexpected heritage finds procedure will be established, implemented, communicated to all site personnel, and followed for the duration of the works.

Hazards

An Environmental Management Plan (EMP) applies to the site, and it is the responsibility of the site owner (TfNSW) and future operator to implement this plan. This EMP is required to ensure that the identified contaminated impacted soils and hazardous ground gases beneath the site are appropriately managed for continued protection of human health for future site workers, occupiers, visitors, and contractors engaged to undertake work at the site.

Climate change

The proposed overwater structures have been designed to achieve a 50 year operational life cycle, with consideration of sea level rise and climate change.

Justification and conclusion

The proposal seeks to demolish the existing overwater structures which have deteriorated overtime. These structures are to be replaced with modernized facilities to ensure that aquaculture activities can continue to operate at Woolooware Bay. The proposal will also improve the visual amenity of the area, through providing a more attractive and compliant facility. The potential disadvantages in the short term will be temporary and are identified as follows:

- Reduction in water quality
- Sedimentation impacts
- Removal of mangroves
- Generation of waste materials
- Air, noise and visual impacts.

These impacts can be mitigated through the implementation of control measures described in this REF, and through preparation of a Construction Environmental Management Plan to be implemented for the duration of the works. The assessment of the environmental and social impacts has determined that the proposal is not likely to have a significant impact and therefore assessment under Division 5.2 of the EP&A Act is not required.

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Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. The proposal objectives and development history are outlined, and the purpose of the report provided.

Proposal identification

Site Location and Description

Transport for NSW (TfNSW) owns a property commonly referred to as "The Oyster Farm" located on Captain Cook Drive, Woolooware Bay (the site). The site is currently leased by TfNSW to a tenant, who operates an oyster processing facility.

The proposal is to demolish and replace the existing overwater and land-based structures such that the existing oyster aquaculture use can continue in upgraded modernised facilities. Service reticulation to support the continued oyster aquaculture operations at the site is also proposed under this REF. No change to the existing use of the site is sought as part of the proposed activity. It is anticipated that any future intensification of the existing use will be pursued under a separate planning pathway.

The site is legally identified as part Lot 3 in DP1165618. The site area is approximately 3,200m2, and the overwater structures footprint is 1586.3m2.

This site is situated in the Sutherland Shire Council Local Government Area (LGA). The site location and layout are shown in Figure 1. For this report, the site has been broken up into two parts:

1. The overwater structures site; and
2. The land site (which is defined by the seawall) and shown in Figure 2.

Figure 1 Site Location (Source: Six Maps)

Figure 2 Aerial view of the site (Source: Six Maps)

This site is located in an ideal position to support the continuation and improved use for oyster aquaculture. It is within the Greater Sydney urban area between the Sutherland Shire and inner southern and eastern suburbs further to the north. It is also located within a unique environmental setting with proximity to local fish markets along the Botany Bay foreshore.

The site is identified as being within a Refuge Zone in the Towra Point Aquatic Reserve. The Towra Point Reserve (identified in Figure 3 below), is a Ramsar listed site that consists of 386.5 hectares of wetlands along the southern shores of Botany Bay. Towra Point Reserve supports the largest wetland of its type in the Greater Sydney region. Improvements to be delivered under the proposal will enhance the environmental values, protect sensitive interfaces to wetlands and ensure the safe operational use of over-water aquaculture infrastructure within this protected Ramsar listed site.

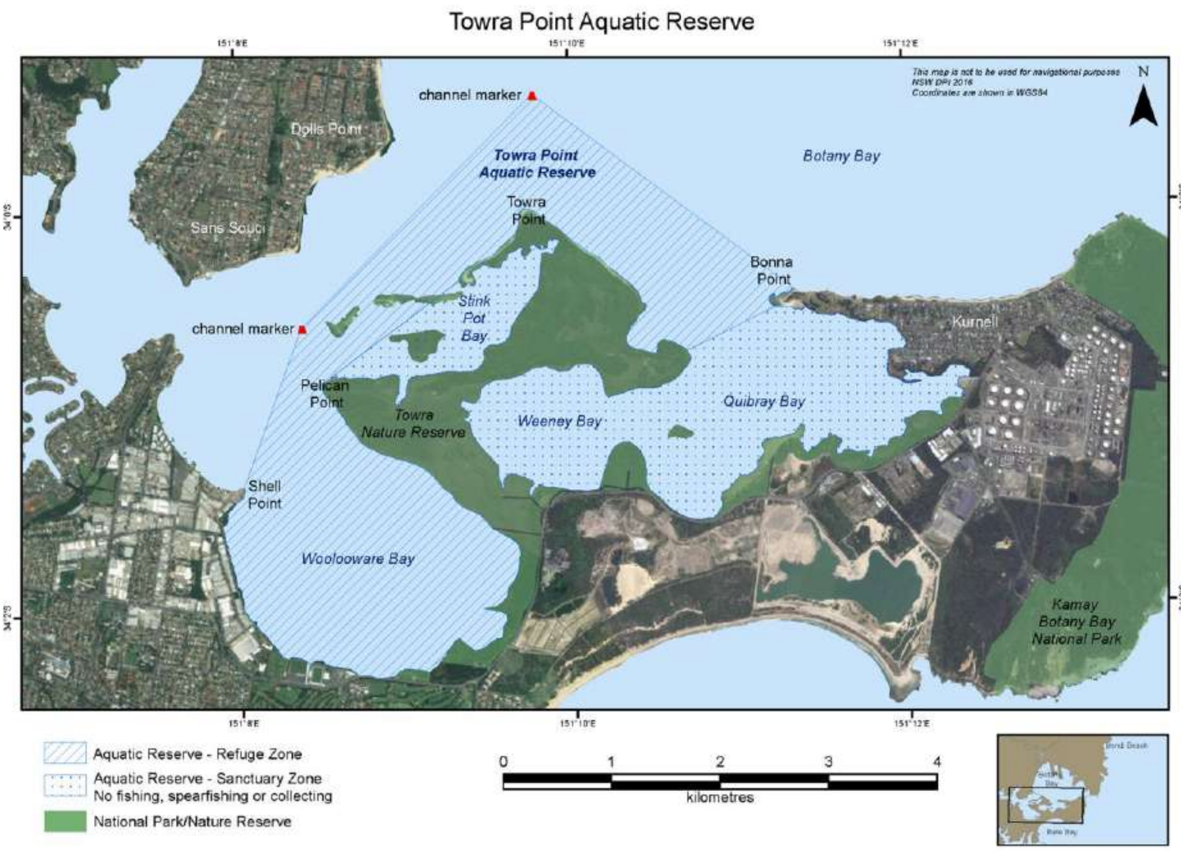

Figure 3 Site location in relation to the Towra Point Reserve

(Source: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/633580/Towra-Point_web.pdf 23/12/2021).

Surrounding Land Use and Zoning

Land use in the surrounding catchment is predominately National Park and RAMSAR wetlands to the east, recreation areas, commercial and general light industrial lining the foreshore of Woolooware Bay to the west. The catchment slopes from south to north towards the Bay with the lower reaches typically flat and low lying. The overwater structures are located in an area that is zoned W1 (Natural Waterways) under the Sutherland Shire Local Environmental Plan 2015 (refer to Figure 4).

Adjacent to the site are zones;

- RE1 – Public Recreation
- C1 – National Parks and Nature Reserve
- C2 – Environmental Conservation
- B2 – Local Centre
- SP2 - Infrastructure

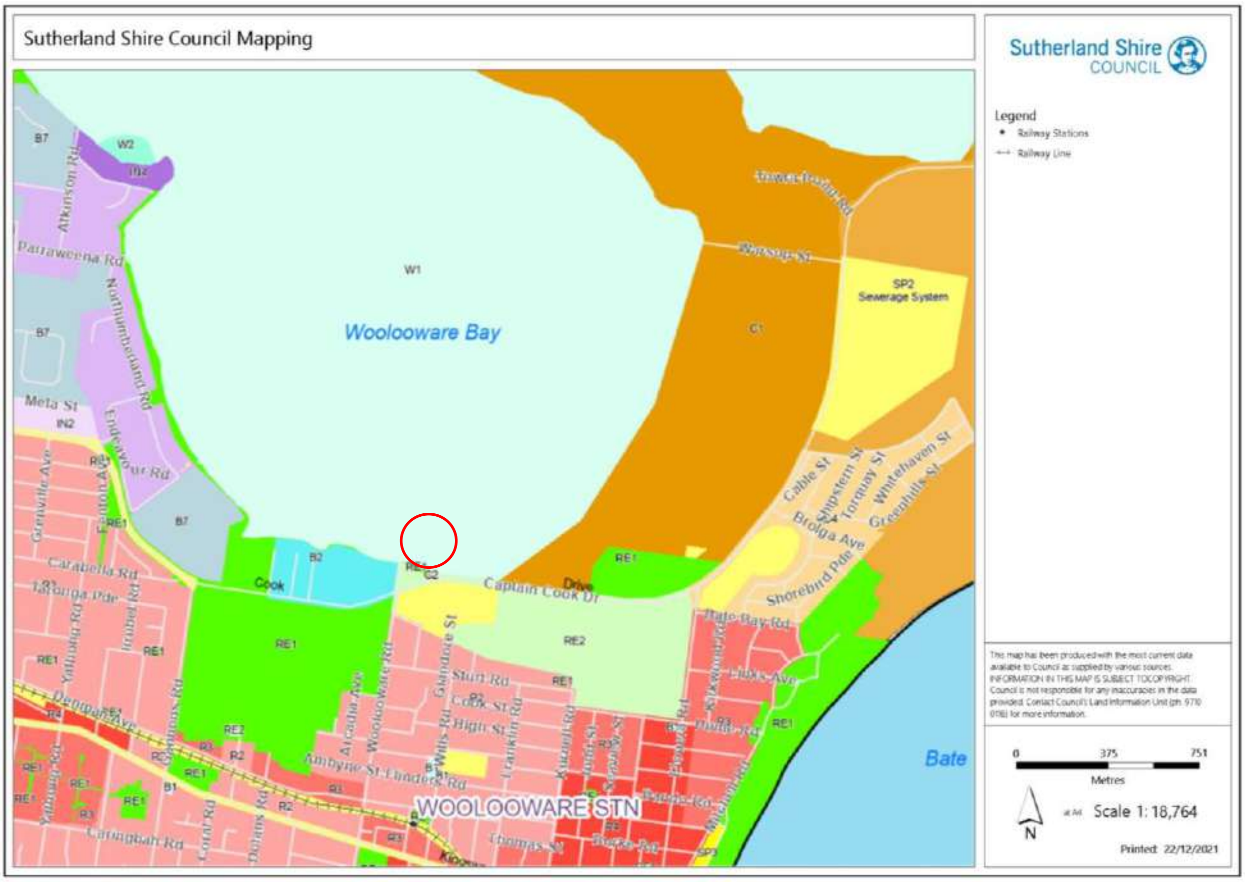

Figure 4 Current zoning for the proposed area

(Source: https://mapping.ssc.nsw.gov.au/ShireMaps/ 23/12/2021)

Background on the site

The site has been historically used for oyster farming, which has previously led to contamination impacts on the site. The site was successfully remediated between 2017-2021. The remediation works undertaken at the site are formally referred to as Stage 1. The remediation footprint comprises an area bound by 400m of PVC sheet pile seawall and an engineered physical barrier (cap) constructed which minimising the risk of the residual contaminants to human health and the environment. The site is governed by a Long-Term Environmental Management Plan (LTEMP) and any disturbance to the ground must adhere the requirements of this report.

Description of Proposed Activity

The proposal is for the demolition and replacement of all the overwater structures and connecting boardwalks across the site which exist in a dilapidated state. The existing structures and their material makeup are detailed below and shown in Figure 5.

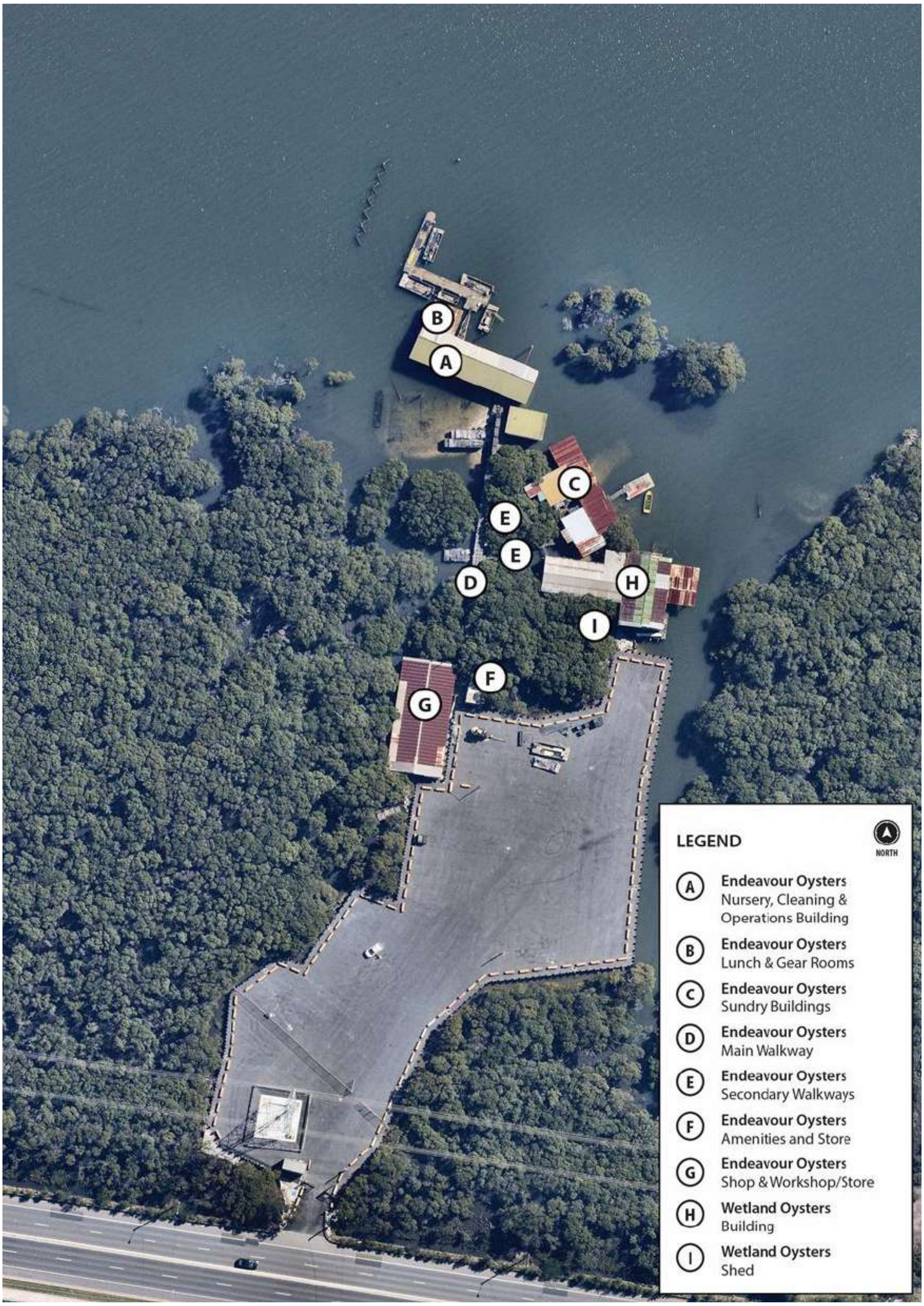

Figure 5 Shows all of the existing overwater structures that require demolition.

Detail of Existing Site Structures
Endeavour Oysters Nursery, Cleaning & Operations Building (currently in operation) • This building consists of 18 rows with 4 timber piles per row which are concreted cased at the seabed • Large timber beams run across the piles with timber decking • Timber beams and frames support the corrugated sheet metal • Timber framed pitched roof and corrugated metal sheeting.
Endeavour Oysters Lunch and Gear Rooms (not in operation) • This building consists of 5 rows with 3 timber piles per row which are concreted cased at the seabed • Large timber beams run across the piles with timber decking • Timber beams and frames supporting the corrugated sheet metal • Timber framed pitched roof and corrugated metal sheeting.
Endeavour Oysters Sundry Buildings (not in operation) • Unknown number of timber piles. • Timber decking, flooring and framing • Timber beams and frames supporting the corrugated sheet metal • Timber roof framing clad with corrugated metal roof sheeting.
Endeavour Oysters Main Over-Water Walkway (not in operation) • 75m in length and 1.8m in width • Timber piles, decking and beams make up this structure. • A steel rail for a small battery powered cart runs parallel the length of this walkway.
Endeavour Oysters Secondary Walkways to Sundays Buildings (currently in operation) • These walkways are approximately 14m and 20m in length and 1.5m in width • Timber piles, poles and posts are of various sizes at various centres. • Timber headstocks span the width of the piles • Timber longitudinal beans and decks boards make up these structures.
Endeavour Oysters Amenities and Store (currently in operation) • Small timber framed timber framed, and sheet metal clad building supported on timber subfloor framing and posts. • The amenities building is a prefabricated shed supported on timber subfloor framing on timber piles and posts.
Endeavour Oyster Shop and Workshop / Store (currently in operation) • Old vessel hull supported by timber piles. • Timber decking, columns and timber roof. • Steal columns supporting steel roof trusses supporting corrugated metal roof sheeting.
Previously Wetland Oysters Building (not in operation) • This building consists of 15 rows with 5-9 timber piles per row some of which are concreted cased at the seabed • Timber piles, decking and beams. • Corrugated sheet metal wall and roof lining.
Previously Wetland Oysters Tank Platform (not in operation) • The platform consists of 3 rows of 3 timber piles per row some of which are concreted cased at the seabed. • Timber beams and decking make up this this structure.

Description of Proposed Development / Works

The demolition is proposed to be undertaken in a systematic method to minimise impacts to the sensitive environment and debris entering the waterway by:

- Undertaking all pre demolition environment surveys (i.e. fauna inspections)
- Environmental controls such as silt curtain, booms and other physical measures to prevent the materials entering the walkway will be assess and approved by TfNSW environmental representative.
- Removing all hazardous materials and obtain clearance certificates prior to demolition
- Once all the approvals are in place each structure, including the boardwalks are to be demolished in a staged manor
- The demolition will enable a staged construction. Once an area has been demolished the area for the piling platform will be created, which will become the floor for the future buildings.
- For areas that are demolished but no buildings are proposed to be constructed on, will undertake a “make good” which will leave the area free of debris and will be accessible by an TfNSW environmental representative.

The proposed construction of new replacement structures will be undertaken in a staged manner following commencement of demolition works to support the continued oyster aquaculture activities at the site. The new structures will replace those existing structures outlined above and will include new raised walkways connecting the structures. The proposed structures are buildings 1, 2 and 3, which will consist of steel fixed piles into the seafloor. Buildings 1 and 3 will be connected to the previously built seawall and will be fixed and elevated above the water level. The floating structures proposed include two pontoons that will be free-floating and attached to fixed structures that float on the surface of the water (refer to Figure 6).

The construction materials for the proposed structures consist of:

- corrugated roofing,
- external and internal cladding,
- fibre reinforced polymer (FRB) wager system or similar,
- steel piles to be protected with corrosion protection,
- all fixings of stainless steel and structural steel with protective treatments and external finished with colours that are sympathetic to the environment.

Most of the materials are proposed to be sourced locally, except for the steel piles that will be imported from overseas.

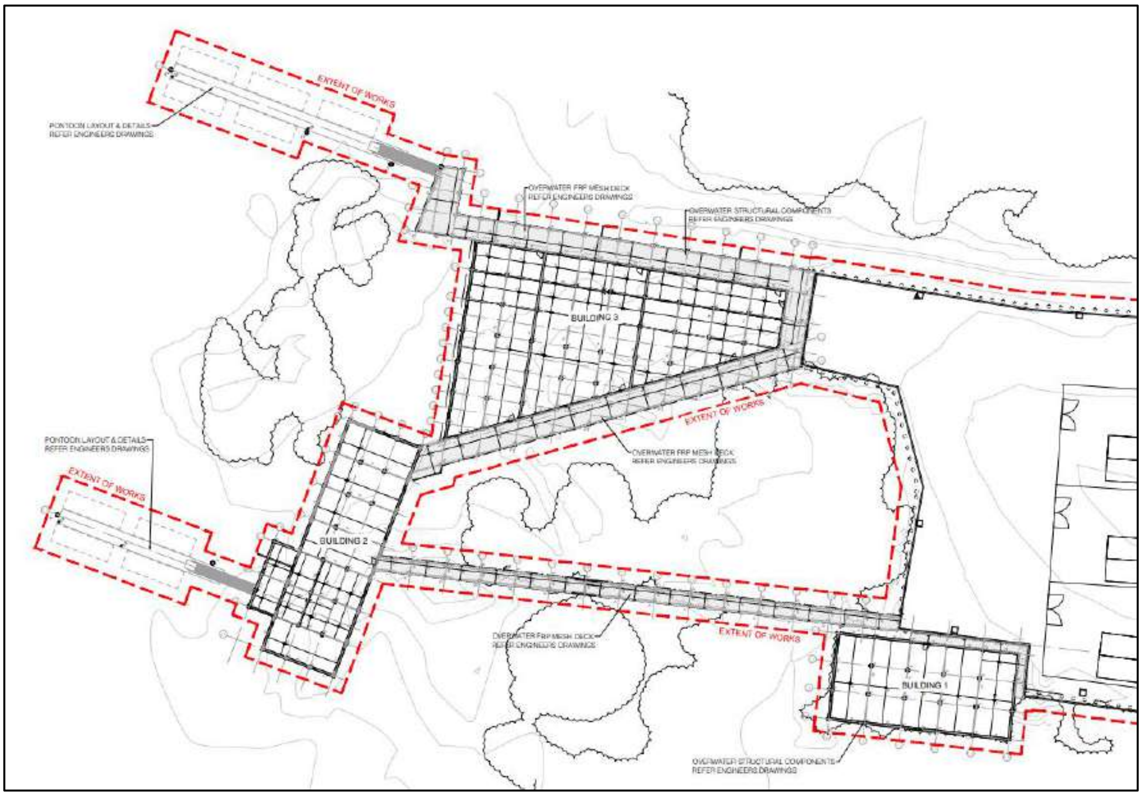

Figure 6 Shows the three proposed overwater structures, connecting boardwalks and pontoons.

Infrastructure Upgrades and Services

The proposal includes infrastructure upgrades and new lead-in and service reticulation on the land site to be connected to the overwater structures to make these facilities operational. New service infrastructure includes:

- Underground high and low voltage cables,
- Underground NBN cables,
- Sea water pipes.
- Potable water pipes,
- Gravity and pressure sewer pipes,
- Distribution board and main switchboard,
- Services and NBN pits,
- Ausgrid Kiosk Substation, and
- 2m Electrical Easement

Works Programme

The proposal would be constructed over a duration of up to twelve (12) months starting in mid-2022.

Figure 7 Concept image of the proposed overwater structures looking southwest (image created by Paterson Design Studio)

Figure 8 Concept image of the proposed overwater structures looking north (image created by Paterson Design Studio)

Purpose of the report

This Review of Environmental Factors (REF) has been prepared by APP Corporation Pty Ltd (APP) on behalf of Transport for NSW (TfNSW). For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The purpose of the REF is to describe the proposal, to document its likely impacts on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 171 of the Environmental Planning and Assessment Regulation 2021, the factors in Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines) (DUAP, 1995/1996), and the Marinas and Related Facilities EIS Guideline (DUAP, 1996), the Biodiversity Conservation Act 2016 (BC Act), the Fisheries Management Act 1994 (FM Act), and the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that TfNSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The potential for the proposal to significantly impact any matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of Agriculture, Water and Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

Need and Options Considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

Strategic need for the proposal

Oyster faming has operated from the site for several decades and TfNSW together with the Department of Primary Industries (DPI Fisheries) want to continue to support the Aquaculture (Sydney Rock Oyster farming) industry at Woolooware Bay. The NSW oyster aquaculture industry is the state's most valuable fishery and accounts for most of the state's aquaculture production. NSW is Australia's largest producer of edible oysters, which is the fourth largest aquaculture industry in Australia.

Aquaculture is one of the fastest-growing industries in the world. Already 54% of seafood consumed worldwide is produced through aquaculture. According to the United Nations' Food and Agriculture Organization, global aquaculture production rose 520% for the period 1990-2018 (DPI Fisheries, 2021). Aquaculture contributions benefit the state's economy, with a flow-on effect to seafood processing and a broad range of other retail businesses.

The strategic need for this proposal is to demolish and replace the aging site structures that are no longer fit-for-purpose to support the continued operations of the Oyster Farm. The new replacement structures are of a contemporary form and materiality which will suitably support and accommodate the oyster aquaculture activities by meeting modern operational and safety standards. The modernisation of site structures, including elevated and over-water walk-ways will also provide for compliant access arrangements across the site.

Supporting Government Strategies

Table 1 Summarises some of the relevant policies and other strategic planning documents that are relevant to the proposal.

Strategy	Description
Future Transport Strategy 2056	This proposal does is not a typical TfNSW transport project however, some of the principals in Future Transport Strategy 2056 have been adopted were relevant. This includes that the prioritising safety during planning, design, construction, management, and operation. As this will help to deliver a safer integrated environment that can enhance the qualities of our places and improving access is equitable for all types of patronage under a range of circumstances.
Disability Inclusion Action Plan 2018-2022	The Disability Inclusion Action Plan 2018–2022 is Transport for NSW's plan for delivering high quality services to all customers including those with disability, including compliance with the disability standards outlined below
Disability Standards	The Disability Standards for Accessible Public Transport (DSAPT, 2002) and Disability (Access to Premises – Buildings) Standards (2010) form part of the DDA. Each prescribe the minimum accessibility standards for disabled access to public transport services and infrastructure, including a timetable for implementation. The proposal meets the above requirements within the

Strategy	Description
	timeframes specified in both standards by providing suitable access for any future workers with a disability.
NSW Oyster Industry Sustainable Aquaculture Strategy August 2021	This proposal allows for future oyster farming by improving operations which will support the vision of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) is to achieve the ecologically sustainable production of 7,500 tonnes of premium NSW oyster products for domestic and export markets by 2030.

Existing Infrastructure and Landform

The site is accessed from Captain Cook Drive, Woolooware via an informal sealed access road. An electrical transmission tower and easement are located at the front of the property to the west of the access driveway. The land-side site has been formed as a result of historical reclamation of the Woolooware Bay foreshore area, with between one and two metres deep of crushed oyster shells and other fill materials used to form a working platform for the oyster farming activities prior to being remediated by TfNSW between 2017-2021.

Post remediation the resulting land-side infrastructure located to the direct south of the proposal area comprises of an engineered capping layer and trafficable pavement system providing an approximate 7,000m2 footprint with stormwater management infrastructure and provision for new services augmentation and site access controls. The land-side area is bound by 400m of PVC sheet pile seawall constructed during the 2017-2021 Stage 1 project.

The existing overwater structures (see Figures 9-10) consist of driven timber piles, posts and stumps. They are constructed of timber walls and roof framing, timber flooring, timber decking, corrugated metal and other light timber wall cladding, with some structural steel elements and corrugated metal roof cladding. All existing overwater structures are in poor condition. The construction of the overwater buildings, piers, and wharves has been largely uncontrolled and has occurred without prior consent or approval and extend from the land into the over water areas within Woolooware Bay. The existing floating structures consist of proprietary type concrete pontoons, steel pontoons, timber restraint piles and various types of hinged access gangways. All these structures are proposed to be demolished as part of this proposal.

Stormwater from Captain Cook Drive and the Woolooware High School Oval, which is located to south of site, discharges via a channel that run along the eastern site boundary into Woolooware Bay. This channel has been historically dredged and is tidally influenced. The newly constructed seawall which discharges via stormwater points (see Figure 13) into the channel from land during rainfall.

Figure 9 (Left) the north-eastern pontoon showing western side of the north-western building looking south, (Right) The north-western building looking south.

Figure 10 (Left) wharf structure located of the eastern building shown at high tide looking south-east, (Right) looking north and the eastern an eastern side of the north building at high tide looking north

Figure 11 (Left) the remediated unoccupied land to the south of the proposal with sandstond protection of the seawall edge looking south, (Right) the enternce gate to property looking north.

Figure 12 (Left) Habitat panels installed as part of the remediation project to the south of the proposal located on the eastern and western seawall exterior, (Right) electrical infrastructure located next to the gate at the entrance to the property to the south of the proposal.

Figure 13 (Left) the eastern seawall and the tidally influenced channel looking south at mid tide, (Right) Electrical Ausgrid tower and easement located near the entrance to the property.

Figure 14 The remediation footprint of Stage 1 of the Project

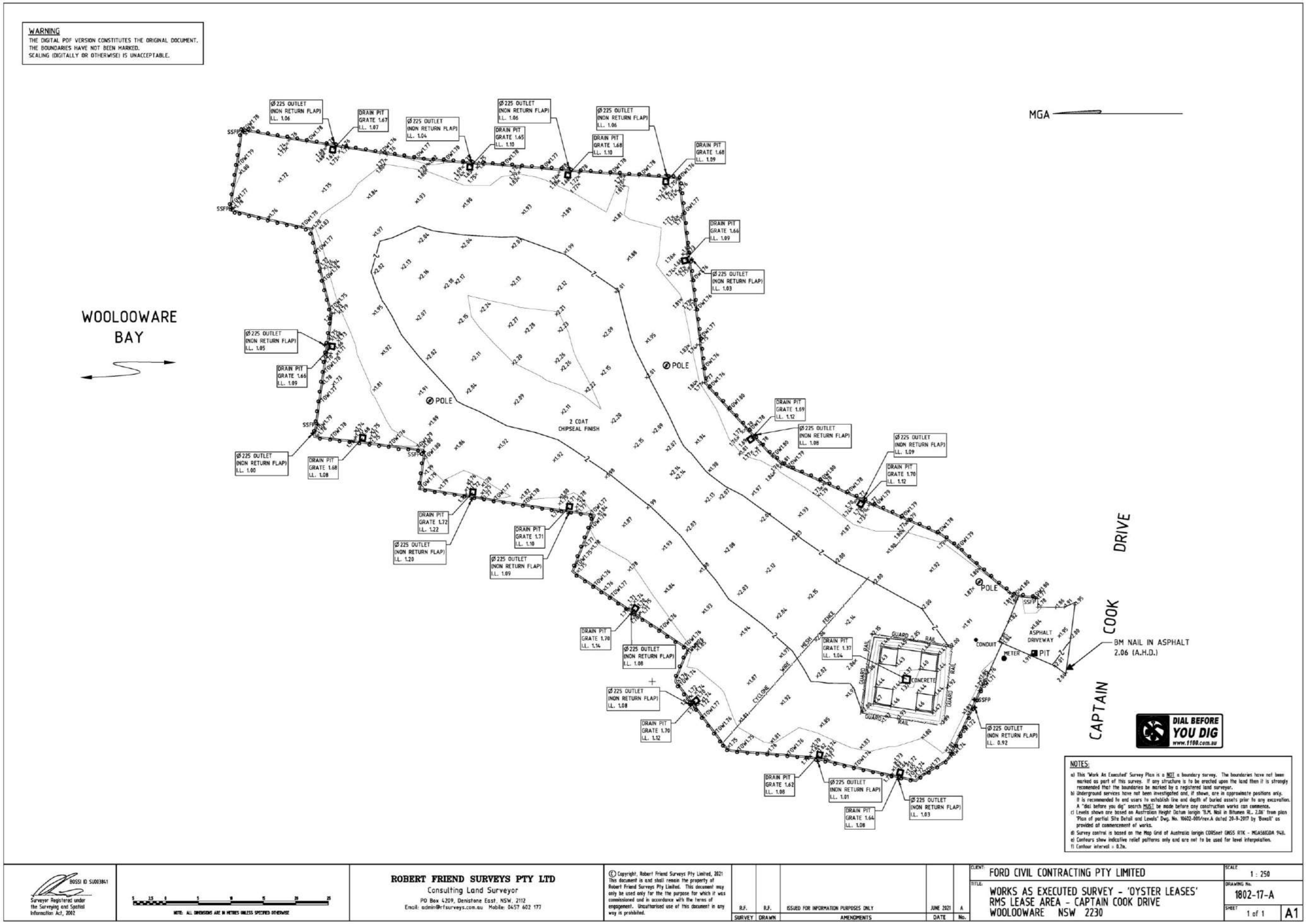

Figure 15 Land site survey on land post the Stage 1 remediation works

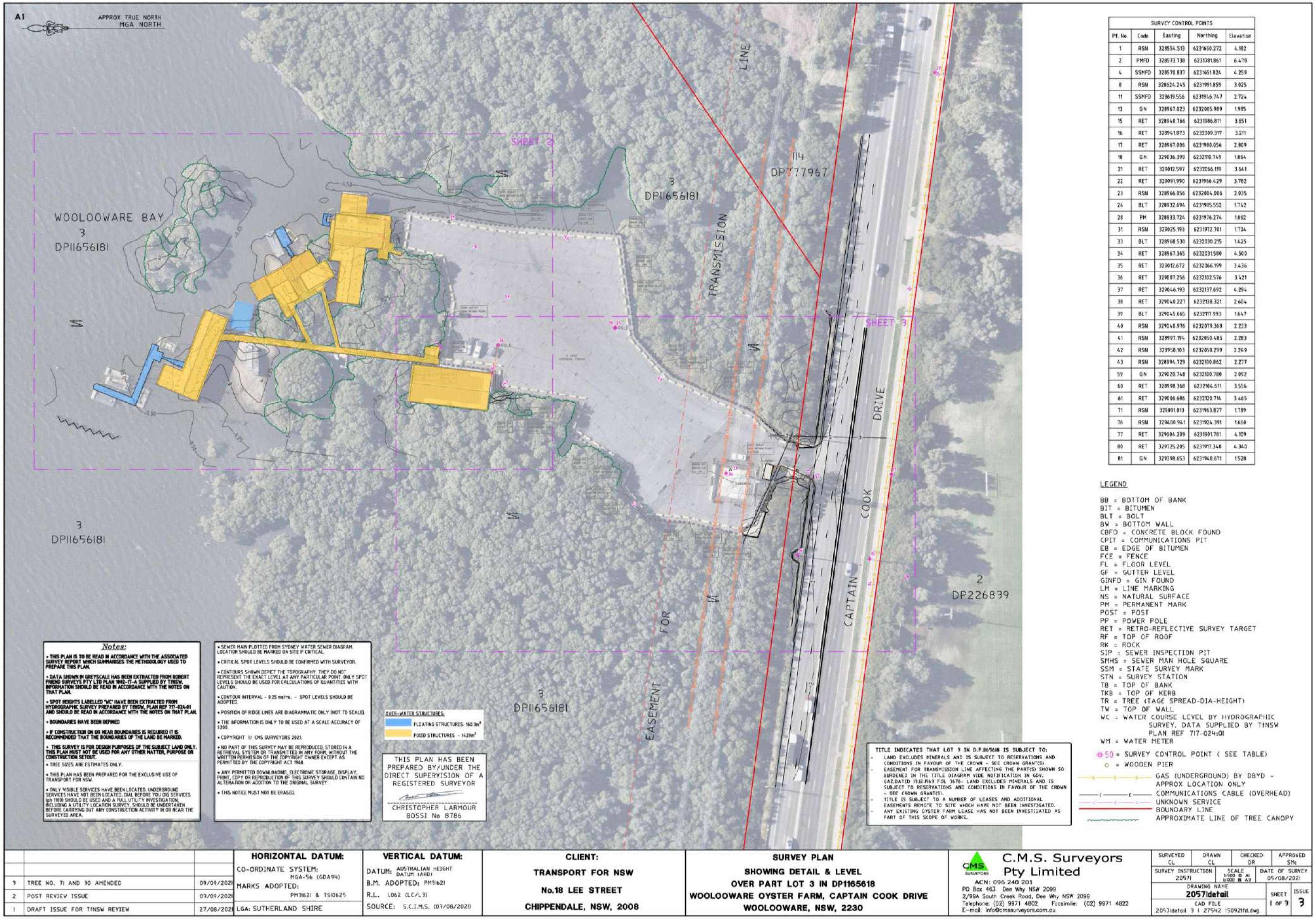

Figure 16 Overwater site survey of the existing structures

Proposal objectives and development criteria

Proposal objectives

The objectives of the proposal include:

- Improve working conditions for staff and ensure the upgrade complies with Work Health and Safety (WHS) requirements and the Australian Building Code
- Provide new high-quality infrastructure to enable all personnel access including those with a disability. The structures are to be compliant with the disability standards.
- Support the aquaculture industry in Woolooware Bay by building modern infrastructure and facilities to support the continuation of the long-established use at the site.
- Undertake the activity in an environmentally sensitive and sustainable manner to protect aquatic biodiversity and wetlands.
- Stage the activity works to minimise disturbances to the existing operator at the site.

Development criteria

The development criteria for the proposal include:

Key architectural objectives:

- Design all elements for ease of maintenance.
- Design to consider the future operational requirements to improve safety of operations.
- Design to provide for an aesthetically pleasing redevelopment when viewed in the context of the sensitive foreshore area.
- Consider sustainable design features, including the recycling of materials and the use of sustainable material during construction.

Key engineering objectives:

- Minimise operator conflict points and crowding points
- Maximise stability (and therefore safety) of the berthing provisions
- Minimise cost of maintenance and future upgrades

Urban design objectives for the proposal include:

- Minimise visual and landscape character impacts to Woolooware Bay and surrounds.
- Integrate the buildings and pontoons within its local area, taking into consideration the nature of the site, local context, and the surrounding biodiversity.
- Create a high quality, secure and positive addition to the surrounding environment.

Alternatives and options considered

Methodology for selection of the preferred option

The existing overwater structures at the site are posing a risk to human health and the aquatic environment as they exist in a state of dis-repair. TfNSW considered each of the options presented below based on the capacity of the option to provide for:

Increased operational safety and access for current and future oyster aquaculture activities.

Protection of the health of the waterway from pollution and maintaining water quality.

Minimisation of impacts to the surrounding marine environmental and the adjacent Ramsar Wetland

- Engineering design requirements, feasibility, and constructability.

Identified options

The following options have been considered:

Option 1 - Do Nothing

This option would retain the current site conditions, including the dilapidated over-water structures to support the continuation of the commercial oyster farming.

Option 2 – Demolish and Replacement of Structures

This option involves the demolition of all existing over-water structures and construction of new replacement structures (via landside) predominantly, with support from barges.

Analysis of options

An analysis of the options presented above is provided in Table 2.

Table 2 Analysis of Options

Option	Proposal Objectives	Development Criteria
Do nothing (Not the preferred option)	Improve working conditions for staff and ensure the upgrade complies with Work Health and Safety (WHS) requirements and the Australian Building Code The existing structures are not compliant with Work Health Safety codes and would present a degree of risk for staff working at the site. Furthermore, the structures are not compliant with the Building Code of Australia and would need extensive retrofitting to bring them up to standard. As such, the 'Do Nothing' option would be in conflict with this objective. Provide new high-quality infrastructure to enable all personnel access including those with a disability. The structures are to be compliant with the disability standards. The existing structures are non-compliant with Australian access standards and would not be suitable for providing access to a person with a disability. Keeping the existing structures in their current state would contravene this objective. • Support the aquaculture industry in Woolooware Bay by building modern infrastructure and facilities to support the continuation of the long-established use at the site The existing operator requires an upgraded facility in order to continue the existing aquaculture use in the long term. The existing facility is not a suitable long-term option and is not fit for purpose to continue oyster aquaculture. • Undertake the activity in an environmentally sensitive and sustainable manner to protect aquatic biodiversity and wetlands. The dilapidated structures are likely to pose an increased risk of environmental harm into the future. This is due to the gradual decay of the existing buildings, potential uncontrolled runoff and other pollutants entering the waterway. As such, retention of these structures is considered to be in conflict with this objective as they would not facilitate sustainable use into the future. • Stage the activity works to minimise disturbance to the existing operator at the site. Whilst the 'Do Nothing' option would allow for the current operator to continue the use without disturbances, this would result in the existing dilapidated structures being retained for use. As outlined, this option conflicts with the proposal objectives as the structures are no longer fit for purpose.	Key architectural objectives: • Design all elements for ease of maintenance The 'Do Nothing' option would allow for the current site layout and form to be retained. Whilst this may suit the operator's processes and maintain ease of maintenance, it is not a viable long-term option due to the dilapidated state of the structures. • Design to consider the future operational requirements to improve safety of operations The 'Do Nothing' option does not consider future operational requirements which would improve safety for operators. This option would make it difficult to upgrade the existing structures to improve safety and would likely incur significant costs for a short-term solution. • Design to provide for an aesthetically pleasing redevelopment when viewed in the context of the sensitive foreshore area. The 'Do Nothing' option would not involve any redevelopment and as such would not satisfy this development criteria. • Consider sustainable design features, including the recycling of materials and the use of sustainable material during construction The 'Do Nothing' approach would retain the existing structures. Key engineering objectives: • Minimise operator conflict points and crowding points The existing layout of the site would remain unchanged under this option. This limits opportunities for potential site reconfiguration to improve pedestrian access around the site and minimise crowding points. The proposed works to the existing operation would allow for an improved outcome in terms of reducing crowding points and conflicts. • Maximise stability (and therefore safety) of the berthing provisions The 'Do Nothing' option would not involve upgrading the stability of berthing stations at the aquaculture operation. • Minimise cost of maintenance and future upgrades The 'Do Nothing' option would retain the run-down structures at the site and result in ongoing and expensive maintenance costs over the coming years. As the existing structures are not considered fit for purpose currently, the ongoing use of the structures is likely to lead to longer term degradation of the site and the surrounding environment. Urban design objectives for the proposal include: • Minimise visual and landscape character impacts to Woolooware Bay and surrounds Proceeding with this option would result in the decaying structures being retained. This will have an increasingly negative impact on the landscape character of Woolooware Bay in the immediate future. • Integrate the buildings and pontoons within its local area, taking into consideration the nature of the site, local context, and the surrounding biodiversity. The retention of the existing structures is likely to lead to longer term environmental degradation which would pose a threat to surrounding biodiversity. • Create a high quality, secure and positive addition to the surrounding environment. Retaining the existing development would not add anything of high quality or positivity to the surrounding environment.

Option	Proposal Objectives	Development Criteria
Demolish and Replacement of Structures (PREFFERED OPTION)	• Improve working conditions for staff and ensure the upgrade complies with Work Health and Safety (WHS) requirements and the Australian Building Code The proposed new structures have been purposefully designed and will be specifically constructed to support improved working conditions for staff. The upgrades will be made in accordance with WHS requirements and the BCA. Provide new high-quality infrastructure to enable all personnel access including those with a disability. The structures are to be compliant with the disability standards. The new structures are to be constructed to enable disabled access. • Support the aquaculture industry in Woolooware Bay by building modern infrastructure and facilities to support the continuation of the long-established use at the site This option is directly aligned with the proposal objective as it will provide modern infrastructure in place of the existing dilapidated structures. The provision of these new facilities will better enable the long term use of the site as an aquaculture operation. • Undertake the activity in an environmentally sensitive and sustainable manner to protect aquatic biodiversity and wetlands. This option will provide high quality, modern structures which have been purposefully designed and constructed to support the aquaculture operation in the long term. As such, this option directly aligns with the proposal objective. • Stage the activity works to minimise disturbance to the existing operator at the site. The proposal involves the staged development of the site. This will minimise disturbances to the operator and will allow operations to continue in a reduced capacity.	Key architectural objectives: • Design all elements for ease of maintenance The proposed contemporary structures will be easily maintained and cost-effective over the long term. • Design to consider the future operational requirements to improve safety of operations New structures have been purposefully designed and will be constructed to support the viable future operations and modest expansion of the oyster aquaculture use at the site. The new facilities will support the safe operations for commercial operators. • Design to provide for an aesthetically pleasing redevelopment when viewed in the context of the sensitive foreshore area. The proposed new structures will be constructed of materials sympathetic to the surrounding environment. External finishes include green spruce weatherboard walls and metal cladding roofs. These materials and external finishes will blend with the surrounding aquatic environment and will not be an offensive addition to the foreshore area. • Consider sustainable design features, including the recycling of materials and the use of sustainable material during construction The redevelopment of the site allows for sustainably sourced materials to be used. Proceeding with this option is a better outcome than retaining the existing structures on site. Key engineering objectives: • Minimise operator conflict points and crowding points Conflict and crowding points will be minimised during the construction phase of the development through efficient construction planning and communication with the operator. • Maximise stability (and therefore safety) of the berthing provisions The redevelopment option allows for berthing provision to be redesigned and constructed. This directly aligns with the development criteria as the new berthing provisions will result in an improved outcome compared to the existing development. • Minimise cost of maintenance and future upgrades Whilst this option presents higher upfront costs in undertaking the proposed works, the new structures will require less maintenance over the long term and result in overall lower maintenance costs. Urban design objectives for the proposal include: • Minimise visual and landscape character impacts to Woolooware Bay and surrounds Redeveloping the site will have a temporary negative impact on the visual landscape character of the site due to ongoing construction activities and site operations. Once complete, the new structures will result in a sympathetic addition to the landscape of Woolooware Bay. • Integrate the buildings and pontoons within its local area, taking into consideration the nature of the site, local context, and the surrounding biodiversity. This option would see the new structures being implemented in largely the same position as the existing development footprint. • Create a high quality, secure and positive addition to the surrounding environment. The redevelopment option directly aligns with this development criteria. The proposal will deliver a modern, high-quality facility which will support future aquaculture operations at the site in the long-term.

Preferred option

Option 2 was identified as the preferred option as it was considered more equitable, met the objectives of the proposal and provided value for money. Option 2 has construction risk compared to the ongoing maintenance burden and costs associated with Option 1. Option 2 provides replacement structures in the form of modern facilities specifically designed to support the longer-term safe, functional and efficient operations from the site. Although the preferred design results in minor impacts to the mangroves, the activity will fundamentally reduce direct impacts to the surrounding natural environs when compared with Option 1. Option 2 was developed as the Concept Design.

Design refinements

While Option 2 was the preferred option following the initial stakeholder engagement, stakeholders recommended further design refinements. Refinements to the Option 2 design undertaken to address stakeholder comments on the preferred option included:

- Fibre reinforced plastic (FRP) mesh decking to allow light penetration, which was a key fishery design consideration for the boardwalks. Meeting held with Fisheries managers see section 5.4.
- Building footprints were relocated to avoid and limit impacts to areas mapped as 'coastal wetlands' under the State Environmental Planning Policy (Coastal Management) 2018 (refer to Figure 17).
- The height of the proposed overwater structures was originally 1.95m AHD. After consultation with the coastal engineer (Cardno), the height was increased to 2.20m AHD with the underside of the floor with a hydrostatic uplift value of 3kpa. As the decking is 50mm the final finished floor level that is to be progressed detailed design is 2.25 AHD. Information surrounding this design refinement discussed in section 6.15.
- The design was discussed with various stakeholders and the outcome was to ensure that the construction process and final footprint limits the removal of mangroves. The original planning advice identified that to replace the overwater structures in their current configuration "like for like" this proposal would have removed 30 mangroves. Therefore, after consideration it was decided to redesign the buildings to reduce the removal of mangroves. The proposal will remove only 8 mangroves. The footprint of the proposed buildings and walkways is located in areas mapped as Priority Oyster Aquaculture (POA) with Approx. 624m2 of the proposed structures which sits outside the area (Figure 17 seagrass). This is less than 0.1ha. Therefore, this can be carried out without development consent (but subject to assessment under Part 5 of EPA Act).

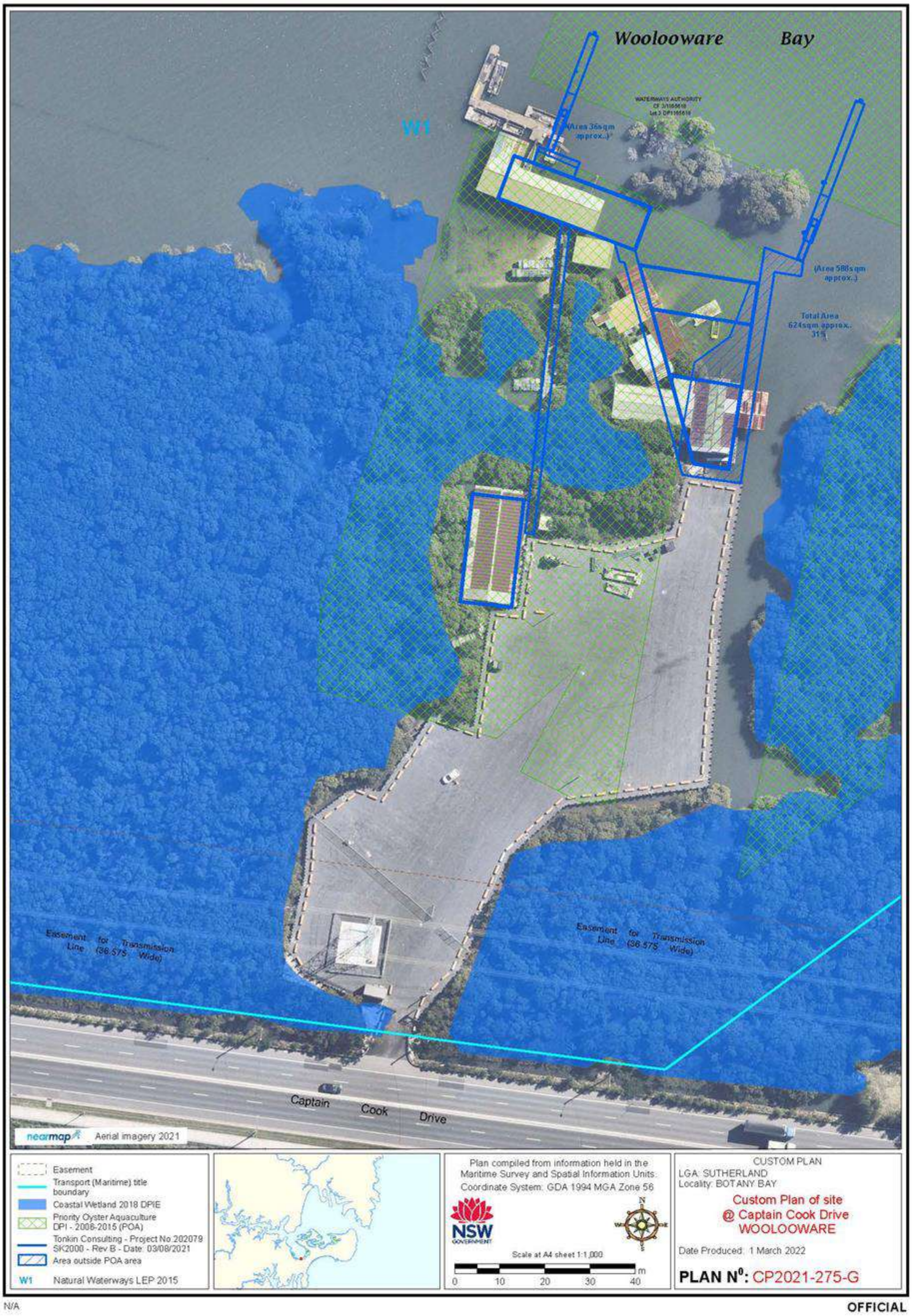

Figure 17 Site overlain with the Coastal Wetland mapping (Blue) and areas mapped as Priory Oyster Aquaculture Area (shaded green

Description of the proposal

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

The proposal

The proposal is to demolish all of the existing over-water structures and replace with new water-based and land-based structures.

The proposal seeks to remove and dispose of the dilapidated overwaters structures that have been constructed in the mangrove system at the Oyster Farm, Woolooware Bay. The existing overwater structure locations are identified in Figure 5. The proposal will include the demolition all structures to the north of the existing seawall including:

- Endeavour Oysters Nursery, Cleaning & Operations Building (currently in operation)
- Endeavour Oysters Lunch and Gear Rooms (not in operation)
- Endeavour Oysters Sundry Buildings (not in operation)
- Endeavour Oysters Main Over-Water Walkway (not in operation)
- Endeavour Oysters Secondary Walkways to Sundays Buildings (currently in operation)
- Endeavour Oysters Amenities and Store (currently in operation)
- Endeavour Oyster Shop and Workshop / Store (currently in operation)
- Previously Wetland Oysters Building (not in operation)
- Previously Wetland Oysters Tank Platform (not in operation)

Post removal, the proposal is to implement a compensatory re-design and re-construction of new structures being sympathetic of the sensitive marine environment. Three buildings are proposed for the overwater structures (building 1, 2 and 3) including the boardwalks with an accumulate area of 1,920m2. Stage 1 will involve the construction of building 3 and Stage 2 will involve the construction of buildings 1 and 2.

The water-based structures are proposed to feature the installation of steel circular piles with corrosion protection and are concrete filled, which will facilitate the connection to the structure.

The water-based structures features will include:

- Building 1 (264.32m2), positioned in the south-western section of the over-water site.
- Building 2 (314.57m2), positioned in the north-western section of the over-water site.
- Building 3 (698.44m2), positioned in the eastern portion of the over-water site.
- Installation of three new over-water walkways, which provide access between the land-site and all over-water buildings.

The water-based floating structures (two pontoons) are proposed to feature the installation of proprietary type pontoons with steel circular restraint piles and aluminium framed hinged gangways. The water-based floating structure features will include:

- 33m in length and 2m in width (attached to the north-eastern section building 3).
- 23m in length and 2m in width (located in the north-western section of building 2).

The proposal includes infrastructure upgrades and new lead-in and service reticulation on the land site to be connected to the overwater structures to make these facilities operational. New service infrastructure includes:

- Underground high and low voltage cables,
- Underground NBN cables,
- Sea water pipes.
- Potable water pipes,

- Gravity and pressure sewer pipes,
- Distribution board and main switchboard,
- Services and NBN pits,
- Ausgrid Kiosk Substation, and
- 2m Electrical Easement

For the purposes of the REF the overwater construction footprint area has been defined as follows (refer to Figure 19). Study areas for specialist disciplines are defined in Chapter 6.

Figure 18 Overwater site boundary highlighted in red and the land site boundary highlighted in blue.

Figure 19 Figure showing the overwater area of barges and vessels movements (overwater construction footprint) and the common car park

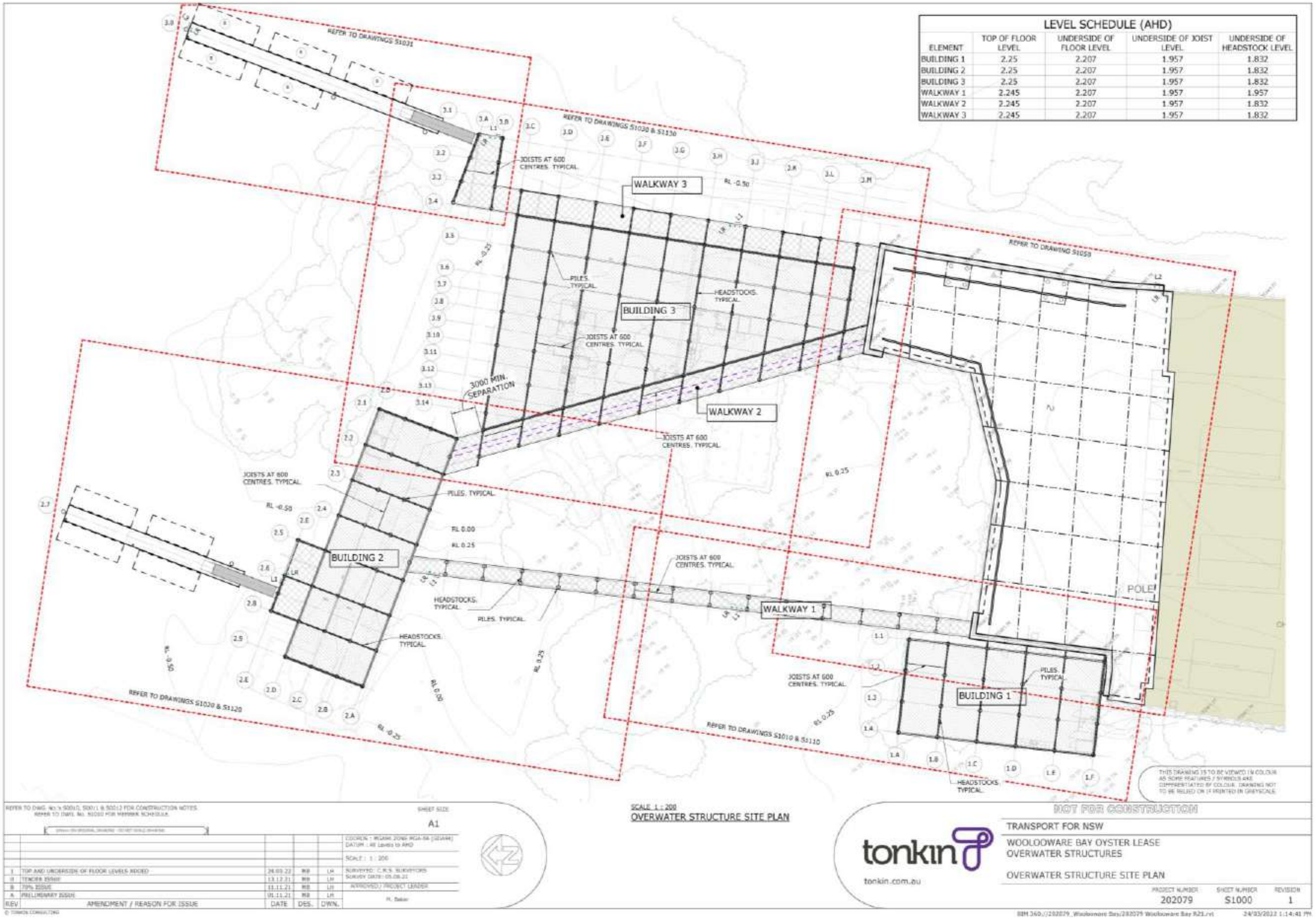

Figure 20 Shows the building 1, 2 and 3 of the overwater structure

Design

Design criteria

The proposal has been designed to NSW and Australian engineering and safety standards, including:

- Disability Discrimination Act 1992 (DDA)
- National Construction Code (NCC) 2016 Volumes 1, 2 and 3 (Formerly Building Code of Australia-BCA)
- Standards Australia: AS4997: 2005 Guidelines for the Design of Maritime Structures.

These standards provide guidance on:

- Overall height of the buildings and walkways are above the water to allow for operation during
- Extreme low and high tide, whilst also considering climate change impacts
- Maintaining vessel navigational channel
- Access and safety requirements
- Operation and stability during extreme storms, accounting for wind, wave and current conditions
- Sufficient water depths at extreme low tide to allow vessels to safely berth
- Without the risk of either grounding or causing notable sediment disturbance and scour
- Appropriate materials selection and durability to support the operational design
- Life of the wharf for a minimum of 50 years.

Overall, the structure has been designed:

- With appropriate materials and durability to support the operational design life for a minimum of 50 years
- To cater for low mobility workers and visitors to the site.
- To operate in different tidal conditions over its design life and take into account climate change and possible sea level rise.
- To be visually sensitive and sympathetic to the special natural characteristics of the RAMSAR wetlands.
- To be an operationally attractive, safe and functional space for workers.
- To allow for operations during Mid to high tide, whilst also considering the climate change impacts is a 2.25RL with an uplift value of 3kpa. This is based on engineering advice provided by the Coastal Engineer from Cardno (appendix K) and is incorporated into the structural design.

Engineering and development constraints

Constraint	Concept design provision
Wind, wave, current and climate change	The design allows the structures to be used during mid to high tidal states (i.e. Highest Astronomical Tide (LAT), with an additional allowance and climate change adaptation and sea level rise (2.25RL with an uplift value of 3kpa).
Disabled Access	The new structures (both water-based and land-based) are required to be accessible to people with a disability to meet the standards of the DDA, DSAPT and current legislative standards for disabled access.
Water Depth	There is limited water depth in Woolooware Bay and in the immediate vicinity of the proposal site.

Constraint	Concept design provision
	TfNSW prepared a hydrographic survey for the site to provide a navigational pathway that is the least impactful pathway for vessels to access the site (Figure 21, 22 and 23). TfNSW developed a passage plan for construction vessels or vessels undertaking investigation works i.e. geotechnical investigation which is further detailed below in section 3.2.3. The generated plans below (Figure 21, 22 and 23) have been created based on 2018 LiDAR bathymetry data available online.
Wetlands / Mangroves	The design recognised the difficulty of constructing buildings withing the mangrove forest. The original advice provided by the arborist was a like for like replacement would result in the removal of 30 mature mangrove. The new structures are proposed to remain in their current position or repositioned to avoid the direct impact to the mangrove forest which has resulted in the removal of 8 mangroves for the design (Appendix E).
Aquatic Biodiversity	The proposed structures are situated on piles allowing more marine organisms to pass through with the tidal movements and do not cause detrimental impacts to fish. The structures and the pontons have been positioned to not block fish passages.
Geotechnical and Soils	For the previous Stage 1 remediation development, geotechnical investigations were undertaken for the landside. The boreholes identified layers of peat, clayey silt, sandy silt, sandy clay, clayey sand, silty clay, silty sand, clay, and gravelly sand over weathered sandstone bedrock. The bedrock level generally falls to the north into the water under the existing over-water structures. For the extent of the overwater structures the bedrock level is estimated to vary from 10m - 13m below the seabed, which was extrapolated from the existing data set and provides an indication of where bedrock is anticipated. This previous assessment is outlined in 'Captain Cook Drive Remediation – Addendum REF Seawall Construction' dated June 2020. The preliminary assessment by the engineering team indicates that the loads against the geotechnical soil profile shows that piles will need to be driven to and socketed a small distance into the weathered sandstone bedrock. Additional geotechnical information is proposed to be collected, subject to the approval of this proposal. The pathway for this investigation and all barges and vessels which access the site is defined in figure 21,22 and 23 (see below).

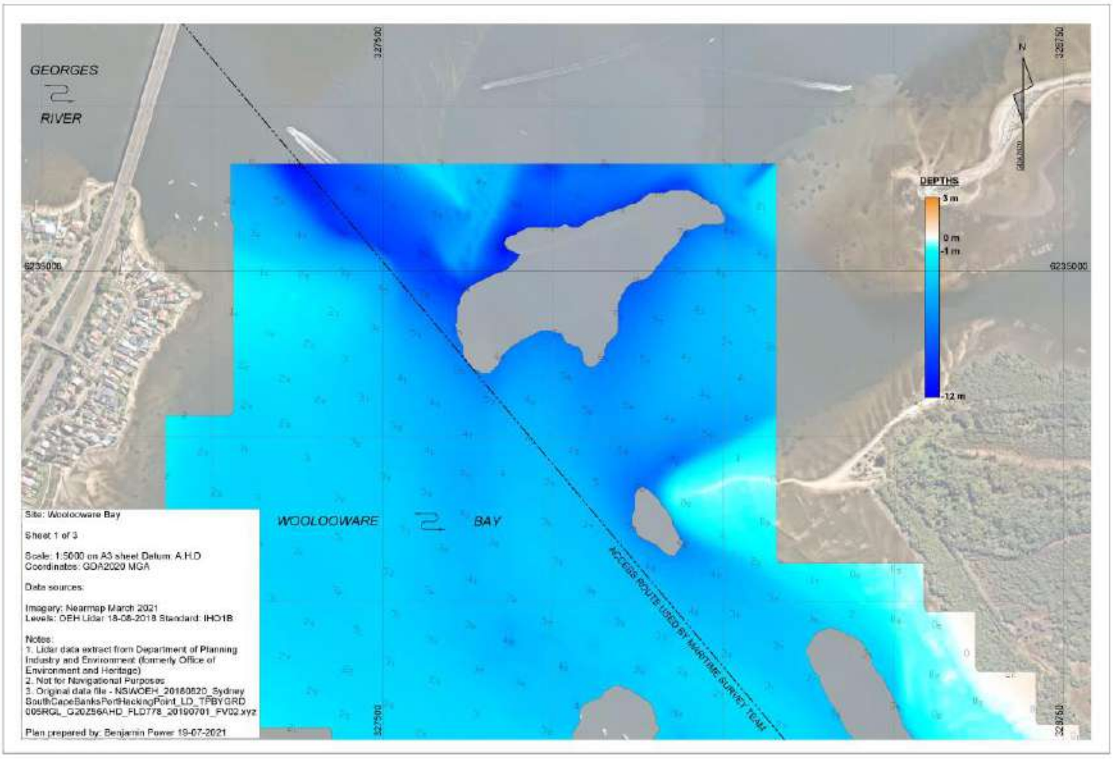

Figure 21 Highlights the path for any vessel or Barge from Caption Cook Bridge to the site.

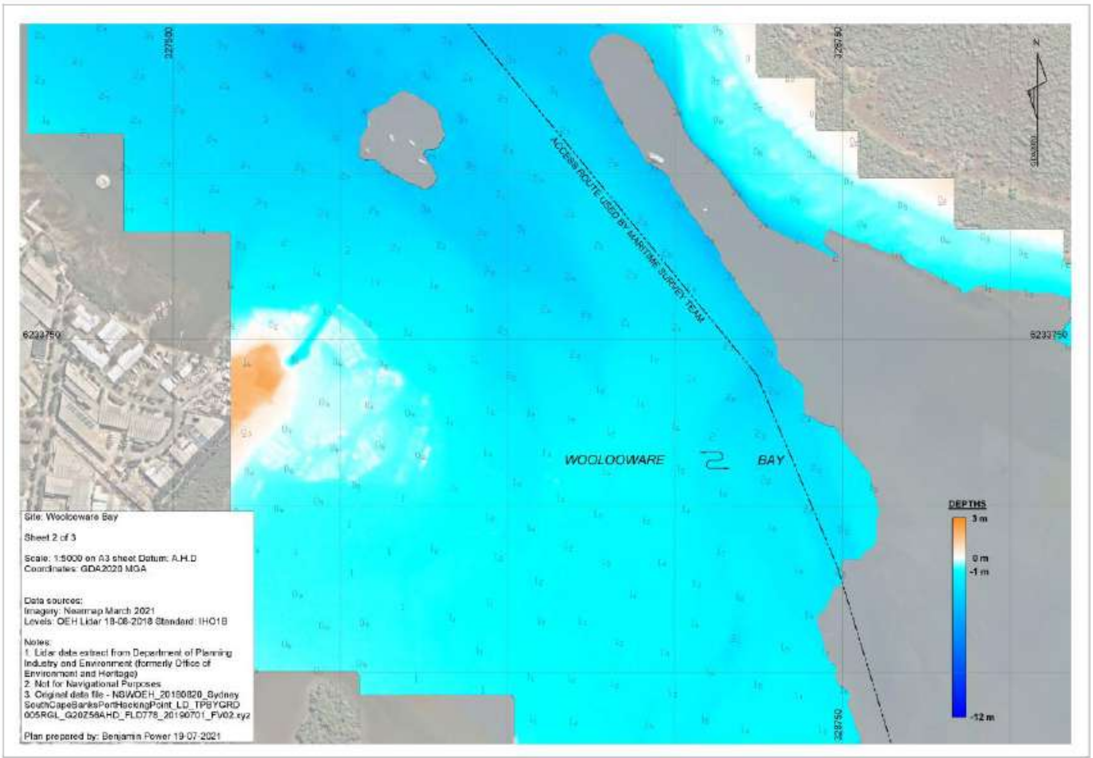

Figure 22 Highlights the path for any vessel or Barge through Woolooware Bay to the Site.

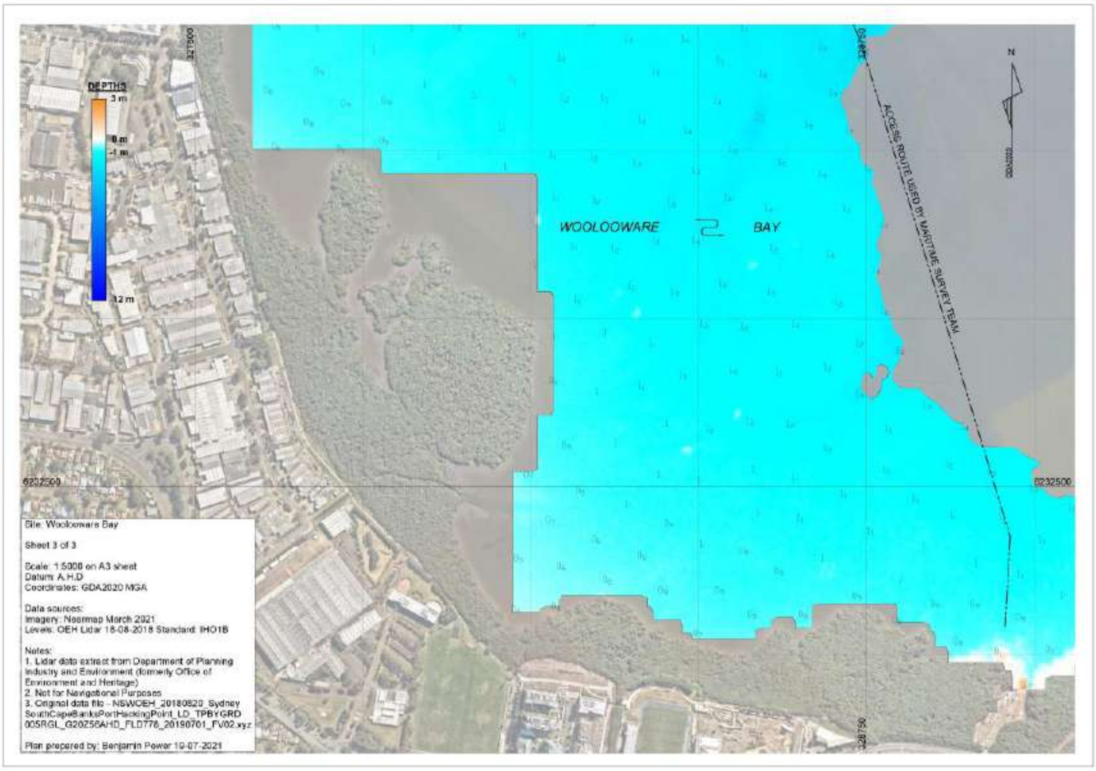

Figure 23 Highlights the path for any vessel or Barge through Woolooware Bay to the Site

Figure 24 outlines that over the footprint of the existing and proposed buildings and walkways, the seabed starts to become exposed above mid tide level and is completely exposed at most low tides.

Overall, the footprint of the existing and proposed floating structures, bed levels generally vary from approximately 0.00 to -0.65 AHD. Therefore, they are proposed to sit on the seabed at mid tide level and below.

Figure 24 Hydrographic survey for the Site which highlights the shallow water depth at the site

Major design features

This section describes the proposals main design features:

Major water-based features

Over-Water Buildings

The proposal includes three overwater structures (Buildings 1, 2 and 3) with a combined area of 1,920m2. All of the overwater structures are proposed to be constructed on steel piles which will be driven into the seabed.

Building 1

Building 1 has an area of 264.32m2 and will be supported by 24 vertical steel piles. The structure will have a maximum height of 5 metres from the finished ground level to the top of the roof structure and wall height of 3 metres measured up the eave. The roof will comprise of corrugated roof sheets and have a slope of 10 degrees. The structure will comprise:

- Framed internal flooring in 38mm 'Webforge' mini-mesh;
- Kitchenette;
- Accessible toilet;
- Accessible shower / changeroom; and
- Storeroom.

Refer to the below Figures 26 – 30.

Building 2

Building 2 has an area of 314.57m2 and will be supported by 37 vertical steel piles. The structure will have a maximum height of 5 metres from the finished ground level to the top of the roof structure and wall height of 3 metres measured up to the eave. The roof is to be comprised of corrugated roof sheets and have a slope of 21 degrees. The structure will comprise:

- Framed internal floor in 38mm 'Webforge' mini-mesh with a small section of 43mm 'Webforge' mini-mesh on the northern elevation;
- An 8m long hinged gangway leading to a pontoon;
- Accessible toilet;
- Accessible shower / changeroom; and
- Kitchenette.

Refer to the below Figures 31 - 35.

Building 3

Building 3 has an area of 698.44m2 and will be supported by 55 vertical steel piles. The structure will have a maximum height of 6.25 metres from the finished ground level to the top of the roof structure and wall height of 3 metres measured up to the eave. The roof is to comprise of corrugated roof sheets and have a slope of 21 degrees. The structure will comprise:

- Framed internal floor in 38mm 'Webforge' mini-mesh with a small section of 43mm 'Webforge' mini-mesh on the northern elevation;
- An 8m long hinged gangway leading to a 2 metre wide and 33 metre long pontoon;
- Kitchenette x 2;
- Accessible toile x 2t;
- Accessible shower / changeroom x 2; and
- Storeroom x 2.

Refer to the below Figures 36 – 40.

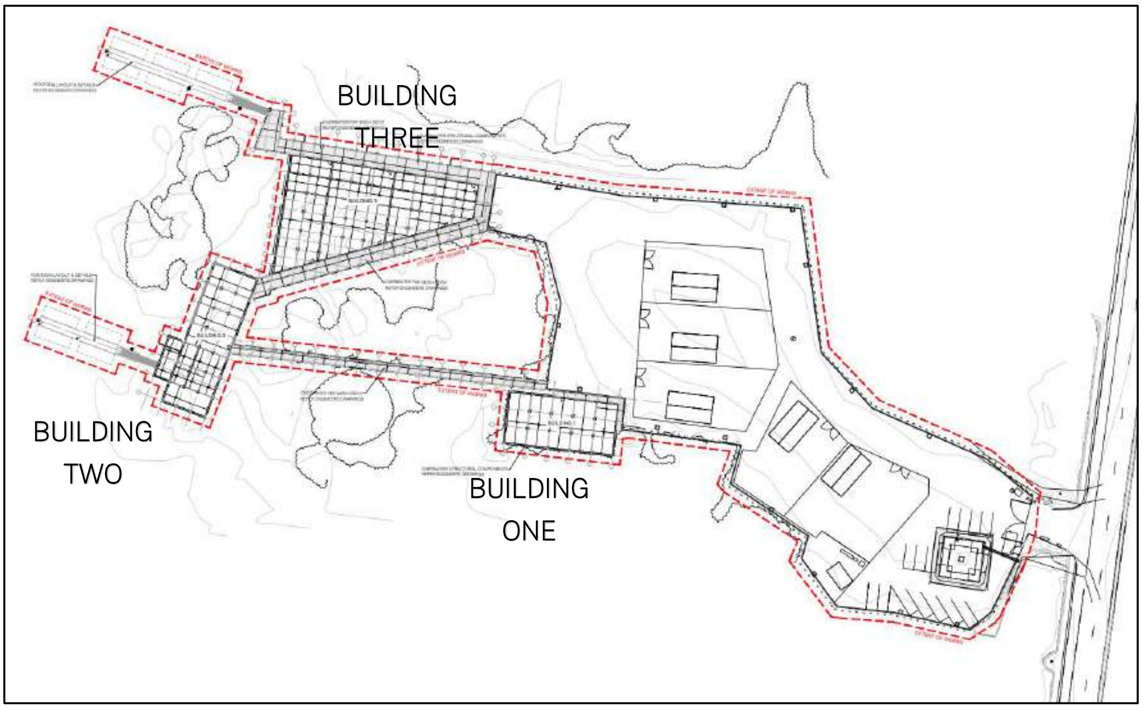

Figure 25 Site Plan Showing the Three Proposed Buildings (Source: Paterson Design Studio)

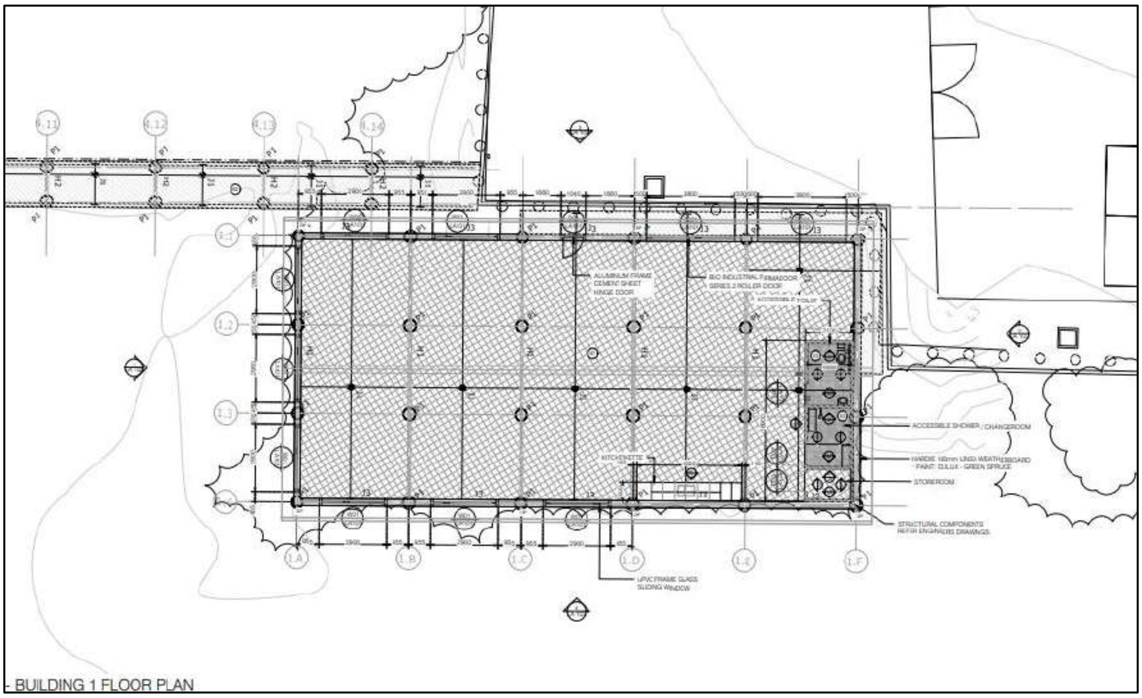

Figure 26 Building 1 Floor Plan (Source: Paterson Design Studio).

Figure 27 Building 1 West Elevation (Source: Paterson Design Studio).

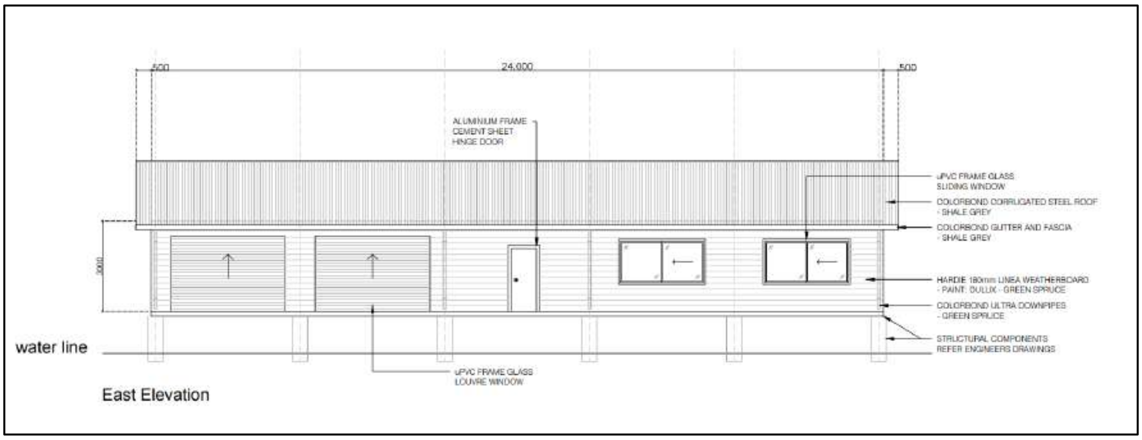

Figure 28 Building 1 East Elevation (Source: Paterson Design Studio).

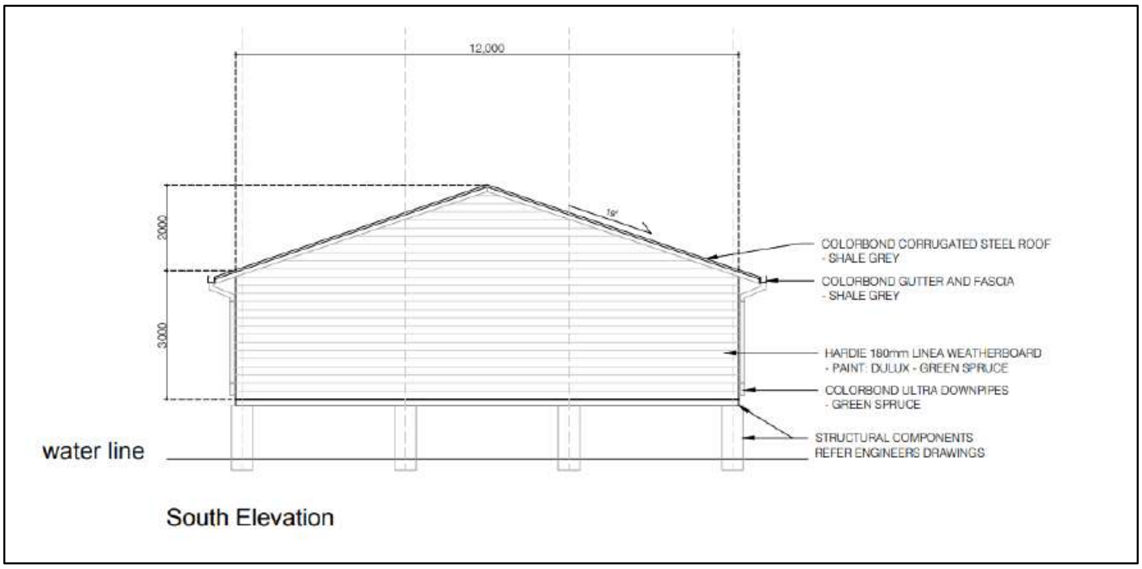

Figure 29 Building 1 South Elevation (Source: Paterson Design Studio).

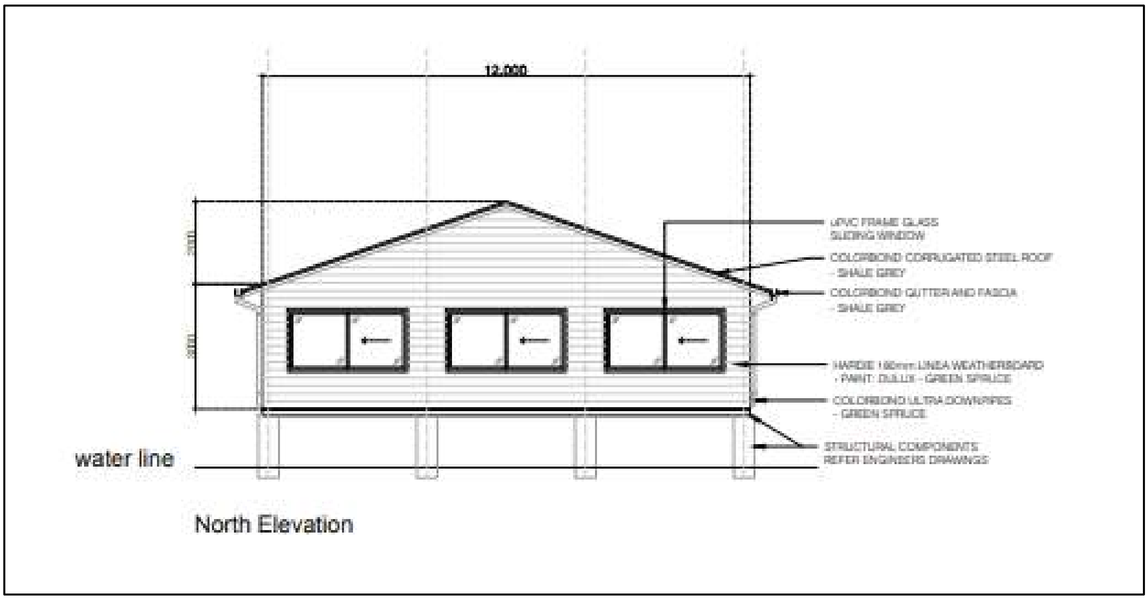

Figure 30 Building 1 North Elevation (Source: Paterson Design Studio).

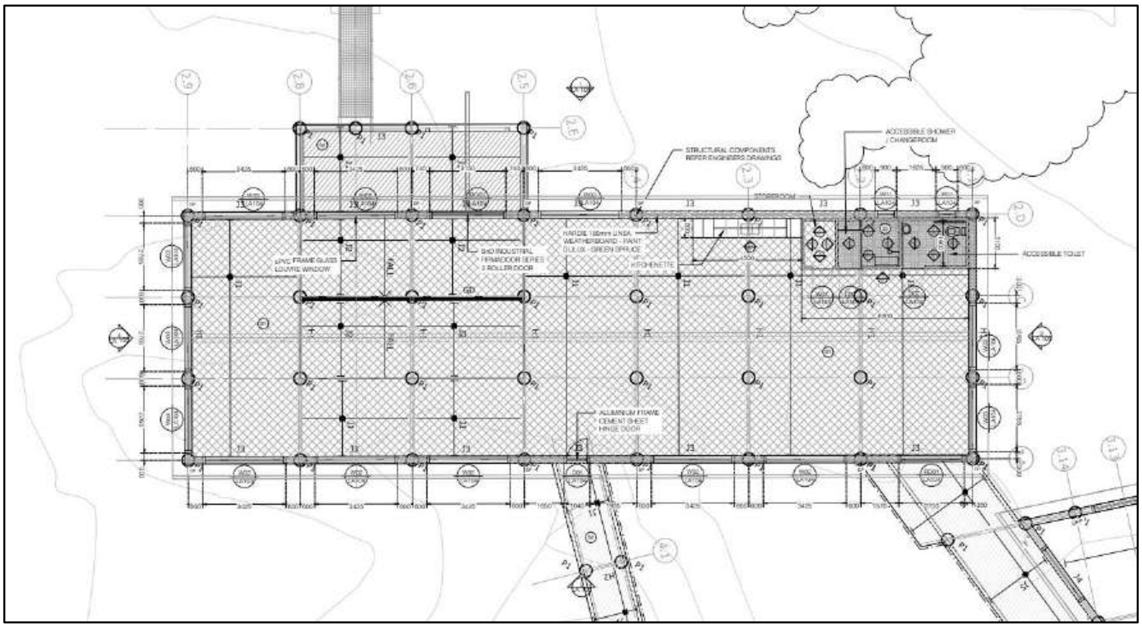

Figure 31 *Building 2 Floor Plan (Source: Paterson Design Studio).*

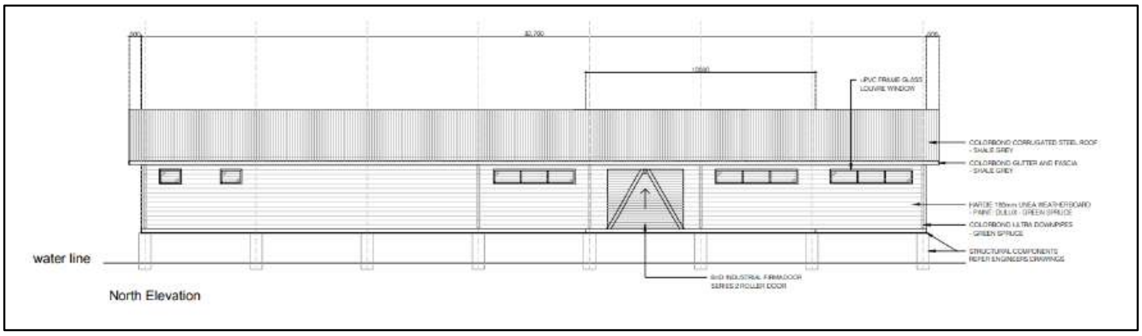

Figure 32 Building 2 North Elevation (Source: Paterson Design Studio).

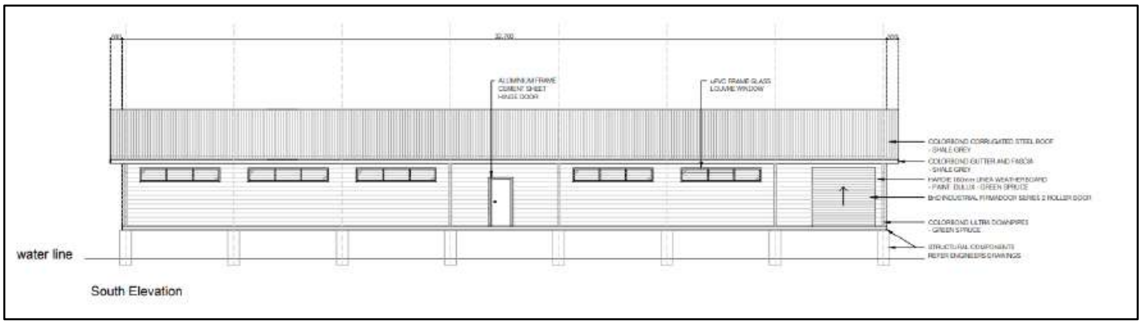

Figure 33 Building 2 South Elevation (Source: Paterson Design Studio).

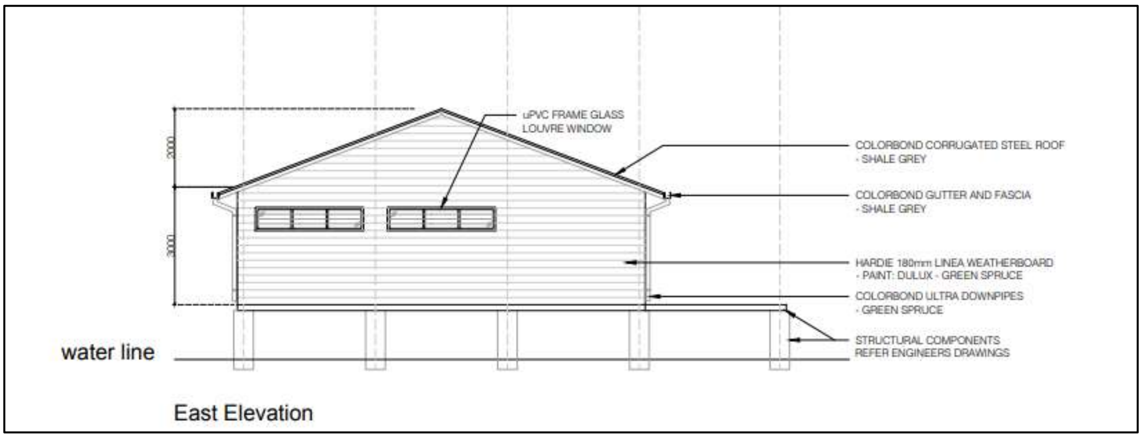

Figure 34 Building 2 East Elevation (Source: Paterson Design Studio).

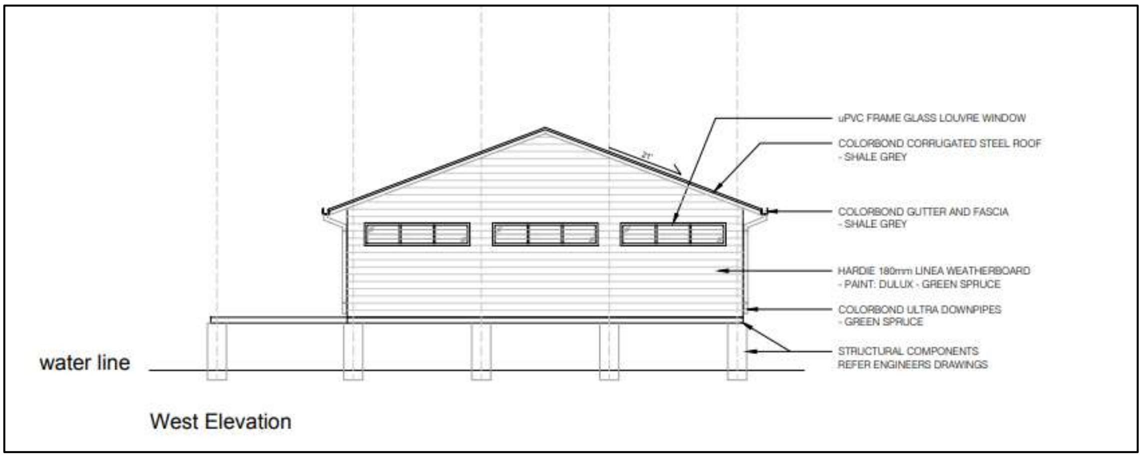

Figure 35 Building 2 West Elevation (Source: Paterson Design Studio).

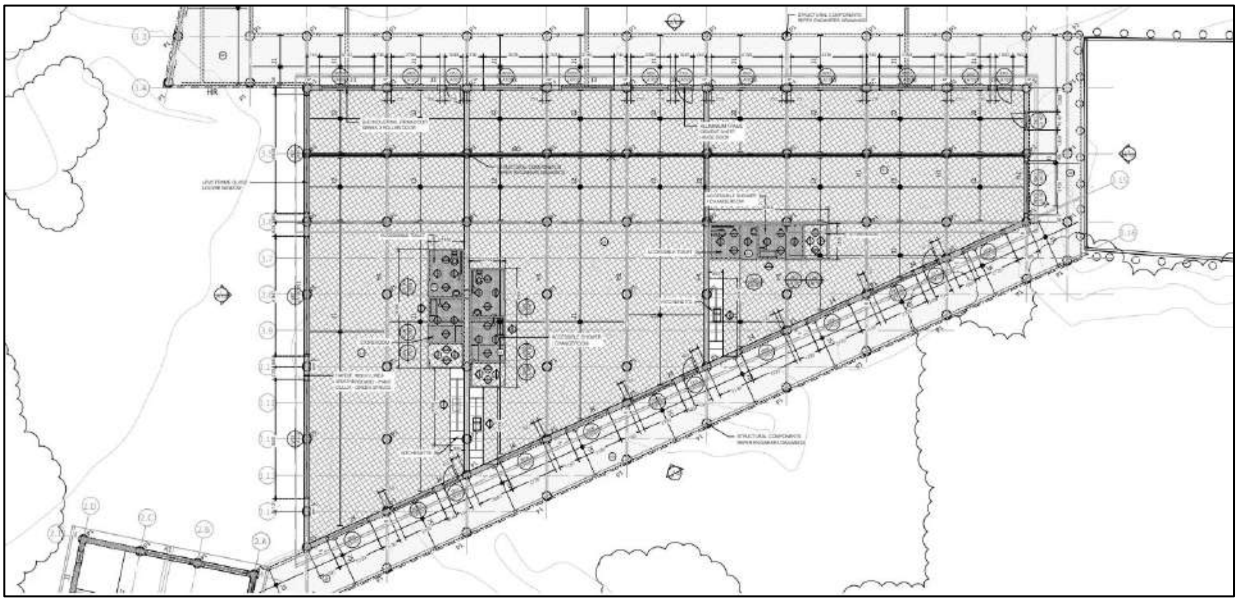

Figure 36 Building 3 Floor Plan (Source: Paterson Design Studio)

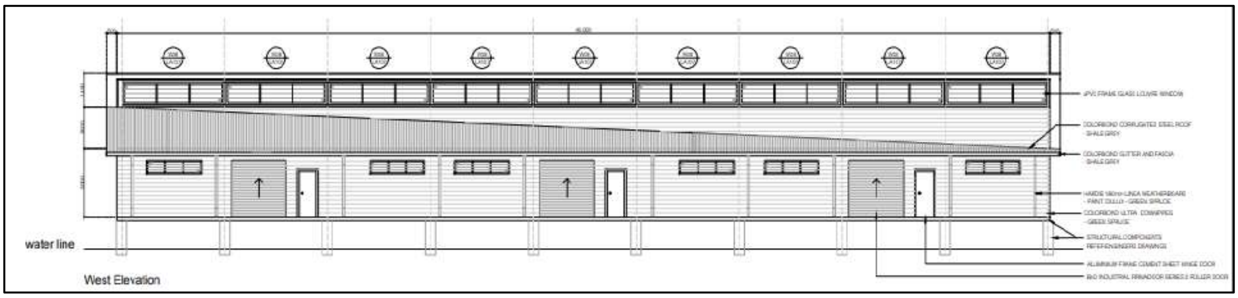

Figure 37 *West Elevation (Source: Paterson Design Studio)*

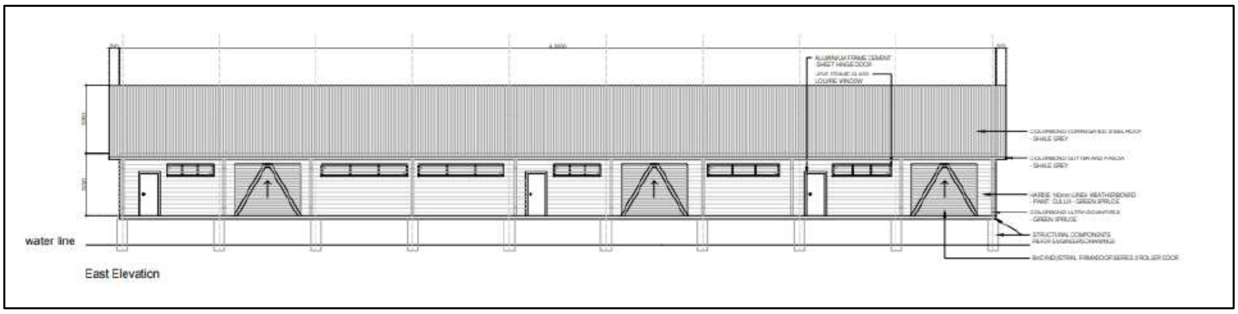

Figure 38 East Elevation (Paterson Design Studio)

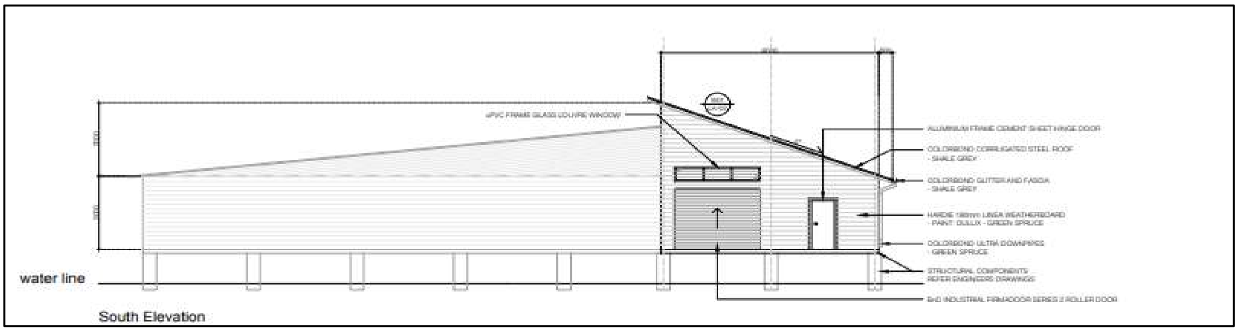

Figure 39 South Elevation- (Source: Paterson Design Studio)

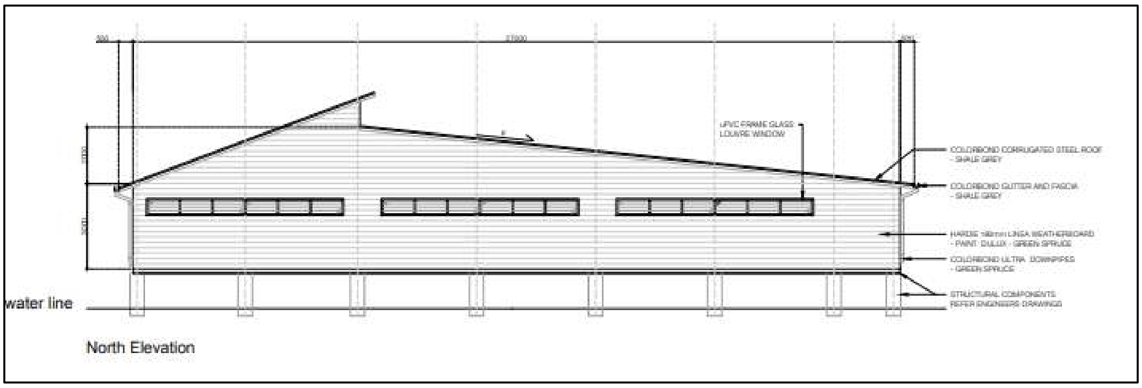

Figure 40 North Elevation- (Source: Paterson Design Studio)

Over-Water Walkways

All of the outer-water walkways (1,2 and 3) will be constructed on vertical steel piles above the water to support operational requirements. The walkways are 1.5m wide and are supported by 57 vertical steel piles. The walkways will be constructed of a FRP mesh to allow light to penetrate through to the water below and include handrails for safe access.

Refer to the below Figures 41 – 43.

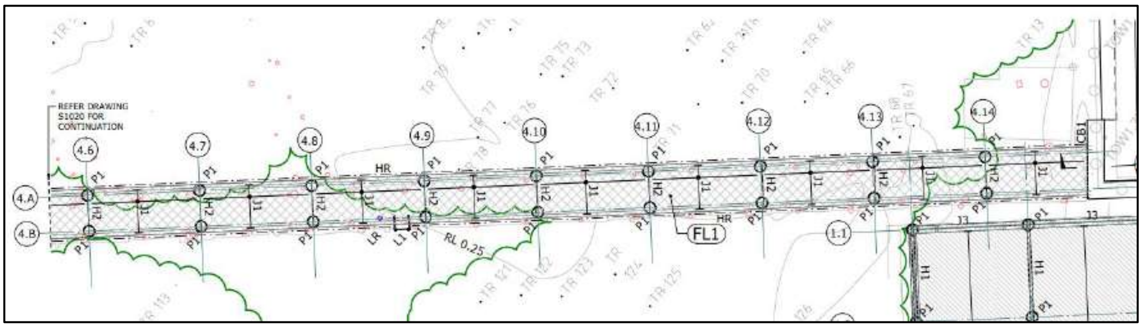

Figure 41 Proposed Walkway 1 (Source: Tonkin)

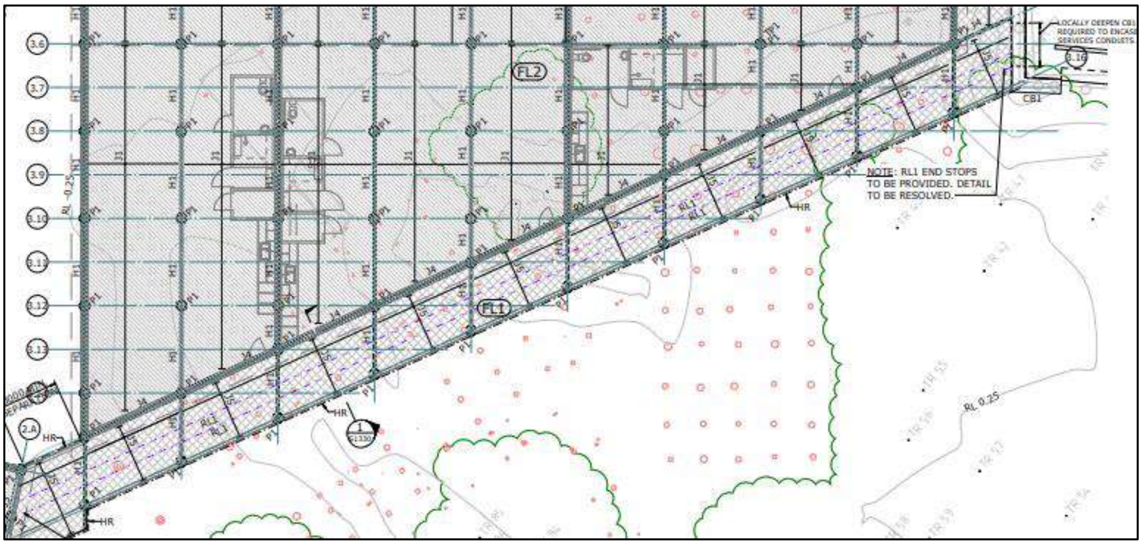

Figure 42 Proposed walkway 2 (Source: Tonkin)

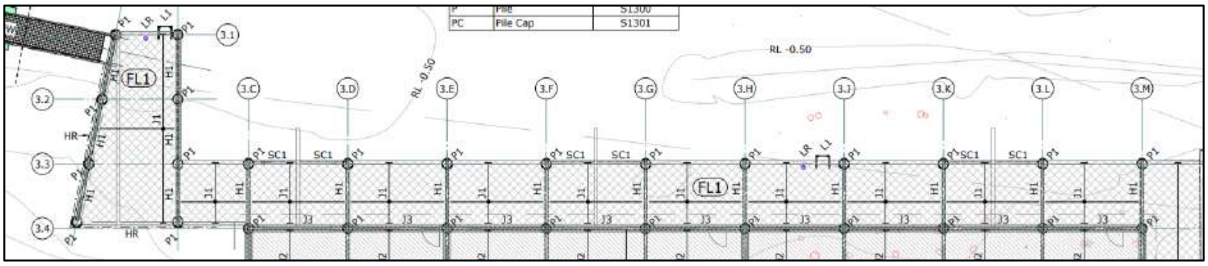

Figure 43 Proposed Walkway 3 (Source: Tonkin)

The water-based structures are proposed to feature the installation of steel circular piles with corrosion protection and are concrete filled, which will facilitate the connection to the structure floor framing (bearers and joists) spanning between the piles. Installation of the wall and roof framing may be supplied to site as prefabricated wall panels and roof trusses, similar to normal domestic type construction. The services to the overwater structures will be upgraded from land and will include water, power, communications, and sewer.

Floating Pontoons

There are two floating structures (proprietary system pontoons) proposed with the following dimensions:

- 33 metres in length and 2 metres in width (attached to the north-eastern section building 3), and
- 23 metres in length and 2 metres in width (located in the north-western section of building 2).

The pontoons will include services bollards with light, water and power. Supply services are proposed to run on the underside of the gangway and within services ducts in the pontoons consistent with other modern marinas and wharves.

Refer to the below Figures 44 and 45.

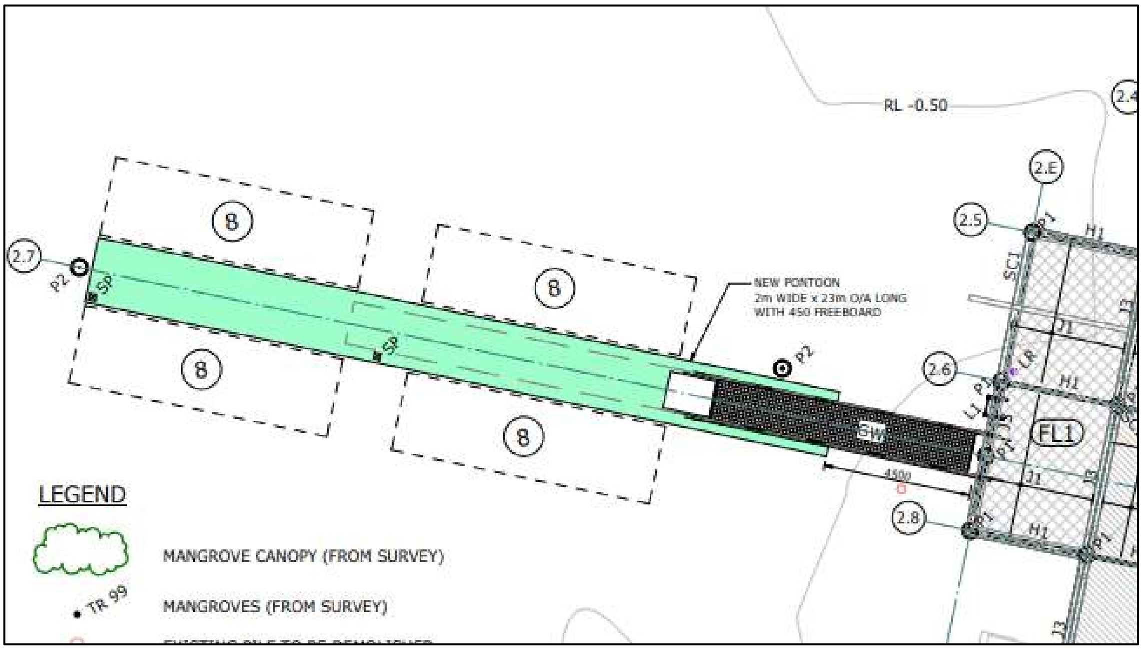

Figure 44 Pontoon adjoining Building 2 (Source: Tonkin)

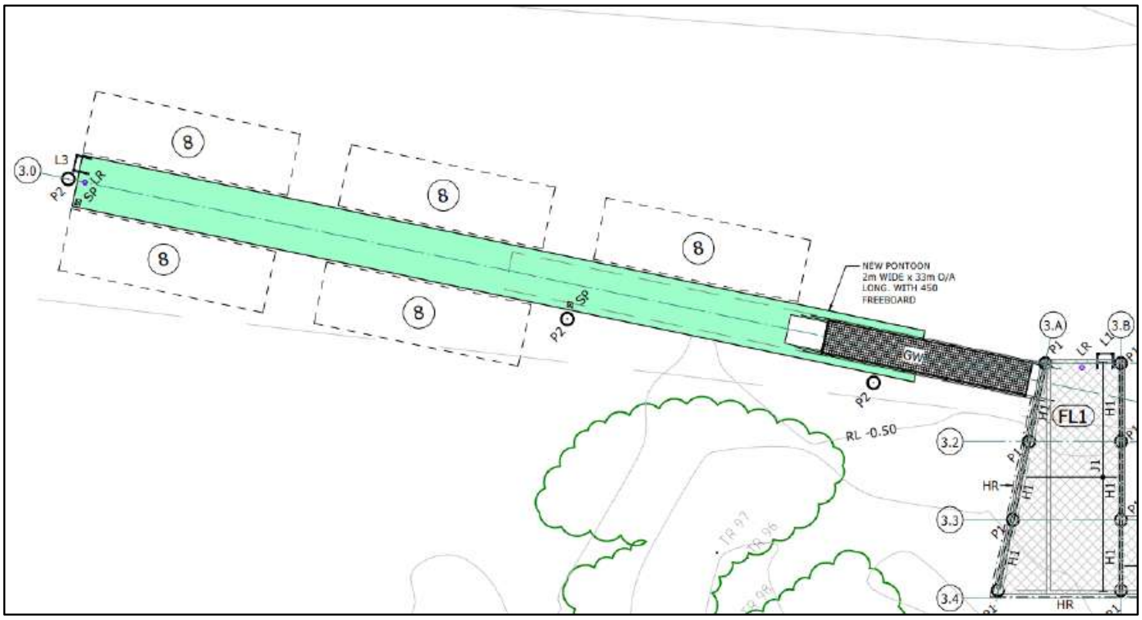

Figure 45 Pontoon adjoining Building 3 (Source: Tonkin)

The water-based floating structures (two pontoons) are proposed to feature the installation of proprietary type pontoons with steel circular restraint piles and aluminium framed hinged gangways. These floating pontoons will include proprietary services bollards with light, water and power. Supply services are proposed to run on the underside of the gangway and within services ducts in the pontoons consistent with modern marinas.

Major land-based features

Buildings

Land based buildings will be the subject of future development applications for industrial warehouse structures.

Pedestrian Access

No public access will be permitted on the site and the operator's pedestrian access from the carpark to the overwater structures would be via a new designated walkway located on the eastern boundary inside the existing seawall. The pedestrians would access the overwater structures via the three designated walkways shown on the site plan in Appendix C from the land side.

Services

The proposal provides for upgrades to the existing services and the construction of new lead in services. Specifically, services will comprise the following:

- Underground high voltage and low voltage cables
- Underground NBN Cables
- Sea water pipes
- Potable water pipes
- Gravity and pressure sewer pipes
- Distribution board and main switchboard
- Services and NBN pits
- Ausgrid Kiosk Substation
- 2m Electrical Easement.

Services will largely be land based, concentrated in an area that has been subject to prior disturbance. New sewer lead in and water mains and underground high-voltage infrastructure will be extended from Captain Cook Drive. The installation of services to the overwater structures will be provided from land.

The services will run on the underside of the gangway and within services ducts in the pontoons. Refer to the below Figures 46-48.

All connections from Captain Cook Drive, across the land site to the overwater structures will be developed during detailed design in consultation with the relevant service providers. Separate authority approvals will be required prior to the disconnection of existing infrastructure, connection and augmentation of services.

Figure 46 Services Plan Sheet 1 of 2 (Source: Tonkin)

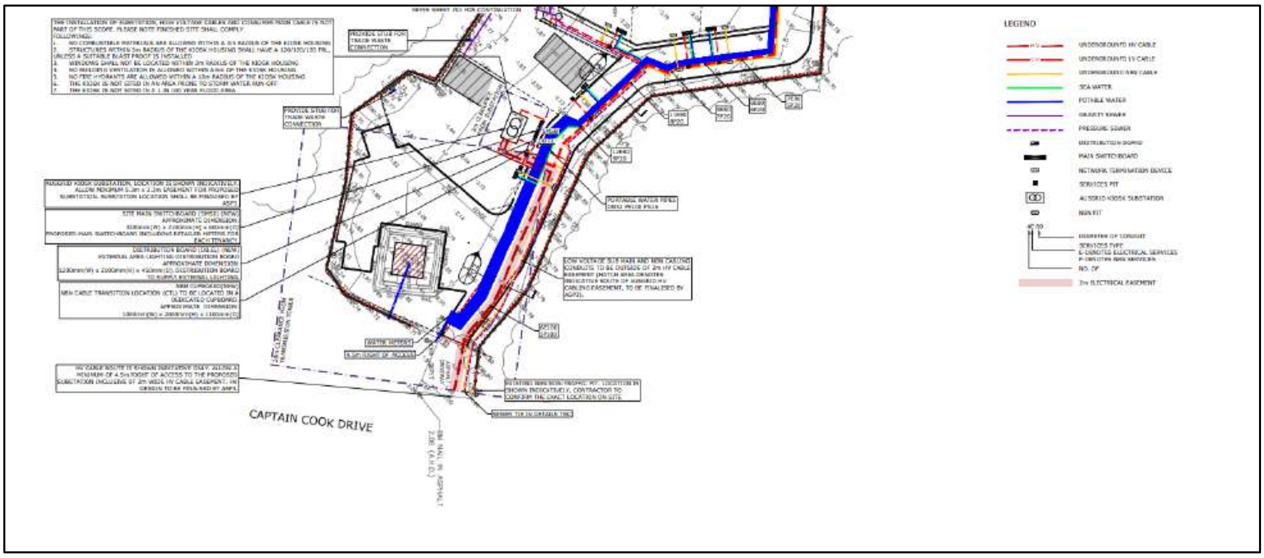

Figure 47 Services Plan Sheet 2 of 2 (Source: Tonkin)

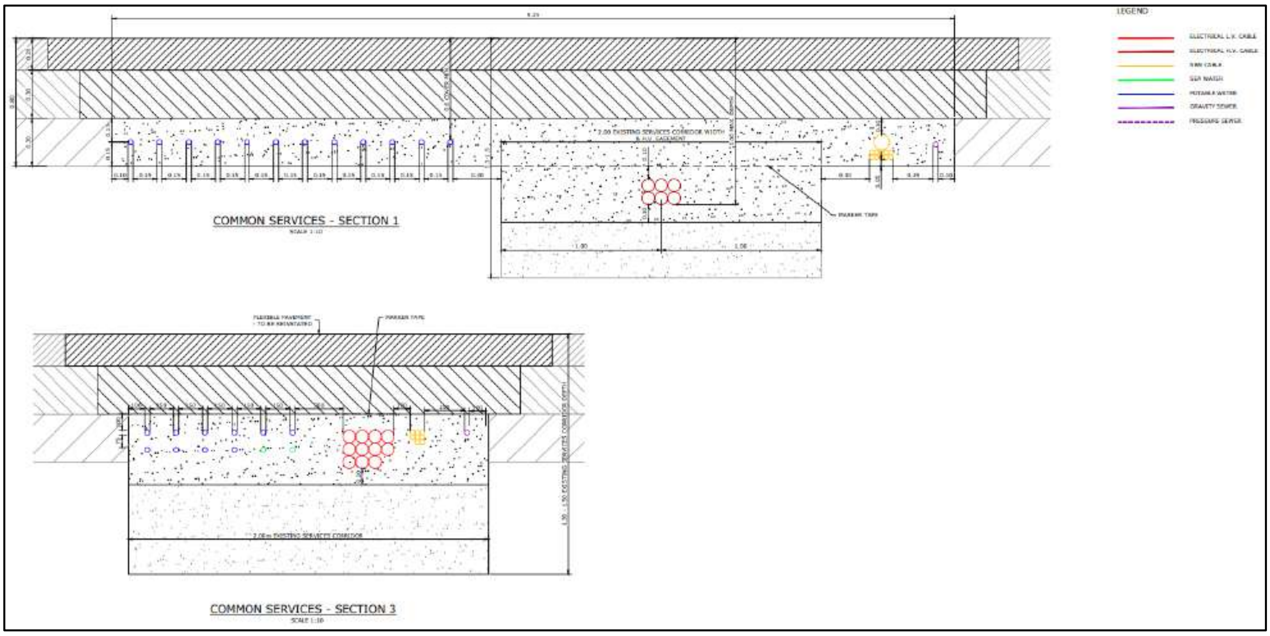

Figure 48 Services Section (Source: Tonkin)

Construction activities

The appointed contractor would confirm the final construction activities in discussion with TfNSW. As such, this section only indicates a likely method, works and staging plan as it may vary due to the identification of additional constraints before commencement, detailed design refinements, community/stakeholder consultation feedback, and contractor requirements/limitations. Should the work method differ from what is proposed in this REF, the contractor would consult TfNSW to determine if an additional assessment is needed.

Staged Construction

The existing overwater and floating structures located at the northern end of the site are currently occupied by an existing operator. The overwater construction footprint is identified in figure 19. Staged demolition and construction would need to be considered to allow this operator continuous occupation during the proposed works.

Progressive Overwater Construction

The technique proposed involves progressively installing piles and floor structure starting from the land and progressing out over the water. The piling equipment is to be supported on the completed piles and reaches out to install the next row of piles. The tops of the piles are proposed to be concrete filled by the piling equipment using concrete kibble buckets or a concrete pumping line or the tops of the piles could be concrete filled by following equipment. Using this method minimises the need for working barges and minimising environmental impacts. The deck framing is proposed to be FRP and so is unlikely to have the capacity to support this equipment. Therefore, it will be necessary to use fabricated structural steel equipment platforms to span between 4 piles and support the machine. Several platforms will be needed to allow them to be leapfrogged forward as work progresses. Leapfrogging of the frames will require slewing or swinging action of the equipment. Regular pile grids will limit the number of different equipment platforms needed.

Demolition

Demolition of the existing structures is proposed to be removed to the land manually or by using small trolleys, and then disposed of to a licence facility or recycled. This is proposed to happen in conjunction with the construction where plant will assist the demolition. The roof structures (roof framing clad and corrugated metal roof) and wall are proposed to be collapsed onto the building floor level and then removed. The timber decking, flooring and framing will be removed followed by the beams and joists. If materials fall into the water body, they will be exposed at low tides so the material would be easily collected. The contractor methodology would define how this can be minimised and managed via the CEMP will regular surveillance by TfNSW.

The existing piles that support the various overwater structures are to be inspected on a case-by-case basis and if the existing are unable to be removed safely it is proposed to cut the piles at the seafloor depth to minimise disturbance to the seafloor. This process will be documented in the CEMP and these field activities will be overseen by TfNSW environmental representative. The existing floating structures (see figure 16) are proposed to be disconnected and towed to a nearby suitable boat ramp facility / slipway. Located in at Shell Point, Woolooware Bay there is a facility where these structures could be disposed of. This will be confirmed with the successful contactor depending on the crane sized proposed, they may be lifted out of the water by crane and onto the land site and be suitably disposed of, or these structures may be deconstructed, loaded onto a working barge and transported to a suitable location for offloading and disposal. The hinged gangways and walkways are proposed to be removed and disposed of concurrently with the main structures. The tide will need to be sufficiently high for the pontoons to be floating for this operation or there is the opportunity to lift these structures and materials onto landside and dispose of via truck to a licenced facility.

Removal of materials/rubbish adjacent to the Overwater Structures

Material adjacent to the structures including bricks, tyres, concrete, metal and timbers that are located on the surface, are proposed to be removed at low tide. No significant excavation or dredging is proposed during these removals. Only a small area of approximately 50m3 of material to be excavation and on the land site. This area is where the land site connects to building 3 (see below figure 49).

Figure 49 Red rectangle highlights the small amount of timber material / soil / Sediment that requires offsite disposal.

Proposed Piling

Where piles are sufficiently close to land, they are proposed to be installed using land-based equipment. Piles that are further out in the marine environment will need to be installed using the progressive overwater construction technique described in the Constructability Assessment in Appendix F and summarised below.

Superstructure

Once the piling has been installed enough piles to create a platform then the beams, bearers and joists constructed which will be the floor of the buildings. It is proposed that the wall and roof frames will come to site as prefabricated panels with some structural steel elements. Manual handling of these elements into place will not be feasible. Cranes large enough to hold and install the frames will be too heavy to be supported on the new flooring. Therefore, erection of the wall and roof framing is proposed to be undertaken using a land-based crane, and for the buildings further out, a crane on a jack up barge. Roof sheeting bundles are proposed to be lifted into place by the same cranes. Wall cladding, doors and windows are proposed to be installed manually and painted from scaffolding external to the buildings. Where there is no deck area outside a building wall, temporary platforms cantilevering out from the underside of the floor framing are proposed to be installed to support scaffolding. These techniques are further described in Appendix F.

Services

The construction and commissioning of all services is proposed to be staged to suit the construction requirements for Stage 1 and 2. As stated above, Building 1 is proposed to be constructed initially followed by the land base civil works, offsite services lead in, land site service reticulation and the Buildings 1 and 2. The methodology will be agreed upon with the successful contractor.

Work methodology

Site establishment

Site establishment would involve the following main tasks:

- Notify Local Council and other stakeholders before work starts (where required)
- Carry out pre-work inspections
- Establishment of a site compound and ancillary facilities within the existing hardstand located to the south of the site
- Set out, de-mark and establish a maritime navigation exclusion zone in the Bay and no-go zones on land and in the bay
- Disconnection of existing services and connection of temporary services as required
- Establishment of environmental controls in accordance with the construction environmental management plan (CEMP) and this REF, including erosion and sediment control measures and silt curtains and booms.

Removal of all hazardous materials pre demolition (i.e. asbestos). Set up of any controls required for hazardous material unable to be removed prior to demolition provision of clearance certificate from suitably qualified consultant.

Staging

A key objective of the project is to undertake the works in stages such that the existing commercial operator (Endeavour Oysters) can continue to operate during the demolition and construction phases. A detailed staging plan and construction methodology has been prepared to support this project objective and broadly includes the decanting of operations and sequential demolition and reconstruction / re-occupation of the over-water and land structures.

Areas on land site and overwater site will need to be defined and the existing operator will be directed to where they can and cannot operate. The details of this arrangement will be outlined in the CEMP to avoid clash points during demolition and construction. The final configuration of this division will be defined in the Construction and Environmental Management Plan (CEMP) prepared by the contractor and approved by TfNSW.

Stage 1 (See Figure 50)

- Installation of environmental and safety controls around Stage 1.
- Demolition of the eastern overwater structures and construction of the proposed building 3 structure in a progressive manner as outlined in section 3.2.4.
- The western part of the new northern building would be commenced so that the equipment could be temporarily located there ready for Stage 2. Alternatively, the equipment could be removed using a crane and jack up barge to await the commencement of Stage 2. Due to budgetary constraints this might be delayed.
- The existing board walks in the central section of the site will be demolish and stopped before the integrity of the western walkway is compromised
- Removal of the existing eastern floating structures and installation of the new pontoons and piles.
- Clean up and commissioning of Stage 1, and removal of environmental controls.
- Once the building is certified then existing operator moves into the newly constructed overwater and floating structures once these buildings once, they are safe to do so.
- The land site civil works would involve the construction of lead in services offsite and service reticulation and on-site levels to be adjusted so the land to the overwater structures is DDA compliant. An engineered reinforced capping structural design will connect the land to the overwater structures which will create functionality for land to water.

Stage 2 (See Figure 51)

- Installation of environmental and safety controls around Stage 2.
- Demolition of the western overwater structures and construction of the new structures in a progressive manner.
- Progressive demolition and reconstruction of the western overwater walkway, which will return the construction equipment to land at the north-western corner of the seawall.
- Removal of the existing eastern floating structures and installation of the new pontoons and piles.
- Clean up and commissioning of Stage 2, and removal of environmental and safety controls.
- The construction is proposed to be undertaken from land predominantly with the support from working barges at suitable tides or a fixed jack up barge. The methodology will be refined by the successful contractor of how the stagging and construction process would be refined during the implementation and monitoring of CEMP.
- Removal of all rubbish on land and any debris which has floated in with the tides
- Remove any safety controls such as maritime navigation exclusion / no-go zones markers
- Remove all of the temporary fencing and amenities
- Remove all environmental controls i.e silt curtains and booms).
- Removal of all rubbish on land and any debris which has floated in with the tides

Figure 50 and Figure 51 below illustrates the proposed staging footprints for the land site and overwater site. The larger version of the engineered drawing are located in Appendix C.

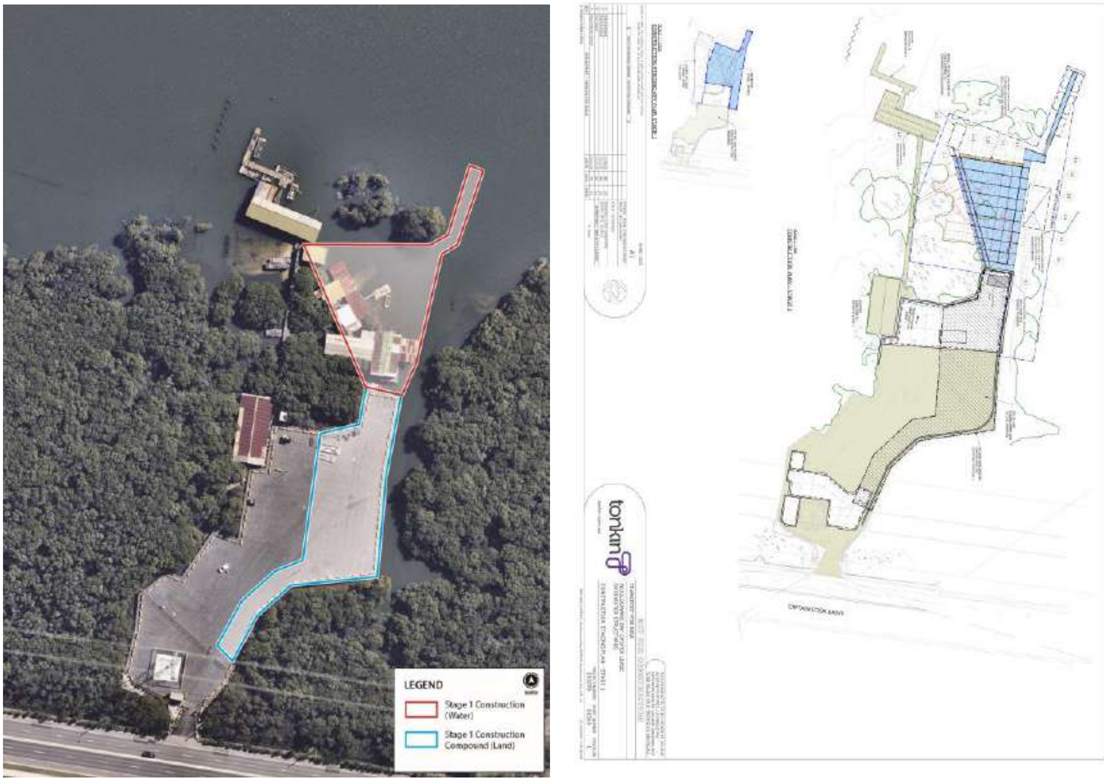

Figure 50 Highlights the area that is proposed to be used by the contractor for Stage 1 of the construction.

Figure 51 Highlights the area that is proposed to be used by the contractor for stage 2 of the construction.

Site clean-up and demobilisation

Demobilise the site compounds.

Construction hours and duration

Construction is expected to commence in March 2022 and take approximately 12 months to complete. All works would be carried out during standard construction hours as required by the NSW Interim Construction Noise Guideline (ICNG). The standard construction hours are:

- 7.00 am to 6.00 pm Monday to Friday
- 8.00 am to 1.00 pm Saturdays
- No work on Sundays or public holidays.

Workforce

While about 30 people would be needed to carry out the main construction activities it is expected that there would be about 10-15 people onsite at any time on average.

Plant and equipment

The plant and equipment needed to build the proposal would be typical of any construction site. It would vary depending on the construction activity. The plant and equipment that would be likely used during the proposal is noted below, however this would be confirmed by the contractor.

- 20 tonne excavators
- Land mounted crane
- Spider crane
- Piling rig
- Excavator
- Concrete truck
- Concrete pump
- Floating boom
- Hand tools
- Generator/s
- Oxy acetylene equipment
- Jack up barge or floating barges
- Chainsaw
- Pneumatic drill/hammer
- Appropriate site facilities

Earthworks

There would be limited earthworks associated with the overwater site. A small amount of localised sediment would be disturbed during the piling work, and demolition of the existing overwater structures however, no sediment would be removed.

Earthworks during construction of the land-based elements would include regrading the existing pavements for the construction of the new ramps to tie in the landside to the overwater structure, regrade the site surface so that the surface water exits though the previous designed stormwater system and minor excavation associated with the proposed service reticulation.

Construction of the capping beam pavement and kerbs may also involve intricate shallow earthworks. Any waste materials generated would be subject to a waste classification prior to offsite disposal. Where possible, the materials would be reused under an exception, unless they classify as a non-exempt waste, in which case they would be shipped (barged) offsite for collection and disposal at a licenced waste management facility.

Source and quantity of materials

Various standard construction materials that are readily available across the Sydney Metropolitan region would be needed to during construction of the proposal. They would be either transported to site via the land site as prefabricated units ready for installation or delivered in small quantities for use as needed. The main materials needed to build the proposal would comprise:

- Proprietary gangway systems and floating structures
- Marine-grade steel, aluminium and zinc for the superstructure
- Prefabricated exterior panels
- Prefabricated barriers and handrails
- Low light fittings for external lighting
- Services cabling and conduits, including electrical cabling and other electronic infrastructure.

The global pandemic has cause supply chain disruption and there is the potential for long lead times for sourcing materials. Early indication (November 2021) is that there is a three (3) month wait for HDPE covered steel piles.

Traffic management and access

Demolition would be facilitated either via truck or truck and dog trailer from the site via Captain Cook Drive. The truck for delivery of the new construction components would likely need to be a prime mover and trailer, a single articulated truck with five axles or small style trucks. In addition, contractor and trade vehicles would be parked in the secure compound or in the site designated parking located at the southern section of the site.

If construction is assisted by barge, the current anticipated waterside departure point is proposed to be Shell Point or subject to availability in Botany Bay vicinity. Marine access routes would depend on the construction approach, which has not been confirmed at this stage. However, TfNSW have provide a pathway so the impacts on Towra Nature reserve are minimised see Figures 21, 22 and 23.

If no barges are used, vehicles would need to access the site directly. Temporary work zones would need to be installed to remove clash points onsite with the existing operator and redefined during stagging of the proposal.

Creation of a maritime navigation exclusion zone around the proposal footprint for the water-side construction works to prevent both commercial and recreational traffic entering the area. A site-specific Traffic Management Plan should be prepared as part of the CEMP.

Ancillary facilities

Ancillary facilities including a construction zone, potential materials staging area and potential works zone would be established on land within the existing secure hard stand area. The compound would be secured by the contractor and re-positioned within the land site. The land site compound would include site sheds for use as an office, amenities as well as storage areas for materials and possibly containers for storage of some tools, equipment, and materials. The construction staging and potential works zones are captured in the Constructability Assessment in Appendix F.

Public utility adjustment

A preliminary assessment of existing utilities near the site was undertaken through a Dial Before You Dig (DBYD). Some impacts to existing electricity infrastructure, water, sewer and telecommunications will occur. Utility services upgrades and extensions are proposed under this REF as detailed previously.

Sydney Water

The closest water mains connection to the entrance of this site is located about 400 metres away at the intersection of Captain Cook Drive and Woolooware Road. The offsite Hydraulics (Sewer and Water) lead-in services will have to be upgraded to bolster the capacity to the site. This will involve trenching from the abovementioned intersection to the site boundary on the opposite side of the road for potable water. For sewer, there are two options proposed to connect into the existing network that is located across the road for the property entrance or pump the sewer to the intersection between above mentioned. Two options to enter/exit the property are:

1. Excavate a trench through the existing road
2. Tunnel bore the services underneath the road

TfNSW have applied to Sydney Water and are waiting for the notice of requirements to be issued.

Ausgrid

The closed high voltage asset is located about 400 metres away at the intersection of Caption Cook Drive and Woolooware Road. The high voltage electrical lead-in services will have to be upgraded to bolster the capacity to the site. This will involve trenching from this intersection to the site boundary on the opposite side of the road. Two options to enter the property:

1. Excavate a trench through the existing road
2. Tunnel bore the services underneath the road

TfNSW have applied to Ausgrid with a preliminary design.

National Broadband Network (nbn)

TfNSW have entered an agreement with the NBN. "Provided that Transport for NSW complies with the terms and conditions of that agreement (including in relation to the construction of pit and pipe or pathway infrastructure at the development site), NBN will agree to procure the installation of broadband infrastructure at the development." The NBN will be required to be tunnel bored or a trench across Captain Cook Drive.

Offsite Lead-in Services Summary

All connections from offsite to the land site to the overwater site will be developed during detailed design. As mentioned above hydraulics and high voltage power and hydraulics will have to be upgraded from the intersection of Captain Cook Drive and Woolooware Road (Figure 49). Discussion with the utility providers is ongoing and these approvals will be finalised in conjunction with this REF and the successful contractor.

Figure 52 Shows the proposed upgrade to the sewer, water and high voltage electrical

Shows the grass in the road verge looking east on Captain Cook Drive

Figure 53 Shows the grass in the road verge looking east on Captain Cook Drive

Property acquisition

No property would be acquired under the proposal.

Statutory planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

Environmental Planning and Assessment Act 1979

State Environmental Planning Policies

State Environmental Planning Policy (Planning Systems) 2021

State Environmental Planning Policy (Planning Systems) 2021 identifies development that is State significant infrastructure and critical State significant infrastructure.

Clause 2.13(1) of the SEPP declares development to be State significant infrastructure if the development is, by the operation of a State environmental planning policy, permissible without development consent and the development is specified in Schedule 3 of the SEPP.

Schedule 3 specifies that development for the purpose of port and wharf facilities or boating facilities (not including marinas) by or on behalf of a public authority that has a capital investment value of more than $30 million is State significant infrastructure.

The proposal has a capital investment value of less than $30 million, so does not become State significant infrastructure as declared by the SRD SEPP.

State Environmental Planning Policy (Primary Production) 2021

Under clause 2.28 of State Environmental Planning Policy (Primary Production) 2021 a consent authority must consider whether, because of its nature and location, the development may have an adverse effect on oyster aquaculture development or a priority oyster aquaculture area. This proposal has been designed to enable the continued oyster aquaculture operations from the site which is located in an area mapped as priority oyster aquaculture. The proposal seeks to modernise and replace antiquated over-water facilities to support the industry in a manner which will also deliver improved longer-term environmental management and protection measures.

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (Codes SEPP) specifies that certain minor alterations to waterway structures can be carried out by or on behalf of a public authority as exempt development (subdivision 40A of the Codes SEPP). These include structural repairs to, or the replacement of jetties and pontoons.

Unlike most other forms of exempt development minor alterations to waterways structures can be carried out on land identified as 'coastal wetlands' under the SEPP (Resilience and Hazards) 2021 (4A.11 of the Codes SEPP). As shown in Figure 16 one of the existing over-water walkway structures traverse parts of the site shown as coastal wetlands. This component of the proposal can be pursued as exempt development.

State Environmental Planning Policy (Resilience and Hazards) 2021

Under the SEPP (Resilience and Hazards) 2021 the area of the proposal is mapped as "proximity area for coastal wetlands" on the Coastal Wetlands and Littoral Rainforests Area Map, as shown in Figure 54. Clause 2.8(1) of the SEPP states:

Development consent must not be granted to development on land identified as "proximity area for coastal wetlands" or "proximity area for littoral rainforest" on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development would not significantly impact on:

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.

As detailed in the following two sections of this REF, development consent is not required in this particular instance. Notwithstanding, the proposal has been assessed as having a negligible impact on the biophysical, hydrogeological or ecological integrity of the adjacent wetlands as outlined in Section 6 of this REF. The proposal is not considered likely to adversely impact the integrity of the adjacent coastal wetlands.

The site is also within the 'coastal use area' (cl.2.11 of the SEPP). This means that development consent must not be granted unless the consent authority has considered the impacts of the proposal on (for example) access to the foreshore, overshadowing, view loss from public places, visual amenity and the scenic qualities of the coast. The proposal does not seek to alter the current use of the site or foreshore area and will have no measurable impacts with regards to public foreshore access, overshadowing, view loss or the scenic visual qualities of the area as detailed further in Section 6 of this report.

Figure 54 Coastal Wetlands Mapping

State Environmental Planning Policy (Biodiversity and Conservation) 2021

The site is shown mapped within the Georges River Catchment and is subject to the provisions under Chapter 11 of the SEPP (Biodiversity and Conservation) 2021.

The aims and objectives of this chapter are:

(a) to maintain and improve the water quality and river flows of the Georges River and its tributaries and ensure that development is managed in a manner that is in keeping with the national, State, regional and local significance of the Catchment,

(b) to protect and enhance the environmental quality of the Catchment for the benefit of all users through the management and use of the resources in the Catchment in an ecologically sustainable manner,

(c) to ensure consistency with local environmental plans and also in the delivery of the principles of ecologically sustainable development in the assessment of development within the Catchment where there is potential to impact adversely on groundwater and on the water quality and river flows within the Georges River or its tributaries,

(d) to establish a consistent and coordinated approach to environmental planning and assessment for land along the Georges River and its tributaries and to promote integrated catchment management policies and programs in the planning and management of the Catchment,

(e) to provide a mechanism that assists in achieving the water quality objectives and river flow objectives agreed under the Water Reform Package.

The proposal is deemed to be consistent with the overarching aims and objectives of this chapter. The demolition and reconstruction works have been designed to avoid any direct adverse impacts to Woolooware Bay and the foreshore areas and sited to avoid impacts to mangroves. All of the safeguards and mitigation measures presented in Section 6 of this REF will collectively work to avoid and or minimise impacts to ecology, water quality and flows within the coastal system.

The modern over-water structures have been designed with materials, finishes and colours which will complement the foreshore setting, reduce stormwater runoff and contribute resilient structures.

The design of the new structures and supporting stormwater infrastructure will work to negate any negative impacts to water flow through and underneath the structures across the site. No adverse impacts to existing tidal flows or flood water levels will result from the installation of the new structures.

Amendments to the SEPP (Biodiversity and Conservation) were gazetted on 31 May 2022, under Section 11.8 Planning Controls. The amendments to the SEPP specify that development consent is not required for oyster aquaculture that is permitted without consent under the Standard Instrument clause 5.19(6). This amendment has been made to ensure that there is consistency between the SEPP and LEP, as it is now the case that both EPIs state that oyster aquaculture can be carried out without development consent. The amended clause is as below:

'Development consent not required for oyster aquaculture that is permitted without development consent under the Standard Instrument, clause 5.19(6). Development consent required for all other aquaculture.'

Under the amendments, the proposed development can be pursed without development consent under the Sutherland LEP, which is further detailed in the following section of this report.

The proposal has had regard to the specific matters for consideration including the likely direct, indirect and cumulative environmental impact of related activities, including:

Consideration	Comment
a) The coating of fishing accessories with protective finishes	All fixings of stainless steel and structural steel will be coated with protective treatments and externally finished with colours that are sympathetic to the environment. This will ensure longevity of structures and long-term protection for the marine environment.
b) The transport and cleaning of cages, racks and other accessories	During operation of the oyster aquaculture operation, the cleaning and transport of cages, racks and other operational accessories will be managed in accordance with the Operational Management Plan. This will minimise ensure that the site remains clear of obstacles and promote worker safety.

Consideration	Comment
c) Whether the proposal includes adequate measures for the disposal of waste	A Construction and Environmental Management Plan will be prepared which will ensure that waste generated during the demolition, construction and operational phase of the development will be managed appropriately.
d) The potential for adverse environmental impacts arising from damage to facilities or equipment associated with the proposal and caused by flooding, stormwater or erosion.	The proposal has considered the potential for adverse environmental impacts from floods, stormwater and erosion, This is addressed in Sections 6.1.1 and 6.1.2 of this report.

Local Environmental Plan

Local Environmental Plan (LEP) – Sutherland Shire Council

The site is located within the Sutherland Shire Council local government area (LGA). Local development control and land use zoning in this LGA is governed under the Sutherland Local Environmental Plan 2015 (LEP). The site is zoned 'W1 Natural Waterway' as shown in Figure 55.

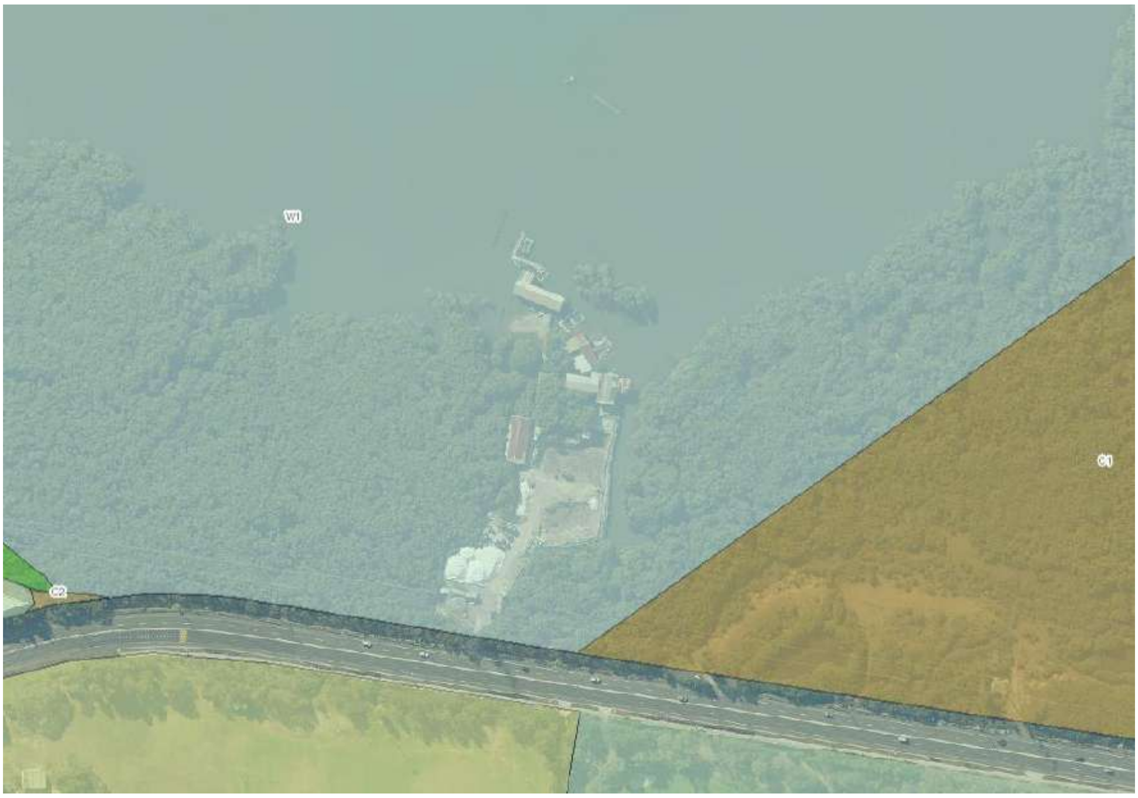

Figure 55 Extract of Zoning Map (Sutherland LEP 2015)

Under the LEP it is possible to carry out certain oyster aquaculture as 'development permitted without consent', as outlined in (cl 5.19 (6)):

6) Oyster aquaculture permitted without consent in priority oyster aquaculture areas

Development for the purpose of oyster aquaculture may be carried out without development consent—

(a) on land that is wholly within a priority oyster aquaculture area, or

(b) on land that is partly within and partly outside a priority oyster aquaculture area, but only if the land outside the area is no more than 0.1 hectare in area.

- The proposal qualifies as 'development permitted without consent' on the basis that: The structures proposed are to support the existing and ongoing use of the site for oyster aquaculture;
- The structures proposed are located partly within and partly outside of the mapped priority oyster aquaculture area, with the area outside being equivalent to less than 0.1 hectares.

Therefore, under clause 5.19(6) of the SLEP the proposal is development permitted without consent. This is consistent with the amendments made to the SEPP (Biodiversity and Conservation) which were brought in to remove consistencies between the SEPP and Standard Instrument to allow for oyster aquaculture without consent within and partially outside of priority oyster aquaculture areas.

Accordingly, the proposal can be assessed under Division 5.1 of the Environmental Planning and Assessment Act, 1979. Development consent from Sutherland Shire Council is not required.

The proposal is also deemed to be consistent with the objectives of the W1 zone

Zone Objective	Comment
To protect the ecological and scenic values of natural waterways	The proposal seeks to protect and enhance the ecological and scenic values of the foreshore area by sitting the new structures clear of protected wetlands and in place of existing disturbed areas of the site. The materiality, finishes, colours and overall design of the structures will improve the scenic quality of the site within the context of the protected mangroves and coastal wetlands.
To prevent development that would have an adverse effect on the natural values of waterways in this zone	The new structures will vastly improve the environmental conditions of the site with regard to water quality and flow control, protection of mangroves and native vegetation and reduced general pollutant output into the waterway.
To provide for sustainable fishing industries and recreational fishing	The proposal supports the continued use of oyster farming in a priority oyster agricultural location. The modern facilities will support future sustainable oyster aquaculture operations.
To protect and preserve beaches and ensure they are free from man-made structures	N/A
To protect and enhance remnant natural features, aquatic habitat, public access and the navigability of waterways.	The proposal will enhance the environmental conditions of the site through the installation of a new on-site stormwater network, upgraded operational facilities and water protection infrastructure.
To allow for a range of water recreation structures, if their size, sitting and form will not dimmish the natural scenic character of the waterways, intertidal areas and aquatic reserves	N/A

Zone Objective	Comment
To ensure that the natural scenic qualities of waterways are not diminished through the cumulative impact of man-made structures.	The scenic values of the site surrounds are preserved and improved under the proposal. The design complements the natural features of the site including the shallow beds, sea-grasses, mangroves and other native vegetation.
To enable uses authorized under the Marine Estate Management Act, 2014.	Refer 4.2.2.

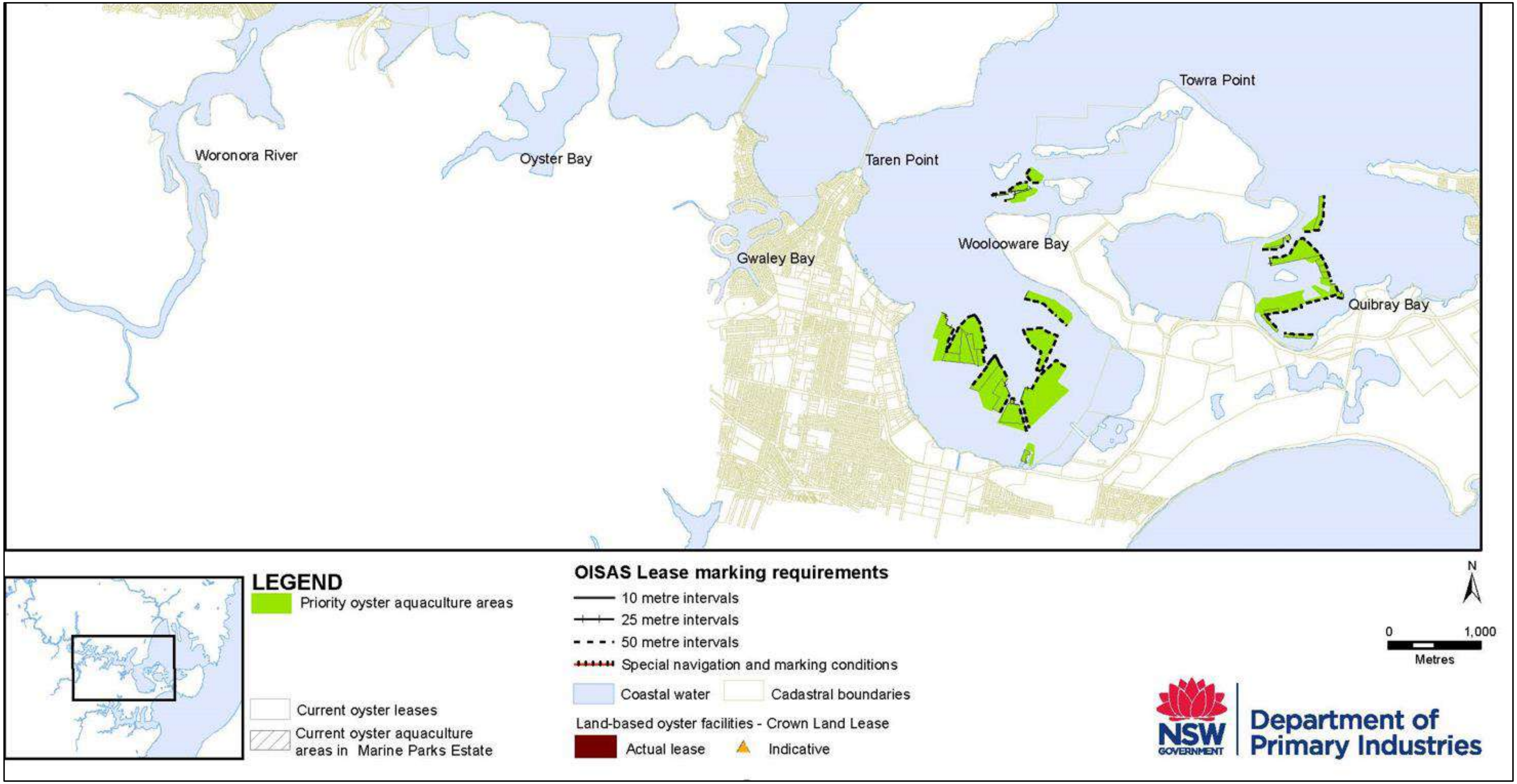

Figure 56 Areas mapped as priority oyster aquaculture areas (site circled in red

Other relevant NSW legislation

Fisheries Management Act 1994

The FM Act aims to conserve, develop, and share the fishery resources of the State for the benefit of present and future generations and in particular to:

- Conserve fish stocks and key fish habitats
- Conserve threatened species, populations and ecological communities of fish and marine vegetation
- Promote ecologically sustainable development, including the conservation of biological diversity, and, consistently with those objectives
- Promote viable commercial fishing and aquaculture industries
- Promote quality recreational fishing opportunities
- Appropriately share fisheries resources between the users of those resources
- Provide social and economic benefits for the wider community of New South Wales.

To meet these objectives, Part 7 of the FM Act outlines legislative provisions to protect aquatic habitat and Part 7A outlines provisions to conserve threatened species of fish and marine vegetation and their habitat.

Under the FM Act, fish means “marine, estuarine, or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead)” and includes oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes. The definition also includes any part of a fish, but does not include whales, other mammals, reptiles, birds, amphibians, or other things excluded from the definition by the regulations.

A permit for trimming the mangroves will be obtained under the Fisheries Management Act.

Marine Estate Management Act 2014

Compliance with the requirements of the Marine Estate Management Act (MEM Act) was assessed in the REF. Under Section 55(3) of the MEM Act:

(3) A determining authority (not being a Minister) must not carry out, or grant approval to carry out an activity (within the meaning of Part 5 of the Environmental Planning and Assessment Act 1979) unless the determining authority has:

(a) taken into consideration:

(i) if there are management rules for the marine park or aquatic reserve, the purposes of the zone within the area concerned is situated as specified in those rules, and

(ii) the permissible uses of the area concerned under the regulations or the management rules, and

(iii) if a management plan for the marine park or aquatic reserve has been made, the objectives of the marine park or aquatic reserve, and

(iv) any relevant marine park or aquatic reserve notifications

The site is in the Refuge Zone of the Towra Point Aquatic Reserve, (See Fig. 5) which is managed under the Towra Point Aquatic Reserve Plan of Management 2001. The proposed works are consistent with the requirements of the Plan of Management.

Government Gazettal No 32/2015 included a notification prohibiting the "taking, gathering, destroying, injuring, or interfering with any fish or marine vegetation (whether dead or alive), other than taking fish using handheld lies or lawful recreational nets from that part of the Towra Point Aquatic Reserve. No fish will be impacted by this proposal,

Under the MEM Act (2014) a permit is required for works in the Aquatic Reserve. Although these proposed works are not located within the Reserve, they are in the Refuge Zone, Department of Primary Industries (Fisheries) has advised that a permit will be required.

Heritage Act 1977

The Heritage Act 1977 provides for the conservation of items of environmental heritage in NSW. The Act defines heritage as items or places that are of state and/or local heritage significance and include: places, buildings, works, relics, moveable objects and precincts. As part of NSW heritage protection and management the Act establishes a register including an inventory and list to protect the listed items. A search of the State Heritage Register and Inventory Heritage register was undertaken. The site is not a listed State or local heritage item, nor is it within a heritage conservation area. The site is within proximity to the locally listed items:

- 2529: Pelican Point, Towra Point; and
- 2530: Site of abandoned oyster lease depot, Towra Point

The site is visually isolated and separated from these historic sites from dense mangrove vegetation. The works will not adversely or directly physically impact upon these items given that they exist hundreds of metres from the proposed structures.

NSW Biodiversity Conservation Act 2016

The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. BC Act applies to terrestrial and aquatic flora and fauna. Pursuant to the EP&A Act an assessment of the impacts of the proposed works in areas of critical habitat or that is likely to affect threatened species, populations or ecological communities, or their habitats listed under the BC Act, must be undertaken in the form of a Test of Significance (ToS) as defined under Part 7 of the BC Act for species listed under the BC Act.

A ToS involves assessing potential impacts of the proposal based on criteria that aid in assessing if the proposal is likely to have a significant impact on threatened species or their habitat or endangered ecological communities present at the Site or that have the potential to occur. If the ToS concludes that a significant impact is likely then a Development Application must be accompanied by a SIS. A ToS was undertaken as part of the Biodiversity Impact Assessment (Appendix D). The ToS concluded that "the risks to species, populations, communities and habitats within Woolooware Bay and the larget Botany Bay could be managed with commonly applied measures. Therefore, it is considered unlikely that this proposal would cause significant impacts, and hence the preparation of a Species Impact Statement is not required".

Disability Discrimination Act 1992

The Disability Discrimination Act 1992 (DDA) is the Commonwealth legislation that seeks to provide equity for people with disabilities. The main objects of the DDA include the elimination, as far as possible, of discrimination against persons on the grounds of disability in relation to access to premises and the provision of facilities and services. The proposal has been designed to respond to the requirements of this Act.

Disability Standards for Accessible Public Transport (DSAPT) 2002

The Disability Standards for Accessible Public Transport 2002 (DSAPT), made under the DDA, prescribes minimum standards of accessibility in relation to both public transport buildings and conveyances to remove discrimination from public transport services. The proposal has been designed to respond to the development standards identified under the DSAPT.

Protection of the Environment Operations Act 1997

Schedule 1, Part, 3 Aquaculture and mariculture:

"mariculture", each meaning the commercial production of marine, estuarine or freshwater organisms, including aquatic animals and plants but excluding oysters, being an activity that involves-

(a) supplemental feeding in tanks or artificial waterbodies, and

(b) the discharge of effluent, liquid sludge or other wastewater into natural waterbodies, including discharge by means of a pipe, drain, drainage depression, canal or other form of conveyance. Therefore, no licence required for extraction of water from Woolooware Bay or for depuration or wastewater used for commercial production of oysters on the land base as per Schedule 1.

Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) a referral is required to the Australian Government for proposed 'actions that has, will have, or is likely to have a significant impact on matters of national environmental significance (NES) or the environment of Commonwealth land'.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Where potential impacts have been identified in Appendix D, appropriate works management procedures to be incorporated into the CEMP will negate significant impacts. Accordingly, the proposal has not been referred to the Australian Government Department of Agriculture, Water and Environment under the EPBC Act.

Those matters of NES relevant to this proposal include:

- Wetlands of International Importance (Towra Point Nature Reserve – Declared Ramsar Wetland)
- Critically Endangered Species
- Endangered Species
- Vulnerable and Migratory Species

Confirmation of statutory position

The overwater structures are located in an area that is zoned as W1 under the Sutherland Shire Local Environmental Plan 2015. Oyster aquaculture may be carried out without development consent (but subject to assessment under Part 5 of EPA Act) on land that is wholly within a "priority oyster aquaculture area", or on land that is partly within and partly outside a priority area but only if the land outside the area is no more than 0.1 hectare in area. As the development is approximately 624m2 outside of areas mapped as priority oyster aquaculture, the determining authority is Transport for New South Wales.

Legislation	Requirement	Determining Authority
Sutherland Shire LEP	Cl 5.19 (6) 6) Oyster aquaculture permitted without consent in priority oyster aquaculture areas Development for the purpose of oyster aquaculture may be carried out without development consent— (a) on land that is wholly within a priority oyster aquaculture area, or (b) on land that is partly within and partly outside a priority oyster aquaculture area, but only if the land outside the area is no more than 0.1 hectare in area.	TfNSW
Fisheries Management Act 1994	Permit to harm Mangroves	DPI Fisheries
Marine Estate Management Act 2014	Permit for works in an Aquatic reserve	DPI Fisheries
Biodiversity Conservation Act 2016	Test of Significance (ToS) as defined under Part 7 of the BC Act	TfNSW
Protection of the Environment Operations Act 1997	Schedule	N/A
Disability Discrimination Act 1992	Incorporated in Design development	N/A
Environment Protection and Biodiversity Conservation Act 1999	A referral to the Australian Government is not required. As per the discussion provided in Section 6 of this REF and the Biodiversity Impact Assessment at Appendix D, the actions associated with the proposed activity will not result in any significant impacts to NES or the environment of Commonwealth land.	N/A

Consultation

This chapter discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

Consultation strategy

There are no adjoining properties that need to be notified. However, a start of works notice would be sent by letter to Sutherland Shire Council and Woolooware High School, a minimum of five working days prior to the commencement of demolition and construction works.

The site is occupied by one existing oyster farmer. TfNSW has consulted with the oyster farmer throughout the previous remediation project (Stage 1).

This project (Stage 2) has been designed with consideration of continuance of operation for the existing operator. This has been done through the implementation of a staged construction methodology, which will support the continued operations of the oyster farmer throughout most of the demolition and construction period. This will include the installation of a separation fence on the paved area to the south of the proposal.

The overall objectives of the consultation strategy are:

- To keep the local community and other key stakeholders regularly informed
- To listen to feedback, investigate suggestions and report back
- To engage in a manner that is collaborative, innovative, and adaptive
- To ensure that community and stakeholder enquiries are managed and resolved effectively

It is considered that as the proposal would not cause any additional impacts to the environment or community, no further community consultation to that described in the REF is proposed.

Community involvement

It is considered that as the proposal would not cause any additional impacts to community. Therefore, no further community consultation in the REF is proposed.

Aboriginal community involvement

Table 3 Summary of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Transport for NSW assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

The Stage 1 of the PACHCI process was completed for the proposal, which confirmed that there is unlikely to be any impact on Aboriginal cultural heritage. The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's Due diligence Code of Practice for the Protection of Aboriginal objects in NSW and the Transport for NSW procedure.

- The cultural heritage potential of the study area appears to be reduced due to past disturbance.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.
- An Aboriginal heritage impact permit (AHIP) under the National Parks and Wildlife Act, 1974 is not needed for the proposal.

SEPP (Transport and Infrastructure) Consultation

Appendix B contains a consultation checklist that documents how SEPP (Transport and Infrastructure) 2021 consultation requirements have been considered. Clause 2.15 of the SEPP specifies consultation with public authorities other than councils. The proposal is adjacent to an aquatic reserve and is therefore considered to be specified development. Consultation has occurred with the following Departments:

- cl.2.15(2)(a): Development adjacent to land reserved under the National Parks and Wildlife Act 1974
- cl.16(2)(c): Development adjacent to an aquatic reserve declared under the Marine Estate Management Act 2014: Department of Primary Industry – Fisheries. Furthermore, the development is on areas mapped as priority oyster area: Department of Primary Industry – Aquaculture

Table 4 Issues raised through SEPP (Transport and Infrastructure) consultation

Agency	Issue raised	Response/where addressed in REF
DPI Fisheries (Aquaculture) (7 July 2021)	TfNSW met with Fisheries on the 7th of July 2021 to discuss the proposal. The key items discussed were how to make minimise the impact to fisheries habitat during and post construction. TfNSW discussed the concept design with a Fisheries Manager who provided information for design consideration to build the walkways to allow light to penetrate through. The outcomes were that the Fisheries Manger provided a link to Fish friendly marinas, wharves and pontoons and boardwalks (Fish Friendly Marine Infrastructure) https://www.fishhabitatnetwork.com.au/fish-friendly-marinas-wharves-and-pontoons-and-boardwalks-fish-friendly-marine-infrastructure This information was reviewed by the design team and the selected materials for the boardwalks to allow light to penetrate. TfNSW were advised that the Shellfish Committee would like to be updated on the progression of the proposal as they are supportive. TfNSW were advised works will also need the normal fish habitat approval required under the Fisheries Management Act 1994	Section 3
DPI Fisheries (Marine Planning) (29 October 2021)	TfNSW met with the Marine planning division at DPI – Fisheries on the 29th of October 2021 to discuss the proposal. Marine Planning division has been consulted throughout the previous remediation project through from concept design to detailed design. The items that were discussed with the on 29 October 2021 was to inform fisheries that the design had progressed to 70%. The key items raised during this meeting were: • The REF is to state that no significant dredging is proposed. TfNSW noted that the proposed new structures will still need to consider the tides for vessel operations. The future oyster farmers will operate in shallow drafted punts similar to historical operations given the water depth. • A clear figure showing the calculated area of the previous overwater structures and the proposal footprint area for the fishery permit. • DPI – Fisheries Marine Parks division is to discuss the proposal with the DPI – Aquaculture department/shellfish interested parties prior to receival of the draft REF. Various items raised could not be answered by TfNSW as they are better directed at internal discussions being: • The species proposed by the Aquaculture department to be farmed in the bay • Current and future lease arrangements • Potential no go areas in the Marine reserve • Genetic disruption from introduced species altering native stock	Section 6

Agency	Issue raised	Response/where addressed in REF
DPI Fisheries (Aquaculture) (3 November 2021)	TfNSW met with Fisheries on the 3rd November 2021 to discuss the proposal. The Aquaculture division has been consulted throughout the proposal through from concept design to detailed design. On 3 November 2021 a meeting was held via zoom to discuss the design which had progressed (90% design). The key items raised during this meeting were: Some of the items raised by were not relevant to the proposal as they were directed at the broader NSW Oyster Industry Sustainable Aquaculture Strategy. Various items raised could not be answered by TfNSW as they are: The species proposed by the Aquaculture department to be farmed in the bay Current and future lease arrangements Potential no go areas in the Marine reserve Genetic disruption from introduced species altering native stock. TfNSW requested that a letter be issued for the shellfish industry if support of the proposal and DPI- Fisheries to facilitate this request. The next committee meeting was scheduled for the 10 November 2021.	Section 6
National Parks and Wildlife Services (on 8 November 2021)	TfNSW met with National Parks and Wildlife Services on the 8th of November 2021 to discuss the proposal. NPWS raised the issue of noise travelling across the bay and impacting the protected bird species in Towra Point (RAMSAR). Noise impacts will need to be assessed as part of the biodiversity assessment. TfNSW emphasized that the noise impacts would be similar to seawall construction. Noise impacts to be managed during construction via monitoring. The biodiversity assessment is to assess these impacts. Make contact with the local indigenous representative in the local area.	Section 6
DPI Fisheries (Aquaculture) (15 November 2021)	TfNSW received a drafted email highlighting to the project team that there were exemptions under the POEO Act which related to the discharge of water and the abstraction of water. "mariculture", each meaning the commercial production of marine, estuarine or freshwater organisms, including aquatic animals and plants but excluding oysters, being an activity that involves- extraction exempt no licence required for depuration or wastewater used for commercial production of oysters on the land base as per Schedule.	Section 4
DPI Fisheries (Aquaculture) (29 November 2021)	APP was contacted on the 29th November 2021 the Program Leader for Aquaculture who indicated that they are proposing to undertake a clean-up of rubbish with ocean watch, the university in the Georges River and areas surrounding the site. The project team is to be informed when a date is selected which was indicated to be in early 2022. For more information on this program see https://www.nswoysters.com.au/clean-ups.html. Early indication provided by DPI Fisheries is that the clean-up would be undertaken between the 14-28 February 2021. This may provide the existing operator the opportunity to work in with the clean-up operation an decant unwanted materials stored on the site.	Section 7

Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal and issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5.

Table 5 Issues raised through stakeholder consultation

Agency	Issue raised	Response/where addressed in REF
TfNSW – Maritime WHS	Discussed the project so that safety in design was considered. This department was invited to weekly design meetings and with review the 100% drawings, so they are suitable for construction with WHS design consideration.	Note
DPI – Fisheries Marine Planning	Permit required under Part 7 of FM Act if dredging is to occur and permit to harm vegetation.	Section 4.2.1. A permit has been applied issued 22 December 2021 for and DPI wish to see the REF approval once complete.
NSW Shellfish Committee (11 November 2021)	Letter form the Chair NSW Shellfish Committee "The NSW Shellfish Committee comprising oyster industry, NSW Farmers Association, wild shellfish harvest and agencies has been kept up to date with the remediation and redevelopment of the sole remaining oyster industry land base in Georges River/Botany Bay. Oyster farming is a sustainable and viable activity producing high quality seafood and creating employment and economic opportunities. In what was the birthplace of oyster farming in Australia, NSW Shellfish Committee advocates that the retention and expansion of the oyster industry in Woolooware Bay and Quibray Bay is a priority outcome. In addition to the production of high-quality seafood, oyster production provides significant environmental services to maintain and improve water quality and support species diversity and abundance in and around oyster cultivation. Oyster industry best management practices are detailed in the 2021 edition of the NSW Oyster Industry Sustainable Aquaculture Strategy which also highlights water quality protection and an industry "good neighbour" policy. These standards compliment the need to protect the adjacent Aquatic Reserve and its values. The redevelopment of the site also supports the ground breaking selective breeding program of Sydney Rock Oysters for disease resistance. The advances in QX disease resistance breeding have been possible because of continuous access to this site since 2005. DPI, CSIRO, University of Sydney, University of Technology Sydney as well as other universities undertake oyster research programs from this site as it provides both access to leases and support from industry to manage experiments. The outcomes of this research support the broader NSW aquaculture industry. This has been raised in importance this year with the detection of QX oyster disease in Port Stephens for the first time.	Note

Agency	Issue raised	Response/where addressed in REF
	NSW Shellfish is very supportive of the work undertaken by Transport for NSW to remediate and redevelop the Woolooware oyster land base into what will become a world class aquaculture precinct". APP contacted the Chair of the committee Shauna Murray on the 16 of November 2021 to request permission for this information to be made public as it would be incorporated into the REF. This request was approved via phone conversation and reiterated the committees support for the proposal	
Sutherland Shire Council	TfNSW conducted a pre-Development Application (DA) meeting with Sutherland Shire Council to update them on the proposal. TfNSW highlighted that the intention was for two planning pathways to be submitted: The Overwater structures demolition and reconstruction to be submitted under Part 5 of the EPA act. The DA master plan for the land structures to be submitted under Part 4 of the EPA act. The focus of the issues which were raised related to flooding and traffic ingress and egress. This was related to future DA which is not assessed as part of this proposal. As Sutherland Shire Council are the determining authority for the Development Applications some of these items will have to be address by the engineering team through detailed design. None of the items were raised by council related to the overwater structures proposal.	Note. A flooding and traffic assessment was commissioned for the DA

Ongoing or future consultation

TfNSW would continue the consultation with:

- DPI Fisheries (Marine Planning) regarding permits required for the proposal
- DPI Fisheries (Aquaculture) regarding the timing of the proposal
- National Parks and Wildlife Services to provide an update
- Council to provide an update
- Surrounding school regarding the upcoming works and timings for the proposal.

This REF would be placed on public display for comment by Government agencies, stakeholders and the community. Following the public display period, Transport for NSW would collate and consider the submissions received then determine whether the proposal should proceed as described or whether any changes are needed are required. It would also decide if any additional environmental assessment, safeguards or management measures are needed.

A submissions report would be published, which would respond to the comments received. Transport for NSW would notify those who made submissions and distribute a community update. The update would summarise the submissions report process and the actions Transport for NSW took to address these comments. Transport forNSW would also meet with affected residents, businesses and other stakeholders.

Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guidelines Is an EIS required? (DUAP, 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2021 and the Marinas and Related Facilities EIS Guideline (DUAP, 1996). The factors specified in clause 171(2) of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix B). Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

Land surface and Hydrology

This section describes the existing land surface and hydrology and potential impacts associated with the proposal. JBS&G Pty Ltd (JBS&G) have prepared a Long Term Environmental Management Plan (LEMP) to document the procedures and standards to be followed in order to manage the risks posed to future commercial occupants and the surrounding environment by contamination identified at the site. The LEMP is provided as Appendix G.

Other studies that are relevant to this chapter included a review of:

- Assessment of Potential Deleterious Effects on Sediment Processes, Oyster Farm Overwater Structures, Woolooware Bay, Prepared by Cardno (Appendix K)
- Arboricultural Impact Assessment, Oyster Farm, (Lot 3 in DP1165618) Captain Cook Drive, Woolooware Bay, NSW, prepared by Allied Tree Consultancy November 2021 (Appendix E)
- Biodiversity Impact Assessment, Removal of Overwater Structures & Construction, prepared by Alison Hunt & Associates Pty Ltd March 2022 (Appendix D)
- Destructive Hazardous Materials (HAZMAT) Assessment, Lot 3, Captain Cook Drive, Woolooware Bay, NSW Woolooware Bay prepared by Progressive Risk Management, 20 October 2021 (Appendix I)
- Factual Results Summary Letter (LTRo1) Timber Structures, Lot 3, Captain Cook Drive, Woolooware Bay, NSW Woolooware Bay prepared by Progressive Risk Management, 20 October 2021 (Appendix J)
- Hydrographic and bathymetric mapping and data, prepared by TfNSW
- Soil Landscape Series Sheet 9029. Department of Conservation and Land Management of NSW, 1993 (DCLM 1993).
- Wollongong – Port Hacking Geological Series Sheet 9029 (Edition 1) 1993. Geological Survey of NSW Department of Mineral Resources, (DMR 1993).

The above-mentioned report prepared by JBS&G was prepared with the following assessments relating to the site:

- Environmental Site Assessment, 'Oyster Farm', Captain Cook Drive, Woolooware NSW, JBS Environmental (JBS 2012)
- Additional Contamination Assessment, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW, (JBS&G 2018a)
- Screening Level Ecological Risk Assessment, 'Oyster Farm', Woolooware, NSW (Geochemical Assessments 2016)
- Remedial Action Plan, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW 4 June 2018 (JBS&G 2018b)
- Offsite Investigation, Sampling Analysis and Quality Plan, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW, 19 April 2018 (JBS&G 2018c) and
- Additional Offsite Investigation, Sampling and Analysis Quality Plan, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware, NSW, 11 July 2019 (JBS&G 2019a).
- Long Term Environmental Management Plan, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 17 March 2022 (JBS&G 2021a).
- Validation Assessment, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 18 February 2022 (JBS&G 2021b).

Existing environment

Natural Environment

Geology

Review of the regional geologic map (Department of Mineral Resources 1993) indicates that the site is underlain by organic-rich muddy marine sand. Review of the regional soil map (Department of Conservation and Land Management 1993) indicated that the local area consists of tidal mudflats with a relief of less than 3m and a slope of less than 3%. The local soils consist of waterlogged calcareous sands and siliceous sands.

Local Hydrogeology

Groundwater sampled at all monitoring wells was found to have total dissolved solids consistent with marine levels, and no definitive groundwater direction was able to be identified. Sub-surface soils were generally found to consist of gravelly sands and sandy clays, with the majority of the site likely to have been historically reclaimed (JBS&G 2018b).

Groundwater is likely to be tidally influenced within the extent of the land site, with recharge of the aquifer by infiltration of both rainfall and marine water to the site. This indicates a level of connectivity between groundwater underlying the site and surface water adjacent to the site. The groundwater assessment was undertaken prior to the PVC sheet piled seawall being installed on the land site.

Acid Sulfate Soils

The site is in an area of high probability of occurrence of acid sulfate soil materials at or near the ground surface (Department of Land and Water Conservation 1997).

Tides

The proposal is located on the southern side of Woolooware Bay. Tidal Conditions within Woolooware Bay are not affected or influenced by any manmade structures. Tidal cycles are semi-diurnal, meaning there is 12.5 hours between high tides. The tidal heights measured from Botany Bay would indicate the tide heights will vary from approx. 0.20m to 2.06m AHD. The demolition process and the connection point between the land and the proposed overwater superstructure will have to consider the tidal impacts when excavating soil/sediment materials. The tidal effect on the site will impact construction and these activities are to be scheduled to occur at high tide when necessary and appropriate. If the contractor does not propose to use barges and the entire construction is undertaken via the landside, the tidal effect on the proposal will be minimal.

Sedimentation

Sedimentation of the surrounding wetlands occurs through natural processes of weathering and erosion, which deposit sediments in Woolooware Bay through alluvial processes. The rate of sedimentation is also influenced by storm events and flooding. During such events, the rate of sedimentation would typically increase and result in deposition due to increased sediment loads. It is noted that the channel on the eastern side of the site is a stormwater channel that takes inflows from Captain Cook Drive and the surrounding area.

Water Depth

The natural wetlands surrounding the site have been modified during the historical land reclamation that created the current land site footprint. The only area accessible to land via vessels is the eastern channel at high tides. The area close to the seawall and overwater site is intertidal and the underlying mudflats are exposed at low tide. Water depth immediately surrounding the site is dependent on the tides and varies from no water to hightide levels of 2.0m+ AHD.

Physical Environment

Land based

The land site entrance is located off Captain Cook Drive, Woolooware where a sealed pavement extends across the land side of the site. The south portion of the land site contains an HV overhead transmission line tower. The land site is bordered with a marine foreshore sea wall retention structure, with an engineered capping layer and trafficable pavement system.

Water based

The nearest water body is Woolooware Bay, immediately north of the site. As discussed in Section 6.1, groundwater across the site is likely to be tidally influenced, with aquifer recharge by infiltration of both rainfall and marine water to the land site. Surface water is likely to infiltrate the sealed surfaces of the land site, with the excess running off directly into the bay or via the eastern channel and dedication stormwater discharge points on the site.

Potential impacts

Construction

Constructability Assessment

The assessment considered the proposed construction activities, work methods, and required management considerations (Appendix F). The construction would temporarily affect the physical characteristics of the aquatic environment including localised sediment disturbance and dispersion.

Marine Erosion

Any work taking place in the aquatic environment has the potential to cause erosion and scour impacts. Under the proposal, the demolition, construction and excavation works for services trenches would be the only works that would impact on the surrounding benthic sediments. However, as the works will be undertaken in sections and will take approx. one (1) day per section the disturbance will only occur to a small area immediately adjacent to the construction works area and is not seen to be enough time to cause any lasting erosional impacts. The construction methodology is outlined in Appendix F, a summarised version is below that outlines the main steps and how impacts will be minimised.

For the proposal excavation of approximal 50m3 is proposed and the contractor will schedule the works for low tide conditions to minimise the effects of sedimentation, turbidity, and disturbance to the surrounding marine area.

The sediment / spill boom will be concurrently moved as each section of the structures are constructed. Minimal sedimentation is expected during construction, the sediment boom will be installed as close as possible to the pilling area to minimise sediment transportation. Any sediment accumulated in the boom will be allowed to settle onto the Bay floor, if excess sediment is accumulated, in the boom, it will be stockpiled and disposed of as per NSW EPA Waste Classification Guidelines.

Any sediments / soils excavated during the demolition / construction process, will be placed in a budded area on the land site and classified, disposed of a licenced facility as per NSW EPA Waste Classification Guidelines.

Once the piles have been positioned, they will be driven using an Impact hammer and hydraulic Power pack. The hammer will be suspended from a crawler crane and remotely operated.

This process will progressively be moved along the length of the structures as the piles and platforms are installed.

The piles will be installed one section at a time and following the below process out for the land site. Progressive demolition is proposed to be undertaken from the constructed platform when the plant equipment is next to the structures that is proposed to be demolished.

Flooding

Should flooding of the land site area occur during construction, there would be increased risk of plant, equipment and materials used during construction entering the Bay and could be swept off-site, potentially resulting in pollution from diesel or other potentially hazardous materials. Flooding, and severe weather warnings would be monitored (such as monitoring the Bureau of Meteorology website for weather forecasts and flood warnings) during construction, with appropriate measures implemented in the event of a flood warning for the area/region. A flooding study was conducted on the landside as part of the DA submission. The entire landside site is built up in the central section of 2.2m and falling away to the seawall and at about 1.8m AHD. The entire land site is above Annual Exceedance Probability (AEP) 1% of 1.70m AHD. The Probable Maximum Flood (PMF) is 2.20m AHD and therefore in an extreme weather there is the potential for flooding to impact the site in the current configuration at the perimeter mainly. The proposed civil plans are designed to increase the site levels in line with the flooding advice prepared by Cardno making the land site compliant with the Development Control Plan (DCP) (Appendix L).

Tides / Currents

The proposal involves activities that would cause physical disturbance to the aquatic environment. These include removal of the existing structures, piling and the installation of new structures. The scale of the disturbance to the local surface hydrology is expected to be minimal and insufficient to cause any dynamic changes in tidal area coverage or tidal height, however, the proposal is likely to result in the temporary localised change to flow regimes during construction. These changes are likely to be temporary as flow regimes would be reinstated at the completion of new structures. The proposal will not obstruct the eastern stormwater channel on a permanent basis. During construction there will be times where this equipment is proposed to be stored in this area of the site temporarily.

The proposal area is located inside Woolooware Bay which in an enclosed system having low ocean energy, which would not impact the proposal area. This is indicated by the presence of mangrove forest to the north, west and east of site.

Cardno's design structural water level was 2.4m AHD at 2075 for zero wave uplift. The underside deck levels have been specified to be 2.2m AHD and the decks must be designed to accommodate a wave uplift of 3kPa. A value of 2.4 was not considered feasible and 2.2m AHD underside of deck was progressed to detailed design. The effect on local sediment transport caused by this inter-action is very low. These uplift loads need to be transferred to the piles, but would cause no change to the current design, other than increased fixings from the flooring to the joists.

Acid Sulfate Soils

While there is the risk of acid sulfate soil there are no plans to remove any sediments or bring them to the surface. Any sediment attached to the extracted piles would be removed in the water. As such, there is no possibility for these sediments to dry and oxidise. Where limited excavation is proposed to be undertaken this must be undertaken with oversight by a suitability qualified environmental consultant to manage this risk associated with acid sulfate soils.

An Acid Sulfate Management Plan was previously prepared for the Stage 1 works, it is proposed that this can be relied upon during the proposed Stage 2 works for the excavation of approximately 50m3. This material is proposed to be excavated and stored on the landsite and treated if necessary and disposed of in a licenced facility.

Contaminated land

JBS&G 2019a conducted, an Offsite Ecological Risk Assessment which concluded that Sampling and analysis of biota samples have demonstrated that the uptake of PAHs in tissue samples is not significantly different (within test samples in areas of identified sediment impact) from background reference sites within Woolooware Bay. On this basis, the risk of bioaccumulation (from potential site related impacts) within biota in proximity of the site, was low. Based on the Weight of Evidence (WOE) assessment undertaken herein, it is considered that the risk of contamination (as associated with the site) causing adverse environmental effects to ecological receptors was low. The ecological significance of contaminants in off-site sediments related to historical Oyster Farming operations is also considered to be low.

As the Stage 1 works have been completed, the presence of contaminated soils on the land site and in the surrounding marine area is considered low and has been documented during the Stage 1 works. However, waste classification testing of materials that are excavated should be undertaken prior to offsite disposal. Should contamination be identified, the safeguards detailed in section 6.1.3 would ensure these materials are appropriately managed, and the risk of exposing contaminants during construction is minimised.

Operation

Land based

No significant change to the existing landside infrastructure is proposed, and no significant impacts to the terrestrial land surface are anticipated.

Water based

Tides, Currents and Waves

It is likely that the demolition and reconstruction of the overwater structures replacement result in a temporary redistribution of the sediments. The redistribution of these sediments is likely to be contained locally and within the sedimentary cell contained by the mangrove forest. The prevailing wave directions is to the northeast which suggest that much of the sediments would be redistributed southwards, where they are likely to result in some infilling of the current dredged channel and wharf area. It is possible that the infilling in the channel may resulting in a loss of navigable depths in that area for vessels, and it is likely that some maintenance dredging may be required to reinstate the desired channel depth. Overall, there would be no significant long-term effects on the coastal processes.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Erosion and Sediment controls	Prepare a site-specific Erosion and Sediment Control Plan (ESC) in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (Blue Book) requirements, as a sub-plan to the CEMP. The plan is to be updated progressively as site conditions change.	Contractor	Pre-construction
Erosion and sediment controls	All in-water activities associated with the excavation of sediments/soil should be scheduled to coincide with favourable tidal conditions to ensure that sediment re-suspension and dispersion is minimised.	Contractor	Pre-construction
Contamination	As hazardous ground gas has been identified during historical site assessments, the proposed design requires validation and verification by an independent HGG Construction Quality Assurance inspector throughout the installation and integrity testing process in accordance with Ground Gas Construction Quality Assurance Plans prepared for the proposal.	Contractor	Pre-construction
Contamination	Buildings and underground services should not be installed within the 5 metre Ausgrid tower exclusion zone due to residual tar impacts remaining in-situ.	Contractor	Construction
Erosion and sediment controls	Where floating barges are to be used during demolition / construction, the anchors for any barges must be positioned to minimise sediment resuspension and dispersion.	Contractor	Construction
Erosion and sediment controls	Excavated materials should be stored on the land site and removed off site as soon as practicable to minimise risk of runoff into adjacent areas. As a precautionary measure, enough ag-lime would be required to be always kept onsite in accordance with the ASS management plan prepared for the Stage 1 works.	Contractor	Construction
Erosion and sediment controls	Rubbish and debris should be collected and stored in appropriate bins and removed off site to prevent it from entering the waterway.	Contractor	Construction
Erosion and sediment controls	No chemicals, fuels and / or wastes would be stored on the foreshore. All such substances are to be contained in sealed vessels of appropriate volumes and stored within bunded areas on the land site or in approved chemical storge shipping containers. In accordance with the ASSMP, an ASS treatment site would be set up on the land site or located in a suitable bunded area or skip bin.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Erosion and sediment controls	Spill Kits (marine and terrestrial) are required to be kept onsite, and all staff trained to use them. If a spill to water occurs, the TfNSW Contract Manager and environmental staff are to be notified immediately in accordance with TfNSW Environmental Incident Classification and Reporting Procedure	Contractor	Construction
Erosion and sediment controls	Place all temporary stockpiles away from stormwater drains and drainage lines.	Contractor	Construction
Erosion and sediment controls	Ensure the spoil treatment area is fully bunded	Contractor	Construction
Storm Emergency	A soil and water management plan including measures to address flood and storm threats should be included in the CEMP. The plan would detail safeguards to prepare, respond and recover from a possible storm event. Measures are to include, but not be limited to: regular monitoring (visual and/or electronic) of Bureau of Meteorology Sydney Closed Waters Forecast and Severe Weather Warnings, as well as predicted tides (especially spring and solstice tides), ocean water level and winds/wave conditions actions for the evacuation of staff and visitors from the water-based facilities to a safe location on land measures to minimise risk of damage from wave action. process for removing equipment and materials off site and out of flood risk areas quickly. Refuelling of plant and equipment and storage of hazardous materials on the land site double-bunded area.	Contractor	Pre-construction Construction

Water quality

Existing environment

Water quality

Woolooware Bay extends to the south of the Georges River, where it joins Botany Bay, approximately 5km south of Sydney Airport. Much of the Georges River catchment has been developed for urban use and extends north-west to Cabramatta before heading south to Macquarie Fields, prior to entering Heathcote National Park. The existing water quality in an urban environment is impacted by stormwater discharge and altered flow regimes. Pollutants commonly associated with stormwater discharge include:

Sediment from erosion and stormwater inflows, impacting turbidity

- Pathogens such as faecal coliforms from litter and other wastes
- Nutrients and pathogens from fertilizers and sewage overflows
- Heavy metals (in river sediments)
- Other contaminants such as hydrocarbons from oil and fuel leaks.

The existing stormwater system for the site was designed on the land site as part of the remediation works undertaken in Stage 1 and does not accommodate the future design of the overwaters structures. The new design will consider the tie in points between the proposed superstructure and the existing seawall to manage surface water flows which will connect into the existing infrastructure.

Potential impacts

Construction

Water quality

The proposed footprint is within the inter-tidal area along the Woolooware Bay foreshore. As such, the proposed demolition works may cause sediment disturbance over a localised area. Activities that will affect water quality are:

- Removal of existing piles from the seabed
- Installation of new piles
- Excavation of approximately 50m3 for mis debris and fill material
- Storage of piles and other demolition material on the land site where the runoff over these structures can re-enter the waterway
- New construction resulting in disturbance of the seabed and land-site soils/ vegetation
- Refuelling of machinery on the land site

There is expected to be a moderate risk of turbidity during the demolition activities. Potential impacts would be limited by the requirement to undertake the excavation works during suitable low tide conditions, when there would be the least water movement in the area immediately surrounding the proposal area.

Locally, the finer sediments could mobilise over a greater area as they would remain buoyant in the water column. Disturbance of sediments would be minimised through the work methodology including use of a silt boom and curtain situated in the most effective position to mitigate any transportation of sediments into the Bay.

Turbidity may cause a short-term reduction in light penetration through the water column in the immediate area around the structure’s demolition. Subsequent sedimentation may cause a localised change in the particle size and distribution of sediment on the seafloor. The duration and scale of the impacts would be minor given the size Woolooware Bay and the tidal influence on the area. The impacts would be confined to bottom waters and particles would settle rapidly. It should also be noted that the seabed within the vicinity of the proposal overwater construction is predominantly loose sediments, which are likely to be subject to mobilisation from tides and currents. In addition to the general soil/sediment excavation works, a stormwater management contingency measure would be put into place to avoid contaminating water from the treatment of ASS. This would include the temporary construction of a bund surrounding the storage bin location for the duration of the on-site storage-treatment of ASS material. Infiltration of surface water (rain or drainage) through the ASS Woolooware Bay surface waters within the treatment area should also be prevented to the maximum extent possible.

Filtration devices are to be installed as part of the drainage infrastructure between the sea wall at the point of the existing land-site infrastructure and the superstructure. This has been designed in accordance with the engineering specifications and will ensure that water quality is maintained across the site during construction.

Operation

Water quality

No significant impacts to water quality are anticipated as a result of the continued future operation of the proposal, as punts / small vessels would operate consistently with the historical movements and no additional sediment disturbance is anticipated. Any impacted stormwater drainage would be reinstalled within the proposed interchange to maintain the existing drainage regime, with no impact to local stormwater quality.

There is always the potential for an accidental spill or discharge during operations. These impacts are expected to be safeguarded against under operational management procedures outlined below and therefore minimised.

Water quality

Existing environment

Water quality

Woolooware Bay extends to the south of the Georges River, where it joins Botany Bay, approximately 5km south of Sydney Airport. Much of the Georges River catchment has been developed for urban use and extends north-west to Cabramatta before heading south to Macquarie Fields, prior to entering Heathcote National Park. The existing water quality in an urban environment is impacted by stormwater discharge and altered flow regimes. Pollutants commonly associated with stormwater discharge include:

Sediment from erosion and stormwater inflows, impacting turbidity

- Pathogens such as faecal coliforms from litter and other wastes
- Nutrients and pathogens from fertilizers and sewage overflows
- Heavy metals (in river sediments)
- Other contaminants such as hydrocarbons from oil and fuel leaks.

The existing stormwater system for the site was designed on the land site as part of the remediation works undertaken in Stage 1 and does not accommodate the future design of the overwaters structures. The new design will consider the tie in points between the proposed superstructure and the existing seawall to manage surface water flows which will connect into the existing infrastructure.

Potential impacts

Construction

Water quality

The proposed footprint is within the inter-tidal area along the Woolooware Bay foreshore. As such, the proposed demolition works may cause sediment disturbance over a localised area. Activities that will affect water quality are:

- Removal of existing piles from the seabed
- Installation of new piles
- Excavation of approximately 50m3 for mis debris and fill material
- Storage of piles and other demolition material on the land site where the runoff over these structures can re-enter the waterway
- New construction resulting in disturbance of the seabed and land-site soils/ vegetation
- Refuelling of machinery on the land site

There is expected to be a moderate risk of turbidity during the demolition activities. Potential impacts would be limited by the requirement to undertake the excavation works during suitable low tide conditions, when there would be the least water movement in the area immediately surrounding the proposal area.

Locally, the finer sediments could mobilise over a greater area as they would remain buoyant in the water column. Disturbance of sediments would be minimised through the work methodology including use of a silt boom and curtain situated in the most effective position to mitigate any transportation of sediments into the Bay.

Turbidity may cause a short-term reduction in light penetration through the water column in the immediate area around the structure's demolition. Subsequent sedimentation may cause a localised change in the particle size and distribution of sediment on the seafloor. The duration and scale of the impacts would be minor given the size Woolooware Bay and the tidal influence on the area. The impacts would be confined to bottom waters and particles would settle rapidly. It should also be noted that the seabed within the vicinity of the proposal overwater construction is predominantly loose sediments, which are likely to be subject to mobilisation from tides and currents. In addition to the general soil/sediment excavation works, a stormwater management contingency measure would be put into place to avoid contaminating water from the treatment of ASS. This would include the temporary construction of a bund surrounding the storage bin location for the duration of the on-site storage-treatment of ASS material. Infiltration of surface water (rain or drainage) through the ASS Woolooware Bay surface waters within the treatment area should also be prevented to the maximum extent possible.

Filtration devices are to be installed as part of the drainage infrastructure between the sea wall at the point of the existing land-site infrastructure and the superstructure. This has been designed in accordance with the engineering specifications and will ensure that water quality is maintained across the site during construction.

Operation

Water quality

No significant impacts to water quality are anticipated as a result of the continued future operation of the proposal, as punts / small vessels would operate consistently with the historical movements and no additional sediment disturbance is anticipated. Any impacted stormwater drainage would be reinstalled within the proposed interchange to maintain the existing drainage regime, with no impact to local stormwater quality.

There is always the potential for an accidental spill or discharge during operations. These impacts are expected to be safeguarded against under operational management procedures outlined below and therefore minimised.

Impact	Environmental safeguards	Responsibility	Timing
Water Quality	Prior to use at the site and / or entry into the waterway, machinery is to be appropriately cleaned, degreased and serviced.	Contractor	Construction
Water Quality	Measures are to be implemented to prevent contaminating the Bay during the treatment of ASS, including bunding the storage bin location for the duration of storage and treatment of ASS material, preventing infiltration of surface water (rain or drainage) through the stored ASS material or water prior to treatment. Any treatment of soil is to be conducted on the land site.	Contractor	Construction
Accidental Spills	An emergency spill kit is always to be kept on site and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site. Spill kits for construction Barges must be specific for working within the marine environment. All workers would be advised of the location of the spill kit and trained in its use.	Contractor	Construction
Accidental Spills	Where possible, all refuelling of plant and equipment is to be undertaken on land where possible. If refuelling of plant / storage of hazardous materials is to occur on Barges, it must be undertaken within an impervious double-bunded area.	Contractor	Construction
Accidental Spills	If an incident (e.g. spill) occurs, the Transport for NSW Environmental Incident Classification and Reporting Procedure is to be followed and the Transport for NSW Contract Manager notified as soon as practicable. In the event of a maritime spill, the incident emergency plan would be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies outlined in the 'NSW State Waters Marine Oil and Chemical Spill Contingency Plan' (Maritime, 2012).	Contractor	Construction

Waste management

The site is located within a mangrove intertidal forest where it is common to observe debris. During Stage 1 there was several additional skip bins that were filled with rubbish that were not related to the remediation project, mainly large amounts of timbers floating in with the tides. The proposal would generate waste materials including asbestos, demolition products and general site wastes. Demolition activities associated with the proposal would generate various waste streams which have the potential to result in environmental and navigational impacts within Woolooware Bay.

Potential impacts

The types of waste likely to be generated by the proposal are outlined below. Most wastes would be generated during the demolition of the structures and associated infrastructure. These wastes would be prevented from entering the water using booms and placing deconstructed materials straight onto land site without laying down on the sediment.

Accidental material spill within the ancillary facility may occur from storing, handing and/or transferring the required small volumes of welding materials, lubricants, solvents, fuels, oils and diesels. Potential impacts would be mitigated through the appropriate management of the storage of such materials, and inclusion of spill kits. The principles of waste management are to minimise the amount of waste generated, recycle waste wherever possible and dispose of the remainder in a responsible manner. This proposal adopts the Resource Management Hierarchy principles embodied in the Waste Avoidance & Resource Recovery Act 2001 (WARR Act).

Waste management

As identified in the long term environmental management plan, hazardous material and timbers assessments (Appendix G, I and J) there are various hazardous materials located in the building including lead paint, synthetic mineral fibres, Polychlorinated Biphenyls (PCB), Chroro-hydro-fluoro-carbon (CHFC) ozone depleting substances (ODS), Asbestos – special waste and General Solid, Restricted and possibly Hazardous Waste. It is proposed that all of the identified substances and materials to be removed from the site in a controlled systemic manner in accordance with the relevant Australian Standards to avoid any impacts to the surrounding environment or construction personnel. A Construction and Demolition Waste Management Plan has been prepared by Elephants Foot Consulting and is provided at Appendix R, which details theestimated volumes of material generated during demolition, classification of materials,and management measures for the contaminated materials listed below.

Proposed Demolition and Construction Waste Management

Phase	Material	Volume (m^3)	Management
Demolition	Excavation Material	250	To be re-used on site or to be disposed of in landfill
Demolition	Green Waste	50	To be re-used on site were possible, recycled off-site or to be disposed of in landfill
Demolition	Bricks	N/A	To be re-used on site where possible or recycled off-site.
Demolition	Tiles	N/A	To be re-used on site where possible or recycled off-site.

Phase	Material	Volume (m^3)	Management
Demolition	Concrete	10	To be re-used on site where possible or recycled off-site.
Demolition	Timber	200	To be recycled off-site or disposed of in landfill.
Demolition	Plasterboard	10	To be recycled off-site or disposed of in landfill.
Demolition	Metals	7	To be re-used on site where possible or recycled off-site.
Demolition	Asbestos	0.2	To be disposed of in landfill.
Construction	Tiles	0.15	To be re-used on site where possible or recycled off-site.
Construction	Concrete	36.5	To be re-used on site where possible or recycled off-site.
Construction	Timber	2.52	To be re-used on site were possible, recycled off-site or to be disposed of in landfill.
Construction	Metals	4.3	To be re-used on site where possible or recycled off-site.
Construction	Other Waste	52	To be re-used on site were possible, recycled off-site or to be disposed of in landfill.

Operational Waste Management

The ongoing operational waste management procedures associated with the use of the new structures has been considered in the Operational Waste Management Plan prepared by Elephants Foot.

The following estimates of operational waste are based on a seven-day operating week.

Rate Used	GFA m²	Waste Generation Rate (L/100m²/Day)	Generated Waste (L/Week)	Recycling Generation Rate (L/100m²/Day)	Generated Recyclables (L/Week)
All Retail	504.12	80	2823.1	70	2470.2
Services	1008.25	55	3881.7	10	705.8
TOTALS	1512.37		6705		3176
Bins and Collections		Bin Size (L)	1100	Bin Size (L)	1100
		Bins/Week	6.1	Bins/Week	2.9
		Collections/Week	2	Collections/Week	2
		Total Bins	4	Total Bins	2

Each structure will have smaller bin receptacles to store waste and recyclables for a minimum of 1-days' worth of capacity. At the end of each day, staff will transport these receptacles to larger bins throughout the site. The proposed development is to include a waste room that will be subject to a future DA which will house the site bins and waste disposal container.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Waste Management	Where practical, excavation material will be reused as part of the development.	Contractor	Construction
Waste Management	Excavation material that is not natural (virgin) material will be transported to an approved landfill site or off-site recycling depot.	Contractor	Construction
Waste Management	A waste classification assessment of the fill material should be undertaken prior to it being acceptable for waste disposal purposes.	Contractor	Construction
Waste Management	Waste disposed of off-site shall be classified in accordance with the NSW EPA Waste Classification Guidelines, prior to disposal and shall be disposed of at an appropriately licenced facility for that waste.	Contractor	Construction
Waste Management	Transportation routes for excavation material removed from site will be identified and used.	Contractor	Construction
Waste Management	All wastes will be classified and recycled, reprocessed, or disposed of in accordance with the requirements of their classification.	Contractor	Construction
Waste Management	Litter in and around the site will be removed daily or as appropriate	Contractor	Construction
Waste Management	Where practicable, recyclable materials will be reused or recycled.	Contractor	Construction
Waste Management	All wastewater from vessels is to be discharged at an approved vessel wastewater disposal facility. No vessel wastewater is to be discharged (i.e. pumped out) directly into the water or onto the land site area	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Hazardous materials management	A hazardous materials assessment has been carried out to identify any asbestos and synthetic mineral fibre containing building materials present on the site. Mitigation measures are to be included in the CEMP and the identified materials are to be removed in accordance with the codes of practice identified in the EP Risk 2021 reports.	Contractor	Pre-Construction
Hazardous materials management	Asbestos containing building materials would be stripped from the site prior to demolition. Asbestos removal must be undertaken in accordance with Code of Practice "How to Safely Remove Asbestos" August 2019	Contractor	Construction
Hazardous materials management	Contaminated material stockpiled on site will be minimised as far as possible and should be stored on HDPE liner, in a bunded location which is protected from inclement weather.	Contractor	Construction
Hazardous materials management	Sediment fences should be installed around the base of stockpiles and the stockpiles should be covered. Where excavated material requires validations, samples should be taken for NATA laboratory testing as per the requirements of the contamination assessment prior to restoration works, backfilling exercises and disposal.	Contractor	Construction
Hazardous materials management	Any trucks carrying contaminated materials should be securely and completely covered immediately after loading the materials (to prevent windblown emissions and spillage) and must be licensed by the NSW Environment Protection Authority.	Contractor	Construction
Hazardous materials management	Decontamination of all equipment prior to demobilisation from the site is important to the contaminated materials are not spread off-site.	Contractor.	Construction

Air quality

Existing environment

The land uses surrounding the site are primarily recreational. The Towra Point Nature Reserve is directly adjacent to the site to the east, and Grey Mangrove Forest continues to the west. The site has a frontage to Captain Cook Drive to the south, with the Cronulla Golf Course and Woolooware High School located opposite. The nearest residential areas are approximately 600m to the south, behind the golf course and the school, whilst the nearest industrial areas are 2.4km to the west at Caringbah and 3.2km to the east at Kurnell.

The closest Office of Environment and Heritage air quality indices (AQI) are for Earlwood, approximately 25km northwest of Woolooware and across Botany Bay. The air pollutants monitored by the Office of Environment and Heritage and used in the AQI are ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and air particles. Air quality at the Earlwood AQI site, and the Greater Sydney East Region generally, is considered Very Good. Pollutant specific AQI data for Earlwood is:

- Particulate matter PM10: 22 – Very Good.
- Particulate matter PM2.5: 16 – Very Good.
- Ozone: 10 – Very Good.
- Carbon monoxide: 3 – Very Good.
- Sulfur dioxide: 0 – Very Good.
- Nitrogen dioxide: 7 – Very Good.
- Earlwood AQI: 22 – Very Good.
- Regional AQI: 22 - Very Good.

The most significant contributor to overall air pollution at Earlwood is PM10; however, at an AQI of 22, PM10 remains in the Very Good range.

Potential impacts

Construction

The proposal has the potential to generate dust and emissions that may impact on local air quality. Emissions that have the potential to occur during demolition of the existing structures and excavation and placement of fill materials include dust,vehicle emissions, and plant, and equipment emissions such as CO, SO2, nitrous oxides, volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons (PAH) from the combustion of petrol and diesel fuels.

The most likely sources of dust and dust-generating activities include:

- Demolition of structures
- Excavation of the soil / sediment
- Delivery and transfer of material to the site
- Dispatch of demolition wastes and unsuitable spoil from the site
- Stockpiling; and
- General works.

The project would not have a significant impact on air quality. The works are short term, do not require extensive excavation or land disturbance, and have a minimal potential to generate significant quantities of dust. The operation of plant, machinery and vehicles will increase exhaust emissions in the local area; however, these impacts would be short term. Demolition of asbestos containing building materials will be carried out according to SafeWork NSW requirements.

Operation

No significant change to the air quality is proposed once the structures have been completed compared to the historical operations on the site.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Air Quality	Materials that have a potential to produce dust would be removed from site as soon as practical.	Contractor	Construction
Air Quality	Effective dust suppression techniques would be used during demolition operations.	Contractor	Construction
Air Quality	During demolition, and where practical, non-powered hand tools or portable power tools that incorporate dust suppression or dust extraction attachments would be used.	Contractor	Construction
Air Quality	Demolition of asbestos containing building materials would be carried out according to SafeWork NSW requirements.	Contractor	Construction
Air Quality	Works are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely.	Contractor	Construction
Air Quality	Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation	Contractor	Construction

Noise and vibration

Existing environment

The noise environment at the site is dominated by traffic on Captain Cook Drive and the operations of the oyster farm. Surrounding land uses are primarily recreational and natural vegetation. The nearest residential areas are approximately 320m south in Locksey and Glandore Streets, across Captain Cook Drive and south of the Cronulla Golf Course approximately 250m, and Woolooware High School approximately 250m to the southwest of the most southern building. Across the Bay is Towra Point Nature Reserve, which is approximately 1.6km.

Potential impacts

Construction

Noise generating activities are expected to take place throughout the Works. Time periods for the proposed activities are as follows:

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm (if required)
- Sundays works not permitted.

The noise generated from the overwater structure demolition and construction would be similar to other site activities that have occurred previous on the site. The methodology will be similar to the seawall construction and is unlikely to impact on the nearest residential receivers.

All noise generating activities are expected to take place during standard working hours. Noise created from construction would likely be negligible considering the existing ambient noise levels. The noise assessment for this proposal was based on a Distance Based Assessment (Noisiest Plant for Bridge Works (61 dB(A) LAeq(15minute)). For the purposes of the assessment classroom at schools and other education institutions parameters were adopted for the school receptors located to the southwest of the Site. The TfNSW Construction and Maintenance Noise Estimation tool, provides background noise levels based on AS1055. The receptors at Locksey Street would be classified as R1, with the following background noise levels:

- Day: 40 dBA
- Evening: 35 dBA
- Night: 30 dBA

The NSW EPA Interim Construction Noise Guideline has nominated a Noise Management Level (being the level at which there may be some community reaction to noise) during the nominated operating hours, as 10dB(A) above the measured background level. For Locksey Street residences, that would be 40 dB(A) during the nominated work hours.

This level is not exceeded for any of the scenarios modelled and presented in Appendix L.

The distance to the nearest residential receivers, the existing noise environment, and the short duration of works, together suggest that noise generated by the proposal is unlikely to be detectable at local receivers or to significantly impact on surrounding areas. Active noise monitoring is therefore not proposed during the works.

The assessment undertaken with the TfNSW Construction and Maintenance Noise Estimator identified with a distance-based assessment of noisiest plant (bored piling rig) residential receivers would be affected if within 185m during standard construction hours. No receivers are within this distance from the site.

Out of Hours Work (OOHW)

No OOHW are anticipated for this proposal, therefore there will be no impact to receptors outside to standard hours. Residential Receiver “Developed settlements (Urban and Suburban)” day works affected distance 500m. Moderately intrusive 20 to 30dB(A) day works within 215m would require mitigation measures. As identified by the above below highlighted in red no residential property is within this distance no further mitigation measures are required.

Non-Residential Receiver "Classroom at schools and Other Educational institutions" day works affected distance 330m. Moderately intrusive 20 to 30dB(A) day works within 140m would require mitigation measures. As identified by the below figure highlighted in blue school classroom is within this distance but no further mitigation measures are required.

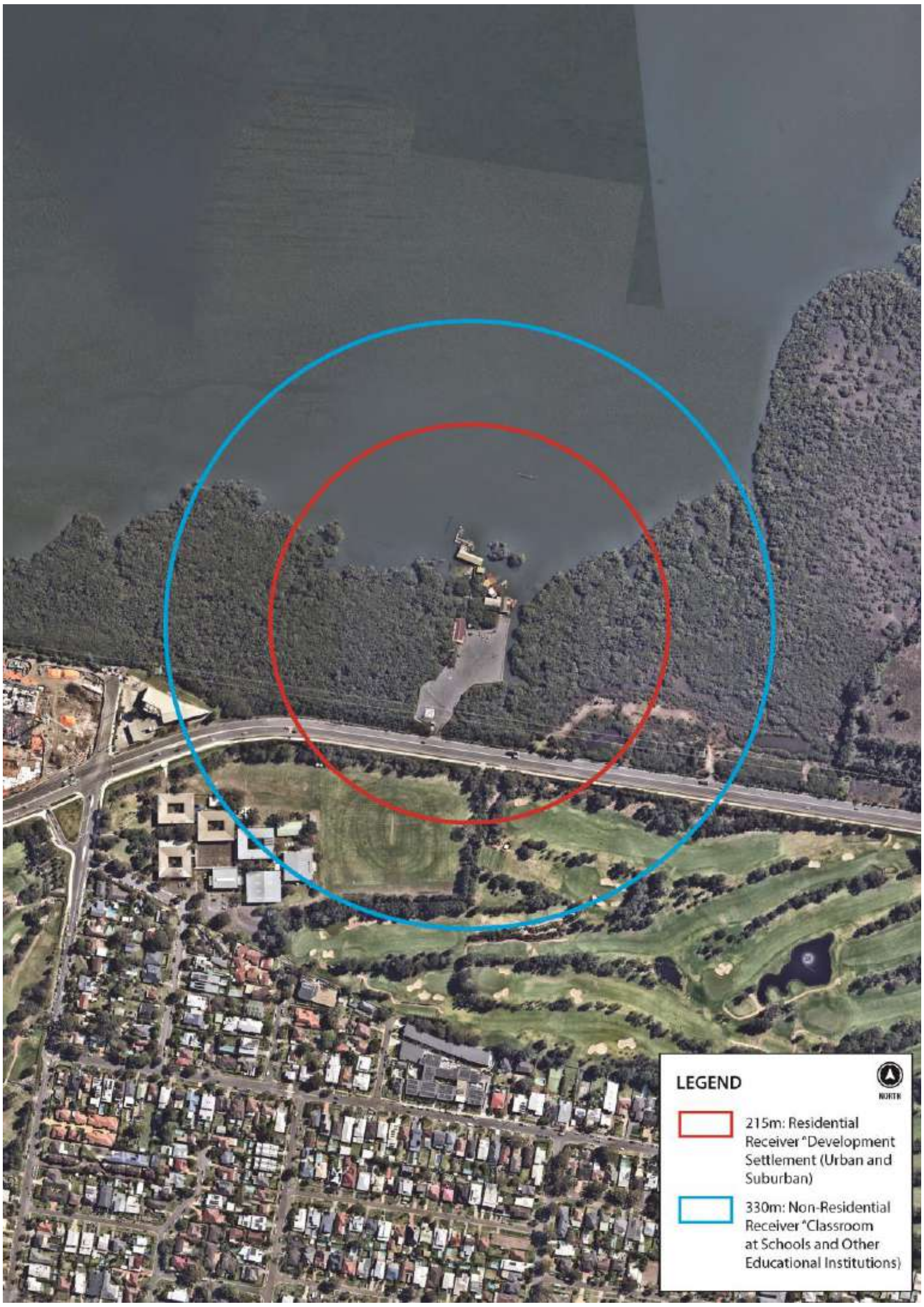

Figure 57 Image depicts the noise receivers and distances from the proposal.

Operation

The upgraded of the structures would service a similar patronage as to the existing environment as what has occurred historically on the site. As such, there is not expected to be any change in amenity noise under the proposal. No change in operational traffic is anticipated.

Impact	Environmental safeguards	Responsibility	Timing
Noise and vibration	Start of works notification to be distributed the local school of the proposal seven days prior to commencement of works.	Contractor/Project	Contractor/Project
Noise and vibration	Works to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). No work is permitted outside of the standard construction hours.	Contractor	Construction
Noise and vibration	Plant would be fitted with appropriate silencers, where available, and all plant and equipment would be maintained in good working order.	Contractor	Construction
Noise and vibration	Plant would be switched off or powered down when not being used.	Contractor	Construction
Noise and vibration	Complaints related to noise or to any other aspect of the works would be addressed in accordance the complaint handling procedures in the CEMP and resolved in consultation with the Project Manager.	Contractor	Construction

Landscape character and visual impact

A Landscape Character and Visual Impact Assessment has been prepared by APP in Appendix Q which provides an assessment of the potential impacts resulting from the proposed development. The assessment has been carried out in accordance with Transport for NSWs 'Guideline for Landscape Character and Visual Impact Assessment' and describes the existing landscape character, the potential impacts of the proposed development as well as recommended mitigation measures.

Existing environment

The land immediately to the east and west of the site supports Grey Mangrove Forest, which, to the east, forms part of the Towra Point Nature Reserve. The site is located within the Refuge Zone of the Towra Point Aquatic Reserve. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

Figure 58 view of the current oyster farm overwater structures is taken from the water inside Woolooware Bay via a drone. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

Figure 58 Shows the northern section of the overwater site and land site facing south-west.

Figure 59 Shows the northern section of the overwater site and land site facing south-west.

Figure 60 Shows the entrance to the land site looking north. Where the overwater structures are proposed will be difficult to view from Captain Cook Drive.

Potential impacts

Construction

The demolition of existing structures and construction of the site will have short-term impacts on the existing character of the site. Site amenities, material stockpiles, and delivery and dispatch vehicles may be visible from viewpoints across Captain Cook Drive and from the waters of Woolooware Bay. Figure 59 and figure 60 further out in Woolooware Bay shows a view from the bay towards the overwater structures north of the site.

Operation

Visually the site will be temporarily impacted by the construction via plant and equipment movements. The long-term visual impacts were assessed by the architect and the footprint of the proposed works, the replacement of existing white buildings with dark green structures and the height, form and design of the new buildings, set within the mangroves, make the development unintrusive and a minimal impact on the landscape character of the setting. Apart from water views from boats, most viewpoints and properties are distant and from these the project will have a negligible visual impact, if not a slight beneficial improvement due to the use of dark colours to replace the existing light-coloured buildings see Appendix N.

Potential impacts

Construction

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Impact	Environmental safeguards	Responsibility	Timing
Construction			
Visual	Avoid unnecessary loss or damage to vegetation adjacent to the proposal by protecting trees prior to construction and/or trimming vegetation to avoid total removal.	Contractor	Pre-Construction
Visual	Site amenities, plant and equipment, and waste skips would be locked, and if possible, placed on barges out of hours.	Contractor	Construction
Visual	Minimise temporary visual impacts by maintaining a clean and tidy worksite.	Contractor	Construction
Visual	Restore any areas that are impacted by construction with appropriate landscape treatments.	Contractor	Construction / Maintenance & Site Establishment

Impact	Environmental safeguards	Responsibility	Timing
Operational			
Visual	Rehabilitation planting to be undertaken as early as possible to replace vegetation that provided screening to sensitive visual receivers.	Contractor	Construction
Visual	If visually significant vegetation takes place unplanned, prepare documentation as soon as possible to mitigate and reduce the visual influence.	Contractor	Construction
Visual	Consistent landscape maintenance works to be undertaken to ensure the health and effectiveness of existing planting to help buffer the removal of any existing landscape items.	Contractor	Construction Maintenance Site Establishment

Biodiversity

Existing environment

The Site is situated on the southern shore of Botany Bay within Woolooware Bay and is adjacent to several significant ecological features. The overwater site has been progressively reclaimed from the surrounding mangrove forest using crushed oyster shells surrounding the overwater structures. Over the period of their residence, the oyster farmers have built several open sided sheds, cool rooms, enclosed storage sheds, access platforms, and boat launch areas. A raised timber walkway, sheds and smaller buildings are constructed on piers that extend beyond the fill platform across the tidal zone. Typical features of the site are shown in Figures 61 and 62.

Figure 61 Shows the central section of the overwater site facing north-west

Figure 62 The north-western section of the overwater site facing west. Note the crushed oysters located at the surface.

The Towra Point Nature Reserve is located approximately 1.3 km to the east of the Site, refer to the below Figure 63. The Towra Point Nature Reserve is the largest and most diverse estuarine wetland complex in NSW and represents approximately 50% of the remaining mangrove area near Sydney and majority of the saltmarsh communities remaining in this region. Towra Point Nature Reserve has been listed as an internationally important wetland under the Ramsar Convention.

It is known to support threatened species, population and ecological communities, populations of plants and animals important for maintaining biodiversity of a particular bioregion, species at a critical stage of their life cycle and it provides a food source, nursery habitat and migration paths for fish (Office of Environment and Heritage 2012).

The site is located within the Refuge Zone of the Towra Point Aquatic Reserve. This reserve covers an area of approximately 1,400 ha, making it the largest in NSW. It is known to be an important nursery area for fish and invertebrates and to provide important habitat for migratory seabirds, being rich in marine biodiversity. The Reserve includes much of the remaining important seagrasses, mangroves, and migratory wading bird habitats in Botany Bay.

AH Ecology was commissioned by TfNSW to undertake an ecological assessment of the terrestrial and aquatic ecology of the site provided in Appendix D. This assessment incorporates the findings of previous reports that have been prepared for this project including AH Ecology 2017, AH Ecology 2019 and AH Ecology 2020 and other ecological studies undertaken across the site since 2016.

The assessment was undertaken to describe the biodiversity values of the site and locality and assess the potential impacts of the proposed activity on biodiversity using the framework provided by Part 5A of the EP&A Act, 1979, the NSW Biodiversity Conservation Act, the Fisheries Management Act and the Commonwealth EPBC Act.

The Biodiversity Impact Report identified:

- The presence or potential for endangered ecological communities, endangered populations, threatened species and/or their habitat under the NSW Biodiversity Conservation Act, 2016 to occur on the Site and within the locality;
- The presence or potential for endangered ecological communities, endangered populations, threatened species and / or their habitat listed under the NSW Fisheries Management Act 1994 (FM Act) to occur on the Site and within the locality;

- The presence or potential presence of any matters of National Environmental Significance (NES) listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) to occur on the Site and within the locality;
- The potential for impacts of the proposed works on biodiversity, especially in relation to the BC Act, FM Act, EPBC Act and the Marine Estate Management Act 2014 (MEM Act); and
- Where potential impacts to endangered ecological communities, endangered populations, threatened species and habitat were identified, appropriate recommendations for the avoidance of impacts and management or mitigation options have been presented and incorporated into this REF.

Field investigations were undertaken to determine the site condition and the presence, or likely presence, of threatened or protected species, populations and communities. The following studies were undertaken:

- Random meander transects across the site noting plant species along with other factors including soil type and condition, the level of weed invasion and other signs of disturbance
- A general fauna habitat assessment including an assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna. In addition, indirect evidence of fauna (e.g. scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded
- The direct observation of any fauna species present within, or adjacent to, the study area
- Diurnal call identifications of fauna species with all calls being identified in the field
- Marine areas across the site including the channel were previously traversed by boat at high tide to search for the presence of seagrass and other marine vegetation. It was further searched at low tide for the presence of encrusting organisms and burrowing organisms and marine vegetation
- The likelihood of threatened terrestrial fauna and flora occurring on the Site was assessed through determining if suitable habitat was present. For plants and animals, this included several factors comprising the vegetation types of present, drainage patterns, weed invasion and current land use activities
- The assessments identified above identified the need for further surveys to target Yangochiroptera bats and migratory wading birds as part of the 2021 studies.

An Arboricultural Assessment was completed by a level 5 arborist from Allied Tree Consultancy to completement the Biodiversity Assessment. This assessment detailed impacts on individual mangroves that will be impacted by the demolition and construction methodology (Appendix E). The Arboricultural report was incorporated into the biodiversity report and the combine impacts were assessed.

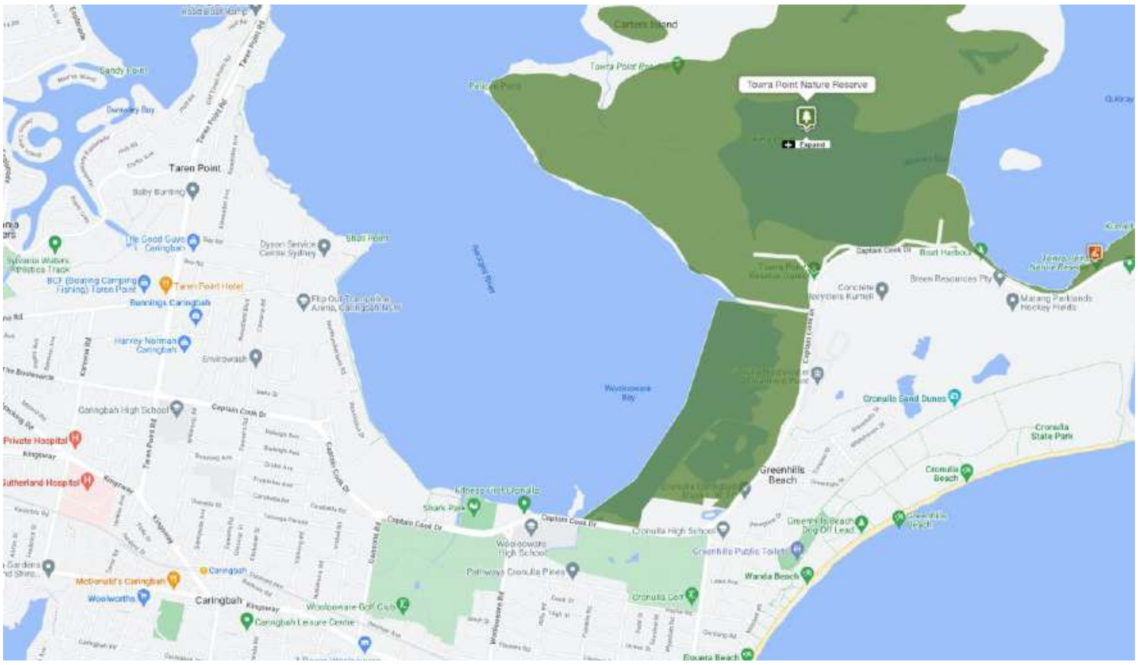

Figure 63 Proximity of the Towra Point Nature Reserve and the site (in red).

Aquatic

As outlined in AH Ecology's and Allied Tree Consultancy reports, Grey Mangrove (Avicennia marina) occurs around the edges of the overwater site and extends as a Mangrove Forest community to the north, east and west. Beyond the northern boundary of the land site a series of raised boardwalks and structures located into the intertidal zone and through the Grey Mangrove Forest. The Grey Mangrove canopy is dense with pneumatophores and seedlings are common. No other plant species were recorded within this forested area. No mangroves or seagrass were recorded growing on the muddy / silty substrate of the channel bordering the east of the site.

The Mangrove Forest community directly adjacent to the site is complex and healthy. Mangroves and mangrove forests provide important habitat and shelter for juveniles and adults of a wide range of fish species, including commercially and recreationally important species. They also produce large quantities of organic matter which are grazed by some marine fauna and further broken down by bacteria and fungi which are eaten by detritivores such as crabs. Sediments within the Mangrove Forest are likely to support benthic infauna.

The marine sediments adjacent to the overwater site and within the channel along the eastern boundary would support macrobenthic infauna. These assemblages are likely to be diverse within the Grey Mangrove Forests which appear to be healthy, functioning ecosystems. Anthropogenic disturbance though contamination and physical alteration of habitat, is known to effect macrobenthic infauna communities and hence the sediments of the eastern channel are likely to be more variable and less diverse (in both richness and abundance) than those in adjacent Grey Mangrove due to contamination and physical alteration of this area.

It is unlikely that the overwater site would provide habitat for amphibian species (e.g. Green & Golden Bell Frog (Litoria aurea)) due to the absence of on-site water bodies and the saline nature of the adjacent habitat. Reptiles, namely snakes and lizards commonly found in urban environments, likely use the abundant debris across the overwater site as refuges and for shelter and foraging. The common Dark-flecked Garden Sun-skink (Lampropholis delicata) has previously been recorded foraging amongst debris on the overwater site (AH Ecology 2017).

Terrestrial

As outlined in AH Ecology's report, the good condition of the adjacent Mangrove Forest Community and the proximity of the listed Towra Point Nature Reserve provide potential for the presence of a range of avifauna across the overwater site. Twenty-one bird species were recorded during the field assessments. These included species common to urbanised areas (e.g. Pied Currawong (Strepera graculina), Australian White Ibis (Threskiornis molucca)), and those more commonly associated with estuarine habitats (e.g. Black-winged Stilt (Himantopus himantopus) and Australian Pied Oystercatcher (Haematopus longirostris).

There are mudflats across the overwater site, oyster shell piles and an island approximately 30m from the most northerly building. All of these are submerged at high tide. At low tide these would provide suitable habitat for the foraging requirements of a range of bird species, including migratory waders. Roosting opportunities also exist throughout the Mangrove Forest some of these birds. The 603.7 ha Towra Point Reserve is located to the east of the site convention. Towra Point Nature Reserve supports approximately 40% of the mangrove communities and 60% of the saltmarsh communities remaining in the Sydney region. Mangrove and saltmarsh communities provide habitat and food for 25 species of fish that are of economic significance. The area also supports 34 species of migratory birds listed under international agreements, three threatened species listed under the Commonwealth EPBC Act, 23 threatened species and five endangered ecological communities listed under the NSW BC Act (OEH 2012).

There are twelve Threatened Ecological Communities (TEC) listed under the EPBC Act that are either known to occur within the locality of the overwater site. Ten Endangered Ecological Communities (EEC) listed under the BC Act are also known to occur within the Sutherland Shire local government area. There are Endangered Ecological Communities (EEC) which occur near the site that are relevant to the proposal being:

- Swamp Oak Floodplain Forest
- Coastal Saltmarsh
- Posidonia australis seagrass meadows
- The Shorebird Community occurring on the relict tidal delta sands at Taren Point.

Fauna and species population

Forty-eight species listed under the EPBC and 49 species and two endangered populations are listed under the BC Act / or FM act have been recorded within the locality of the site.

- Amphibians: The Green & Golden Bell Frog (Litoria aurea) and Red-crowned Toadlet (Pseudophryne australis) have been recorded within the locality. Due to its saline nature amphibians have not been recorded across the overwater site.
- Terrestrial Mammals: Four species of Yangochiroptera bats listed under the BC Act are known to occur in the locality. Recordings of another four Yangochiroptera bat species recorded across the overwater site suggested that all are roosting in areas off-site and moving across the overwater site during foraging. One species of Yinpterochiropteran bat listed as Vulnerable under the EPBC Act and BC Act, the Grey-headed Flying-fox, was recorded calling approximately 600m east of the Oyster Farm during the field studies.
- Avifauna (birds): The sandflats / mudflats associated with Woolooware Bay to the north of the Site. A further 15 bird species listed under the EPBC Act as solely Marine and / or Migratory birds are also known from the locality. On occasion some of these species may visit habitat on the Site and surrounding mangrove forests. A Whimbrel (Numenius phaeopus) was observed approximately 150 m west of the Site and this species is listed as Marine / Migratory under the EPBC Act (AH Ecology 2017). During the 2021 surveys two Australian Pied Oystercatchers (Haematopus longirostris), listed as Endangered under the BC Act, were observed perched on a structure that is present about 100 m north-east of one of the overwater structures. Given the fauna habitats present, combined with the land use history of this site, the Pied Oystercatcher is not considered to use the Site area for any of its life cycle requirements. No other observations of listed species were made during surveys of this overwater site.
- Marine fish: Botany Bay is known or predicted habitat for several fish species, reptiles, sharks, cetaceans, and other marine mammals and is especially important as nursery habitat for many commercially important species due to the extant seagrass and mangrove communities throughout the area. Several species have been identified listed under the FM Act, BC Act in the locality but were not recorded on the overwater site.

Marine and Terrestrial Flora

It is unlikely that any of the five terrestrial plant species listed under the EPBC Act and / or BC Act would occur on the site or directly adjacent. All marine vegetation is protected under the FM Act which includes the mangrove forest community across the site and extending into Woolooware Bay and Towra Point Nature Reserve. The endangered seagrass population located in Botany Bay were not recorded directly adjacent to the site and the closest mapped occurrence within Woolooware Bay is approximately 900m to the north-east of the overwater site.

Potential impacts

Construction

Aquatic

The seagrass population is located at Wooloware Bay and around Towra point bus and is not present across the site. Being located at Wooloware Bay and Towra Point, seagrass communities are well-setback from the site, achieving the following separation distances:

- Zostera / Halophila: approximately 400m to the north and the north-east of the site.
- Posidonia Australia seagrass meadows: approximately 900m to the north-east of the site,

As such, it is unlikely that the proposal will impact these communities. Where Barges approach the site through Woolooware Bay this should be taken at desirable tides and the pathway mapped out in Figure 21, 22 and 23.

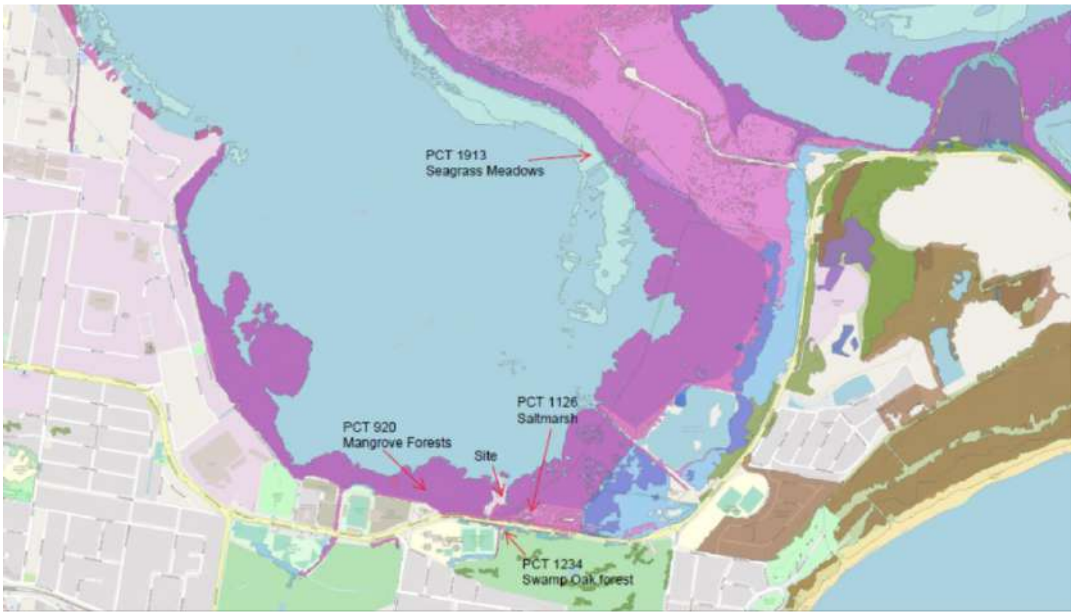

Figure 64 Estuarine Mapping demonstrating sea grass meadows to the north (Source: Alison Hunt and Associates).

Grey Mangrove trees located within the Towra Point Nature Reserve will need to be removed and / or trimmed to allow for demolition or construction of the overwater structures. Allied Tree Consultancy (2021) determined that a total of 8 Grey Mangrove trees across the overwater site would need to be removed. This would include removal of 6 mangroves during demolition works (i.e. Tree numbers 67, 69, 78, 92, 95) and 2 during construction (i.e. Tree numbers 141,142). A further 37 Grey Mangrove trees would be subject to a major encroachment during demolition although these would be retained and instead pruned and / or branches tied back. Seventeen of the 37 trees identified for trimming during demolition would also require further trimming during the construction phase. There will be no removal and / or trimming of Grey Mangrove trees from within the Towra Point Nature Reserve.

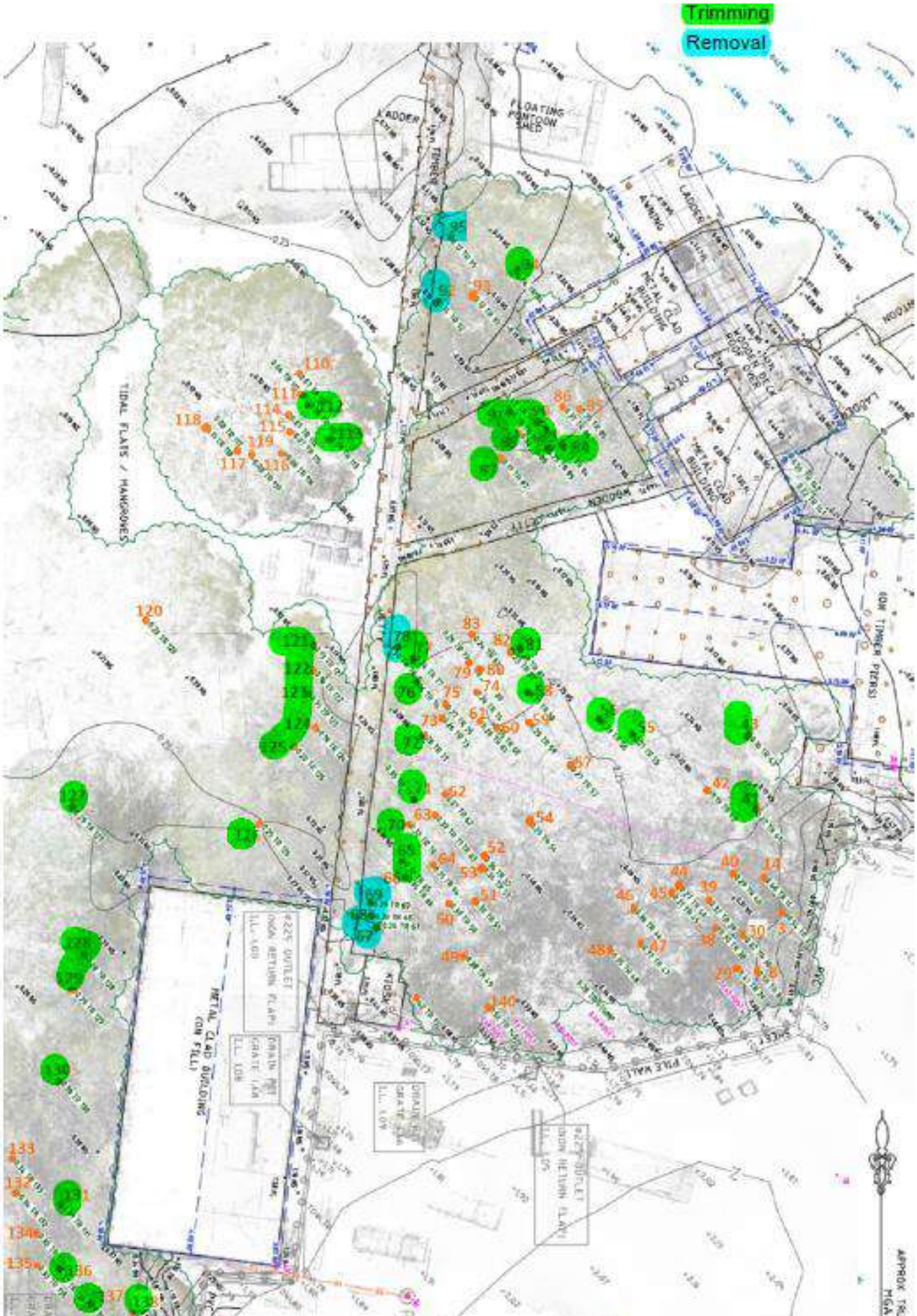

Figure 65 All of the mangroves that have been identified for removal or trimming in the western section of the overwater site.

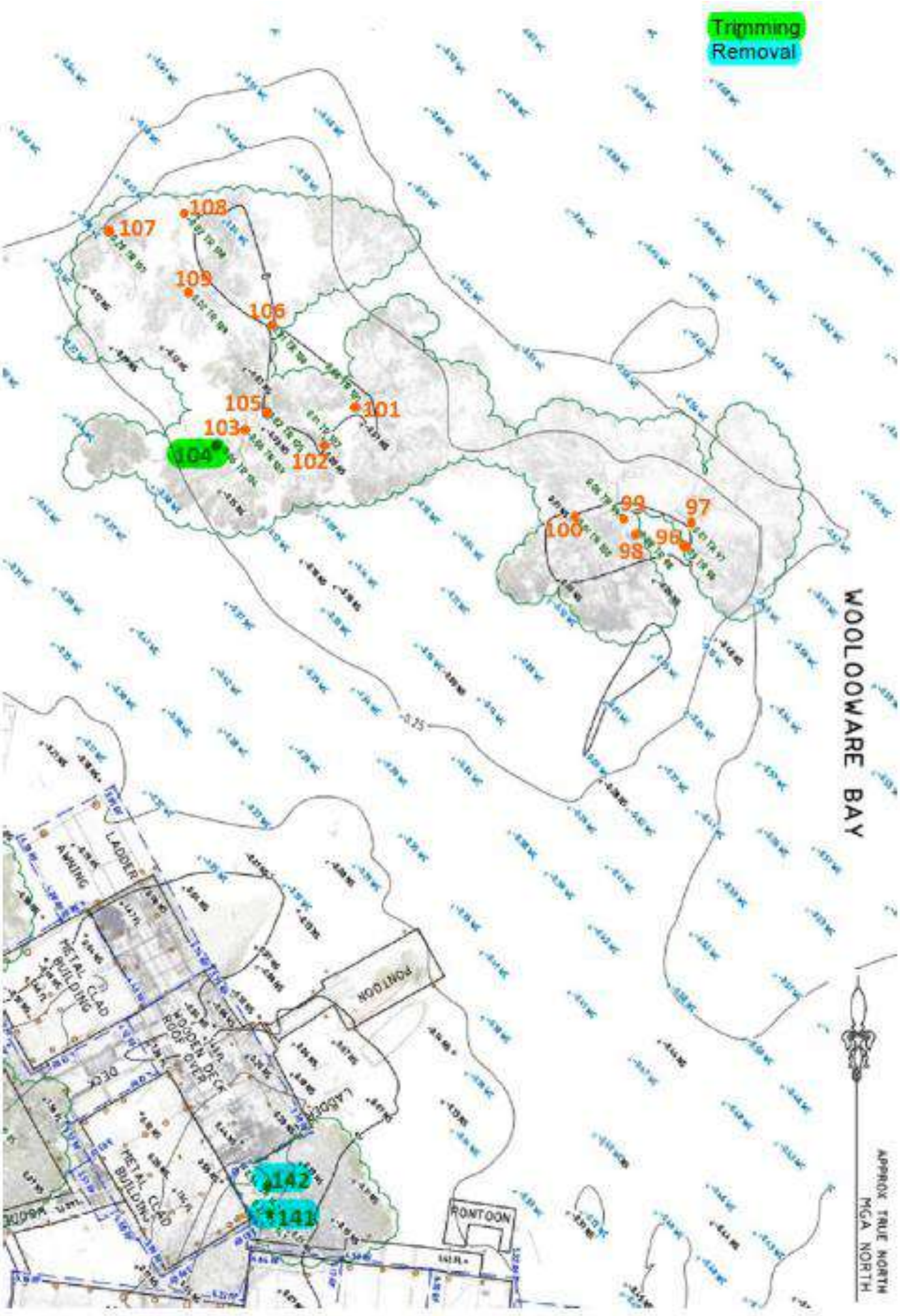

Figure 66 All of the mangroves that have been identified for removal or trimming in the eastern section of the overwater site.

Figure 67 All of the mangroves that have been identified that will be impacted by the plant during demolition and construction.

Removal of the eight trees would reduce the number of Grey Mangroves across the overwater site and trimming of a further 37 trees would reduce the flowering and hence seed production from those limbs removed. Given that there are high densities of seedlings present throughout the Mangrove Forest it is likely that these trees would be replaced by seedlings already present.

It is likely that these seedlings would respond to the opening of habitat, and this is already evident in areas that have lost trees, or parts of trees, through natural processes, supporting the highest densities of seedlings. To mitigate against these risks, Allied Tree Consultancy (2021) has detailed Zones of Protection and the rationale behind establishment of these zones. It should also be noted that many of the trees trimmed for the construction of the new seawall now have epicormic growth on branches and / or trunks (Plate 8) This demonstrates that sympathetic pruning of these trees is a successful way to mitigate against larger tree loses.

The majority of impacts to Grey Mangrove trees that are proposed to be impacted are associated with the removal and reconstruction of the current wooden walkway which currently connects the landside to the most northerly building. Many of the trees trimmed for the construction of the new seawall at the land site now have epicormic growth on branches and / or trunks demonstrating that sympathetic pruning of these trees is a successful way to mitigate against larger tree loses.

Figure 68 Shows the mangroves recovering post trimming caused by impacts in the stage 1 project.

Terrestrial

This Ramsar listed wetland has the potential to be indirectly impacted through poor water quality during demolition and construction as a consequence of:

- Mobilisation of sediments during civil works on-site causing
- Uncontrolled surface water runoff from the construction area
- Movement of sediment during removal of current piles and the installation of new piles and boreholes
- Pollutants from machinery and construction equipment including lubricants, oils and fuels
- Sewage and grey water spills.

The implementation of a Construction Environmental Management Plan (CEMP) and Erosion and Sediment Control Plan (ESCP) and stringent overall environmental controls to mitigate against these potential risks.

Construction impacts and activities

Floating booms, silt curtains or screens would be used during the removal and installation of the piles and structures to minimise the mobilisation of sediments and the spread of suspended sediments. Existing piles would be removed where possible and those unable to be removed would be cut off at the sea floor.

Inspection of buildings and other structures for signs of fauna nesting or brooding by a fauna specialist prior to demolition. The protection of the Mangrove Forest Community should be given the highest priority. Disturbance and / or decline of this community could substantially impact the adjacent areas of high conservation value. The removal and trimming of Grey Mangrove trees should be minimised and undertaken under the direction of a qualified Level 5 Arborist as per Allied Tree Consultancy (2021) Arboricultural Assessment. The removal and trimming of the Grey Mangrove trees are unlikely to permanently disrupt the connectivity within the locality as any removal or trimming would occur in a relatively small area of the overwater site which is set amongst dense Grey Mangrove Forest.

In-water activities should be avoided or minimised where possible. If they are unavoidable the in-water activities should be scheduled to coincide with favourable hydrodynamic conditions to ensure that sediment re-suspension and dispersion is minimised, e.g. calm conditions and high tide. Barges or other vessels used to assist with demolition and construction should be towed into the deeper areas of the eastern channel for overnight / day storage to avoid smothering sediments and injuring Grey Mangroves through settling onto sediments and pneumatophores during low tide vessels accessing the overwater site. All vessels operating over water should strictly adhere to the well-established channel between historic oyster leases to avoid any impacts on seagrass beds within Woolooware Bay.

The demolition of the current overwater structures, construction of the new facilities and services installation are unlikely to substantially alter flow regimes from their current state, as both the current facilities and new facilities are all positioned on piles above the high tide mark to facilitate movement of tidal flows. The sedimentation impact was assessed by a coastal engineer (Cardno 2022) with this study concluding that there would be no significant disruption to the local sediments (Appendix K).

It is likely that potential noise, vibration and light impacts would be greatest during demolition and construction period and therefore, these would occur over a relatively short and fixed period of time. Activities during construction, are likely to include construction workers, vehicles, large cranes, piling equipment, piling which is proposed to be steel driven to rock, concrete pumping, 20t tracked machine, demolition activities including cranes, hand demolition and the use of power tools.

Cumulative Impacts

Each of the stages of the Oyster Farm Project have contributed to cumulative impacts. The remediation of the land site and the installation of a new seawall altered habitats, but these alterations ultimately provided benefits to the site and locality.

This proposal the demolition of structures and replacement with purpose-built facilities across a footprint which includes the removal of 35.3 m2 of floating structures but inclusion of an additional 491.0 m2 of fixed overwater structures which is likely to change the structure and functioning of biological communities because of solar shading which disturbs the growth and biomass production in aquatic environments. However, the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the overwater site, and hence the site is predicted to remain a shallow intertidal area vegetated with Grey Mangroves that occur across a sediment substrate.

It is considered that the removal of the existing decaying structures and replacement of the purpose-built facilities, including the new reticulation services, is likely to provide an overall benefit to species within the locality.

Operation

The upgraded structures would service a similar patronage as that which has occurred historically on the site. As such, there is not expected to be any substantial deterioration in amenity, noise or light pollution under the proposal

Conclusion on significance of impacts

As outlined by AH Ecology, the proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act 2016 or Fisheries Management Act 1994 and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the Environment Protection and Biodiversity

Conservation Act 1999. A referral to the Australian Department of the Environment and Energy is not required for biodiversity matters.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
All project impacts	A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas requirements set out in the *Landscape Guideline* (RMS, 2008) pre-clearing survey requirements procedures for unexpected threatened species finds and fauna handling procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • protocols to manage weeds and pathogens.	Contractor	Pre-Construction
Flora and Fauna Impacts	An Environmental Work Method Statement (EWMS) is required for clearing and grubbing works. The EWMS would be submitted to the Transport for NSW Environment branch staff for review and endorsement prior to commencement of works. The EWMS must include, but not be limited to: • description of the works/activities including machinery and set up of exclusion zones • outline of the sequence of work/activities, including interfaces with other construction activities (for example the interface between cut and fill areas, stabilisation of exposed areas, excavation for an installation or upgrade of culverts) • identification of potential environmental risks/impacts due to the works/activities which is to include risks associated with wet weather events • evaluation of methods to eliminate/reduce the environmental risk • mitigation measures to reduce environmental risk	Contractor	Pre-Construction

Impact	Environmental safeguards	Responsibility	Timing
	• any safeguards resulting from consultation with public authorities and other stakeholders, where appropriate • a map / diagram indicating the locations of sensitive locations (such as threatened species), the likely potential environmental impacts and work areas as well as controls • identification of works areas and exclusions areas • details of a process for progressive review, for example monitoring processes and mitigations to eliminate/reduce environmental risks/impacts		
Edge effects on adjacent - Towra Point Nature Reserve / Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay	Exclusion zones will be set up at in accordance with the CEMP	Contractor	Construction
Edge effects on adjacent - Towra Point Nature Reserve / Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay	Floating booms, silt curtains or screens should be used during the removal and installation of the piles and structures to minimise the mobilisation of sediments and the spread of suspended sediments. The sediment boom and curtain will be installed around the construction activity. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line and rest on the seafloor.	TfNSW / Contactor	Construction
Impacted fauna prior to demolition	Inspection of buildings and other structures for signs of fauna nesting or brooding by a fauna specialist prior to demolition;	TfNSW / Contactor	Construction
Trimming and removal of mangroves	The removal and sympathetic trimming of Grey Mangrove trees should be minimised and undertaken under the direction of a qualified Level 5 Arborist as per Allied Tree Consultancy (2021) Arboricultural assessment. Trimming and removal will be required for the safe access of plant and equipment will require a permit under Section 7 of the FM Act	TfNSW / Contactor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Trimming and removal of mangroves	Tree protection measures to be installed around mangroves and to be inspected regularly by TfNSW	TfNSW / Contactor	Construction
Seagrass impacts	Vessels accessing the site over water should strictly adhere to the well-established channel between historic oyster leases to avoid any impacts on seagrass beds within Woolooware Bay; and	Contractor	Construction
Aquatic impacts	A spill management plan will be developed and communicated to all staff working on site. Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site. All workers will be advised of the location of the spill kit and trained in its use.	Contractor	Construction
Noise, vibration and light	Detailed design of the proposal should reduce the time taken for demolition and construction thereby reducing opportunities for impacts of noise, vibration light pollution.	Contractor	Construction
Noise, vibration and light	Confine works on Site to standard working hours (i.e. during daylight hours) and ensure that security lighting is shielded and minimised.	TfNSW / Contactor	Construction
Aquatic impacts	Worked with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction
Aquatic impacts	Piling to stop if marine mammals are observed within 100 metres of the project area.	Contractor	Construction
Aquatic impacts	Barges or other vessels used to assist with demolition and construction should be towed into the deeper areas of the eastern channel for overnight / day	Contractor	Construction

Socio-economic

Upgrade of the overwater structures would generate economic benefits over the next 50 years, with the overwater structures being an attractor for investment and jobs in the area. Design of the overwater structures has also incorporated measures to decrease the maintenance required for operation. The implementation of these measures would result in cost savings for the ongoing operation proposed facility.

Land transport and parking

Existing environment

Land transport

The site is located off Captain Cook Drive at Woolooware, NSW. Captain Cook Drive is an 70kph arterial dual carriageway regional road. Access to and from the oyster farm is via a sealed driveway, with a bicycle lane providing some protection for vehicles using the access. Public transport a long Captain Cook Drive is limited to a bus service, operated by Transdev NSW, which provides services between Woolooware and Cronulla Sharks Leagues Club. There are no existing bus stops in the vicinity of the site.

Parking

Informal on-site parking is available for staff and visitors to the oyster farm located at the southern section on the land site. Kerbside parking is generally permitted along either side of the road adjacent to the site. Temporary parking for construction workers will be provided in a designated area on the land site (see figure 18).

Potential impacts

Construction

The existing access is located on a straight section of road and provides for good visibility for drivers entering and exiting the site. For the posted speed limit of 70 km/h the sight distance requirement is 151 metres. The sight distance has been assessed on site and exceeds 230 metres to the right for drivers exiting the site. Due to the raised median, there are no requirements for visibility to be provide to the left for drivers exiting the site.

As the whole of the proposal will take place within the site, road or lane closures will not be required. Traffic management measures will be limited to the application of stop and turn restrictions. All vehicles entering or leaving the site will be restricted to left in and left out. All vehicles leaving the site will be required to stop and yield to oncoming traffic, including bicycles.

Additional vehicle movements will be generated throughout the proposal through the mobilisation and demobilisation of plant, equipment, and site amenities, and by light vehicles and light truck deliveries. This will be in the order of 10 vehicles per day (20 vehicle movements per day).

Parking

Traffic management measures would be limited. This will be discussed with the local operator and the increase traffic flow would not be on minimal impact to the business.

Operation

Land transport

It is considered that the proposed development will have minimal impact upon the operation of the road network in this location. The existing road operates well, with the roundabout to the west at Woolooware Road operating very well with low delays and congestion. The additional traffic movements created by the demolition and construction will have a minimal impact upon the overall operation of this roundabout.

Parking

The lease area allows for 4 leases overwater and 5-6 leases and a maximum of 2 people required per lease giving a demand for up to 20 cars to park on the site. It is considered that due to the lack of pedestrian access to the site and no public transport there is no opportunity for reducing the car parking requirements. The site has reasonable access for cyclists with an off-road footway / cycleway on the opposite side to the subject site and an on road sealed shoulder for cyclists. However, it is not considered that parking could be reduced due to these facilities.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Traffic and Access	All vehicles entering or leaving the site would be restricted to left in and left out.	Contractor	Construction

Water transport

Existing environment

The overwater structures have various jetties extending out into the Bay. The overwater structures are in an area on low vessel traffic movement and the impactors to other operators or recreational personnel would be low.

Potential impacts

Construction

There is potential that the proposal could temporarily restrict waterside access to the existing operator during works, however it is not anticipated to significantly impact the surrounding maritime navigation passages. A water transport management plan would be prepared for the proposal with specific measures to be implemented to ensure access is maintained.

Operation

The proposal would not impact on access in operation and would improve navigational safety by removing a potential future navigation hazard and the overwater structures are structurally unsound.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Water Transport	All floating plant would be in survey and suitably marked and lit.	Contractor	Construction
Water Transport	A water transport management plan would be prepared for the proposal	Contractor	Construction

Aboriginal cultural heritage

The Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (Department of Environment, Climate Change and Water, 2010) sets out the reasonable and practicable steps which individuals and organisations need to take in order to:

- Identify whether or not Aboriginal objects are, or are likely to be, present in an area

- Determine whether or not their activities are likely to harm Aboriginal objects (if present)
- Determine whether an Aboriginal Heritage Impact Permit (AHIP) application is required.

Existing environment

A search of the Office of the Environment and Heritage AHIMS web service was conducted by APP on 29 September 2021 for the area between (Latitude/Longitude) 34.04,151.15, with a buffer of 100 metres. The results of the AHIMS search are provided in Appendix O. The search showed that TfNSW Demolition and construction of the Overwater Structures Review of Environmental Factors proposal indicated that no Aboriginal sites have been recorded in or near the search location, and that no Aboriginal places have been declared in or near the search location. A PACHCI Stage 1 Assessment was undertaken by TfNSW Aboriginal Cultural Heritage Officer with the conclusion that the proposal is unlikely to have an impact on Aboriginal cultural heritage. The PACHCI Assessment Letter is attached at Appendix O.

Potential impacts

Construction

The proposal requires excavation which would disturb the surface for dislodgement of the structures and excavation would impact natural ground surface however, there are no confirmed site records or associated landscape feature information on AHIMS. Demolition and excavation works would be carried out with caution, so as to ensure there are no impacts to neighbouring landscape features. An unexpected Aboriginal heritage finds procedure would be established, implemented, communicated to all site personnel, and followed for the duration of the works.

Operation

No impacts are expected.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Unexpected Aboriginal Heritage Finds	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Standard Management Procedure: Unexpected Heritage Items must be followed.	Contractor	Pre-construction Construction

Non-Aboriginal heritage

Existing environment

The existing environment surrounding the site has a strong history in Oyster farming. Approximately 2.6km North-West of the site is an Oyster jetty from the 1960s that has been restored. Captain Cook Bridge, approximately 3.7km to the north west of the site a NSW heritage location, can be seen from the site. Captain Cook bridge was the first of its type in the Sutherland Shire and represents the importance of the development of motorways and bridges. The structure is a fine example of the post-World War II style bride and is an important typology in the state of NSW. The proposal would have no associated negative implications on the surrounding non-aboriginal Heritage of the area and is not within proximity to any areas of heritage significance. The removal of the Demolition and Reconstruction of these Structures would improve the views of Captain Cook Bridge from the operators in Woolooware Bay.

Potential impacts

There are no known non-aboriginal heritage items that would be impacted by the proposal. An unexpected heritage finds procedure would be established, implemented, communicated to all site personnel, and followed for the duration of the works.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Unexpected Non-Aboriginal Heritage Finds	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed. Transport for NSW Senior Environment Specialist – Heritage must be contacted immediately, and Sydney region environment manager notified.	Contractor	Demolition

Hazards

Existing environment

Previous investigations undertaken at the land site identified that soils and groundwater were impacted with polycyclic aromatic hydrocarbons (PAHs) and total recoverable hydrocarbons. These contaminants are associated with the historical use of tars on the site to treat timbers associated with oyster farming. Additionally, butyltins (BTs) and asbestos were also identified at the site. In 2018 JBS&G recommended that tar-based contamination, acting as potential source material, within the extent of the site was removed and an Environment Management Plan (EMP) be prepared for the site. A Remedial Action Plan (RAP JBS&G 2020) was prepared to guide the remediation and validation procedures to make the site suitable for the proposed commercial/industrial land use.

The site was subject to remediation from 2017 to 2021 which included excavation, waste classification and off-site disposal of tar impacts and associated wastes resulting from remedial excavations across the site. Following remediation and validation of excavations, a marker and capping layer was installed across the site to encapsulate remaining TRH, PAH, BT and asbestos impacted soils in accordance with the RAP (JBS&G 2020) to make the site suitable for the proposed commercial/industrial land use. Documentation of the validation works are detailed in the Validation Report prepared for the site (JBS&G 2021b). There are some residual tar impacts remaining within the 5 metre Ausgrid tower easement to the north and west of the tower footprint which require ongoing management in accordance with the EMP.

As part of the validation works soil vapour sampling identified concentrations of methane and carbon dioxide above the adopted threshold for action of 1% volume/volume (v/v) and 1.5 % v/v. Therefore, a detailed hazardous ground gas risk assessment (HGGRA) was completed. The HGGRA identified that the site is classified as Characteristic Situation (CS) 3, with specific gas mitigation management or controls required for the proposed commercial/industrial land use. We note that this value has been agreed upon as part of the site audit process.

This EMP applies to the site and it will be the responsibility of the site owner (TfNSW) and operator to implement this plan following issue of the Site Audit Statement (SAS) by the Site Auditor. This EMP is required to ensure that the identified TRH, PAH, BT and asbestos impacted soils and hazardous ground gases beneath the site are appropriately managed for continued protection of human health for future site workers, occupiers, visitors, and contractors engaged to undertake work at the site.

Potential impacts

Construction

The land site is a fenced vacant land parcel with a lockable gate, with the ground surfaces comprising a 2-coat bitumen spray seal. Sandstone blocks encompassed the land site of the site boundaries. A high-voltage Ausgrid transmission tower (Ausgrid tower) is present in the southern portion of the site. A concrete slab encompassing the footprint of the Ausgrid tower is present with a stormwater pit in the centre of the slab. Additional stormwater pits are evenly spaced around the boundary of the site. Any breaches of the cap onsite with require strict adherence to the EMP that has been prepared by JBS&G for the site. This will include the installation of lead-in services for the Captain Cook Drive to the overwater structures.

Operation

The future operation on the site will not impact the cap and therefore disturbed the contaminated materials. All future operators are to be made aware of the EMP to minimise the risk of harm to human health and the environment. It is the responsibility of contractors and personnel undertaking works within the site (extent of the EMP) to ensure that:

- They do not commence any works within the site unless they have been inducted into and understand the requirements of this EMP; and
- They implement all the procedures documented within this LTEMP during all works at the site as well as any additional contamination and/or WHS regulatory requirements in force at that time inclusive of communications with the site operator.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Contamination	A copy of the EMP is to be supplied to all persons conducting intrusive works on the site	TFNSW	Pre-construction, construction and operation

Climate change

Strategic framework

In 2009, the NSW State Government outlined a Sea Level Rise Policy Statement that specified sea level rise planning benchmarks comprising an increase by 0.4 m by 2050 and 0.9 m by 2100 above 1990 mean sea level. In 2010, the Department of Planning published an NSW Coastal Planning Guideline: Adapting to Sea Level Rise which adopted those planning benchmarks.

In 2012, the Sea Level Rise Policy Statement (2009) was repealed, however global projections for sea level rise have remained largely unchanged since that policy statement was published. Many public authorities (e.g. Councils) continue to plan for a 0.4 m and 0.9 m rise above 1990 mean sea level by 2050 and 2100 and these values are considered reasonable.

Over the coming century, sea level rise will contribute to increased risk of coastal flooding in lowland areas. AS2997-2005 Guidelines for the Design of Maritime Structures state that maritime structures should be designed to cater for increase in ocean water level due to sea level rise. It also states that the amount of sea level rise to consider for design purposes should depend on the design life of the structure. The design life of the overwater structures would be based on a 50-year life and this has been considered by the design engineers.

The height of the proposed overwater structures was originally 1.95m AHD. After consultation with the coastal engineer the height was increased to 2.20 with a hydrostatic uplift value of 3kpa. As the decking is 50mm the final finish floor level that is to be progressed detailed design is 2.25 AHD.

Potential impacts

Construction

The construction of the overwater structures is proposed to be undertaken within the next twelve months and sea level rise is not an issue for the construction phase.

Operation

Sea level rise will have a positive impact on the future operations as the punts previously constructed high tide operation would be able to operate at low tide.

Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Climate change and sea level rise	Sea level rise will be taken into account in the design of the upgrading, having regard to the design life of 50 years. The height of the proposed overwater structures finished floor is to be 2.25 AHD with a hydrostatic uplift value of 3kpa.	TfNSW	Pre- construction (Detailed design)

Other impacts

Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Utilities Upgrade	Updates on any delays or changes to the construction period will also be communicated.	Impact to programme if significant utilities upgrades are required

Cumulative impacts

Study area

Cumulative impacts have the potential to arise from the interaction of individual elements within the proposal and the additive effects of other external projects. TfNSW is required under Clause 228 (2)(o) of the Environmental Planning and Assessment Regulation, to take into account potential cumulative impacts as a result of the proposal. The cumulative assessment has considered overwater works in Woolooware Bay and landside works in the vicinity of the proposal.

Broader program of work or nearby developments

The is not broader program of works or nearby developments that would impact or this proposal would impact.

Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

Environmental management plans

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, Sydney Region prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in QA Specification G36 – Environmental Protection (Management System).

Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in table 6 below.

Table 6 Summary of safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following: • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity. details of waste management for the project	Contractor / Transport for NSW Project Manager	Pre-construction / detailed design	1
General - notification	All key stakeholders (eg fisheries, local councils) affected by the activity would be notified at least four weeks prior to commencement of the activity.	Contractor / Roads and Maritime Project Manager	Pre-construction	2
General - environmental awareness	All personnel working on site would receive training to ensure awareness of environment protection requirements to be implemented during the project. This would include up-front site induction and regular "toolbox" style briefings.	Contractor / Roads and Maritime Project	Pre-construction Construction	3

Impact	Environmental safeguards	Responsibility	Timing	Reference
		Manager		
Erosion and Sediment controls	Prepare a site-specific Erosion and Sediment Control Plan (ESC) in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (Blue Book) requirements, as a sub-plan to the CEMP. The plan is to be updated progressively as site conditions change.	Contractor	Pre-construction	4
Erosion and sediment controls	All in-water activities associated with the excavation of sediments/soil should be scheduled to coincide with favourable tidal conditions to ensure that sediment re-suspension and dispersion is minimised.	Contractor	Pre-construction	5
Erosion and sediment controls	If floating barge should be used during demolition / construction. The anchors for any barges must be positioned such as to minimise sediment resuspension and dispersion.	Contractor	Construction	6
Erosion and sediment controls	Excavated materials should be stored on the land site and removed off site as soon as practicable to minimise risk of runoff into adjacent areas. As a precautionary measure, enough aglime would be required to be always kept on one of the working Barges in accordance with the ASS management plan.	Contractor	Construction	7
Erosion and sediment controls	Rubbish and debris should be collected and removed off site to prevent it entering the waterway	Contractor	Construction	8
Erosion and sediment controls	No chemicals, fuels and / or wastes would be stored on the foreshore. All such substances are to be contained in sealed vessels of appropriate volumes and stored within bunded areas on the land site. In accordance with the ASSMP, an ASS treatment site would be set up on the land site.	Contractor	Construction	9
Erosion and sediment controls	Spill Kits are required to be kept onsite, and all staff trained to use them, If a spill to water occurs the TfNSW Contract Manager and the RMS environmental staff are to be notified immediately in accordance with TfNSW Environmental Incident Classification and Reporting Procedure	Contractor	Construction	10

Impact	Environmental safeguards	Responsibility	Timing	Reference
Erosion and sediment controls	Place all temporary stockpiles away from stormwater drains and drainage lines.	Contractor	Construction	11
Erosion and sediment controls	Ensure the spoil treatment area is fully bunded	Contractor	Construction	12
Storm Emergency	A soil and water management plan including measures to address flood and storm threats would be included in the CEMP. The plan would detail safeguards to prepare, respond and recover from a possible storm event. Measures are to include, but not be limited to: • Regular monitoring (visual and/or electronic) of Bureau of Meteorology Sydney Closed Waters Forecast and Severe Weather Warnings, as well as predicted tides (especially spring and solstice tides), ocean water level and winds/wave conditions actions for the evacuation of staff and visitors from the water-based facilities to a safe location on land measures to minimise risk of damage from wave action. process for removing equipment and materials off site and out of flood risk areas quickly. • Refuelling of plant and equipment and storage of hazardous materials on the land site double-bunded area.	Contractor	Pre-construction Construction	13
Erosion and sediment controls	All in-water activities associated with the excavation of sediments /soil should be scheduled to coincide with favourable tidal conditions to ensure that sediment re-suspension and dispersion is minimised.	Contractor	Pre-construction	14
Erosion and sediment controls	Any Barges that are used for demolition and or construction must be positioned such as to minimise sediment resuspension and dispersion.	Contractor	Contractor Pre-construction	15
Erosion and sediment controls	Floating booms, silt curtains or screens should be used during instream activities to minimise the mobilisation of sediments and the spread of suspended sediments.	Contractor	Construction	16
Erosion and sediment controls	Excavated materials must be store on the land and removed off site as soon as practicable to minimise risk of runoff into adjacent areas. As a	Contractor	Construction	17

Impact	Environmental safeguards	Responsibility	Timing	Reference
	precautionary principal aglime would be required to be kept onsite at all times in accordance with the ASS management plan.			
Erosion and sediment controls	Rubbish and debris should be collected and removed off site to prevent it entering the waterway	Contractor	Construction	18
Storm Emergency	A soil and water management plan including measures to address flood and storm threats would be included in the CEMP. The plan would detail safeguards to prepare, respond and recover from a possible storm event. Measures are to include, but not be limited to: • regular monitoring (visual and/or electronic) of Bureau of Meteorology Sydney Closed Waters Forecast and Severe Weather Warnings, as well as predicted tides (especially spring and solstice tides), ocean water level and winds/wave conditions • actions for the evacuation of staff and visitors from the water-based facilities to a safe location on land • measures to minimise risk of damage from wave action. • process for removing equipment and materials off site and out of flood risk areas quickly. • Refuelling of plant and equipment and storage of hazardous materials on barges is to occur	Contractor Pre-construction	Contractor Pre-construction	19
Waste Management	Waste disposed of off-site shall be classified in accordance with the NSW EPA Waste Classification Guidelines, prior to disposal and shall be disposed of at an appropriately licenced facility for that waste. Where necessary, this shall include sampling and analysis.	Contractor	Construction	20
Waste Management	All wastes will be segregated and stored separately, including wastes from the site compound and decontamination activities.	Contractor	Construction	21
Waste Management	All wastes will be classified and recycled, reprocessed, or disposed of in accordance with the requirements of their classification.	Contractor	Construction	22

Impact	Environmental safeguards	Responsibility	Timing	Reference
Waste Management	Litter in and around the site will be removed daily.	Contractor	Construction	23
Waste Management	Where practicable, recyclable materials will be reused or recycled.	Contractor	Construction	24
Waste Management	All wastewater from vessels is to be discharged at an approved vessel wastewater disposal facility. No vessel wastewater is to be discharged (i.e. pumped out) directly into the water or onto any land adjacent.	Contractor	Construction	25
Hazardous materials management	A hazardous materials assessment has been carried out to identify any asbestos and synthetic mineral fibre containing building materials present on the site. Mitigation measures are to be included in the CEMP and the identified materials are to be removed in accordance with the codes of practice identified in the EPRisk 2021 reports.	Contractor	Pre-Construction	26
Hazardous materials management	Asbestos containing building materials would be stripped from the site prior to demolition. Asbestos removal must be undertaken in accordance with Code of Practice "How to Safely Remove Asbestos" August 2019	Contractor	Construction	27
Water Quality	Prior to use at the site and / or entry into the waterway, machinery is to be appropriately cleaned, degreased and serviced.	Contractor	Construction	28
Water Quality	Measures to are to be implemented to prevent contaminating the Bay during the treatment of ASS, including bunding the storage bin location for the duration of storage and treatment of ASS material, preventing infiltration of surface water (rain or drainage) through the stored ASS material or water prior to treatment. Any treatment of soil is to be conducted on the land site.	Contractor	Construction	29
Accidental Spills	An emergency spill kit is always to be kept on site and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site. Spill kits for construction Barges must be specific for working within the marine environment. All workers would be advised of the location of the spill kit and trained in its use.	Contractor	Construction	30

Impact	Environmental safeguards	Responsibility	Timing	Reference
Accidental Spills	Where possible all refuelling of plant and equipment is to be undertaken on land where possible. If refuelling of plant / storage of hazardous materials on Barges is to occur within an impervious double-bunded area.	Contractor	Construction	31
Accidental Spills	If an incident (eg spill) occurs, the Transport for NSW Environmental Incident Classification and Reporting Procedure is to be followed and the Transport for NSW Contract Manager notified as soon as practicable. In the event of a maritime spill, the incident emergency plan would be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies outlined in the 'NSW State Waters Marine Oil and Chemical Spill Contingency Plan' (Maritime, 2012).	Contractor	Construction	32
Air Quality	Materials that have a potential to produce dust would be removed from site as soon as practical.	Contractor	Construction	33
Air Quality	Effective dust suppression techniques would be used during demolition operations.	Contractor	Construction	34
Air Quality	During demolition, and where practical, non-powered hand tools or portable power tools that incorporate dust suppression or dust extraction attachments would be used.	Contractor	Construction	35
Air Quality	Demolition of asbestos containing building materials would be carried out according to SafeWork NSW requirements.	Contractor	Construction	36
Air Quality	Works are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely.	Contractor	Construction	37
Air Quality	Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation	Contractor	Construction	38
Noise and vibration	Start of works notification to be distributed the local school of the proposal seven days prior to commencement of works.	Contractor/Project	Contractor/Project	39

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	Works to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). No work is permitted outside of the standard construction hours.	Contractor	Construction	40
Noise and vibration	Plant would be fitted with appropriate silencers, where available, and all plant and equipment would be maintained in good working order.	Contractor	Construction	41
Noise and vibration	Plant would be switched off or powered down when not being used.	Contractor	Construction	42
Noise and vibration	Complaints related to noise or to any other aspect of the works would be addressed in accordance the complaint handling procedures in the CEMP and resolved in consultation with the Project Manager.	Contractor	Construction	43
Visual	Avoid unnecessary loss or damage to vegetation adjacent to the proposal by protecting trees prior to construction and/or trimming vegetation to avoid total removal.	Contractor	Pre-Construction	44
Visual	Restore any areas that are impacted by construction with appropriate landscape treatments.	Contractor	Construction / Maintenance & Site Establishment	45
Visual	Rehabilitation planting to be undertaken as early as possible to replace vegetation that provided screening to sensitive visual receivers.	Contractor	Construction	46
Visual	If visually significant vegetation takes place unplanned, prepare documentation as soon as possible to mitigate and reduce the visual influence.	Contractor	Construction	47
Visual	Consistent landscape maintenance works to be undertaken to ensure the health and effectiveness of existing planting to help buffer the removal of any existing landscape items.	Contractor	Construction Maintenance Site Establishment	48
Visual	Site amenities, plant and equipment, and waste skips would be locked, and if possible placed on barges out of hours.	Contractor	Construction	49

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual	Temporary visual impacts must be minimised by maintaining the work site in a clean and tidy state	Contractor	Construction	50
Edge effects on adjacent -Towra Point Nature Reserve / Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay	Exclusion zones will be set up at in accordance with the CEMP	Contractor	Construction	51
Edge effects on adjacent -Towra Point Nature Reserve / Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay	Floating booms, silt curtains or screens should be used during the removal and installation of the piles and structures to minimise the mobilisation of sediments and the spread of suspended sediments. The sediment boom and curtain will be installed around the construction activity. The silt boom and curtain would extend from a minimum of 100 millimetres above the water line and rest on the seafloor.	TfNSW / Contactor	Construction	52
Impacted fauna prior to demolition	Inspection of buildings and other structures for signs of fauna nesting or brooding by a fauna specialist prior to demolition;	TfNSW / Contactor	Construction	53
Trimming and removal of mangroves	The removal and sympathetic trimming of Grey Mangrove trees should be minimised and undertaken under the direction of a qualified Level 5 Arborist as per Allied Tree Consultancy (2021) Arboricultural assessment. Trimming and removal will be required for the safe access of plant and equipment will require a permit under Section 7 of the FM Act	TfNSW / Contactor	Construction	54
Trimming and removal of mangroves	Tree protection measures to be installed around mangroves and to be inspected regularly by TfNSW	TfNSW / Contactor	Construction	55
Seagrass impacts	Vessels accessing the site over water should strictly adhere to the well-established channel between historic oyster leases to avoid any impacts on seagrass beds within Woolooware Bay; and	Contractor	Construction	56

Impact	Environmental safeguards	Responsibility	Timing	Reference
All project impacts	Integrate the management of flora and fauna into the construction environmental management plan (either as a standalone flora and fauna management plan or a subplan). This is to include all terrestrial and marine flora and fauna.	Contractor	Construction	57
Aquatic impacts	A spill management plan will be developed and communicated to all staff working on site. Appropriate land and aquatic spill kits are to be maintained on site and on barges. Aquatic spill kits must be specific for working within the marine environment. The spill kit must be appropriately sized for the volume of substances at the work site. All workers will be advised of the location of the spill kit and trained in its use.	Contractor	Construction	58
Noise, vibration and light	Detailed design of the proposal should reduce the time taken for demolition and construction thereby reducing opportunities for impacts of noise, vibration light pollution.	Contractor	Construction	59
Noise, vibration and light	Confine works on Site to standard working hours (i.e. during daylight hours) and ensure that security lighting is shielded and minimised.	TfNSW / Contactor	Construction	60
Aquatic impacts	Worked with positioning barges, drilling and pile driving should occur during calm conditions to prevent excessive scouring and other impacts.	Contractor	Construction	61
Aquatic impacts	Piling to stop if marine mammals are observed within 100 metres of the project area.	Contractor	Construction	62
Aquatic impacts	Barges or other vessels used to assist with demolition and construction should be towed into the deeper areas of the eastern channel for overnight / day	Contractor	Construction	63
Traffic and Access	All vehicles entering or leaving the site would be restricted to left in and left out.	Contractor	Construction	64
Water Transport	All floating plant would be in survey and suitably marked and lit.	Contractor	Construction	65

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected Aboriginal Heritage Finds	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime Standard Management Procedure: Unexpected Heritage Items must be followed.	Contractor	Pre-construction Construction	66
Unexpected Non-Aboriginal Heritage Finds	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items must be followed. Transport for NSW Senior Environment Specialist – Heritage must be contacted immediately, and Sydney region environment manager notified.	Contractor	Demolition	67
Contamination	A copy of the EMP is to be supplied to all persons conducting intrusive works on the land site and is to be strictly followed.	TFNSW	Pre-construction, construction and operation	68
Climate change and sea level rise	Sea level rise will be taken into account in the design of the upgrading, having regard to the design life of 50 years. The height of the proposed overwater structures finished floor is to be 2.25 AHD with a hydrostatic uplift value of 3kpa.	TfNSW	Pre- construction	69

Licensing and approvals

Table 7 Summary of licensing and approvals required

Instrument	Requirement	Timing
Fisheries Management Act 1994	The application is for a permit to dredge, reclaim, obstructing fish passage, harm marine vegetation, in accordance with PARTS 2 & 7 of the Fisheries Management Act 1994	Prior to start of the activity.
Marine Estate Management (Management Rules) Regulation 1999	The application is to harm animals or plants or take or interfere with habitat in a marine park or aquatic reserve in accordance with Part 1 of the Marine Estate Management (Management Rules) Regulation 1999	A minimum of 28 days prior to the start of work.

Justification and conclusion

This chapter provides the justification for the proposal considering its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

Justification

The proposal for the demolition and construction of the overwater structures is essential for accessibility, safety according to meeting the relevant standards. The proposal would also improve the visual amenity of the area and provide a compliant facility. The removal would enhance the habitat for natural flora and fauna, enabling the restoration of a natural landscape. The disadvantages in the short term include and are temporary and potentially include:

- Reduction in water quality
- Sedimentation impacts
- Removal of mangroves
- Generation of waste materials
- Air, noise and visual impacts.

These impacts would be mitigated through the implementation of control measures described in this REF, and through preparation of a CEMP that would be implemented for the duration of the works. The benefits arising from the proposal would outweigh the potential short-term impacts associated with carrying out the works. Based on the findings of this REF, the proposal is considered justified.

Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal has been designed to minimise the impact on the community and biodiversity by removing unsafe structures and improving aesthetics. The natural environment would be dramatically improved. The proposal is creating future employment on the site.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The proposal's urban design includes high quality, durable and low impact materials to minimise ongoing maintenance requirements which will provide for a sustainable urban environment over its 50-year design life which is sympathetic to the marine environment.
1.3(c) To promote the orderly and economic use and development of land.	The proposal includes continuation of the existing oyster aquaculture use at the site in upgraded facilities supported by new utility service upgrades and improved site access. The proposal will allow for the continued orderly and economic use of the site.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species	A biodiversity assessment has been prepared for the proposal, which is summarised in section 6.7. The assessment concluded that no

Object	Comment
of native animals and plants, ecological communities and their habitats.	significant impact to biodiversity would be caused by the proposal. Mangrove removal is expected to occur from the proposal.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Not relevant to the proposal.
1.3(g) To promote good design and amenity of the built environment.	The proposal has been designed to be consistent with the urban design objectives identified in section urban 2.3.3.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The proposal would benefit the future operators through improving amenity, safety and productivity. The proposal reduces maintenance the design consideration.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Stakeholder consultation would continue during the public display of this document to capture feedback. Should the proposal proceed to construction, consultation with the community and stakeholders would continue throughout.

Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the proposal.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

Through the assessment of the potential impacts of the proposal in Chapter 6, it has been demonstrated that threats of serious or irreversible environmental damage do not exist for the proposal. To account for the partisanship of professional judgement applied in environmental assessment and modelling uncertainty, worst-case assumptions have been incorporated into the assessment, including the following:

- Best available technical information, environmental standards and measures have been used to minimise environmental risks
- Conservative scenarios were considered while assessing environmental impact based on a worst-case basis.
- Technical specialist studies were incorporated to gain a detailed understanding of the existing environment including the ecology, landscape appeal and visual assessment, noise and vibration and sedimentation modelling
- Undertaking verification monitoring to validate results and allow modification of safeguards and mitigation controls accordingly.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations. The proposal would result in benefit to the future operator and provide seafood for the community through improvements to amenity, safety and productivity for the next 50 years. No potential impacts to future generations would be generated by the proposal.

Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity has been considered through the assessment of ecology provided in section 6.3, and Appendix D. Providing the safeguard measures are implemented, the proposal would not have a material or significant impact on biological diversity and ecological integrity within the proposal footprint or surrounds.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things. Environmental issues were considered as key matters in the route selection process and in the economic and financial considerations for the proposal. The value of the project to the community in terms of improved safety was recognised. Mitigation measures for the avoidance, reuse, recycling and management of waste during construction and operation are to be implemented.

Conclusion

The proposed demolition and construction of the overwater structures at Woolooware Bay is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into consideration the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

The proposal as described in the REF best meets the project objectives but would still result in some impacts on water quality, ecology, traffic and transport, landscape character and visual assessment, non-Aboriginal heritage, socio-economic values and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also provide a world class aquaculture facility for the next 50 years which will improve productivity of edible oysters and improve the safety for the future operators. On balance the proposal is considered justified, and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the Environment Protection and Biodiversity Conservation Act 1999. A referral to the Australian Department of Agriculture, Water and Environment is not required.

Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Jake Cashman

Senior Project Manger

APP Corporation

Date: 17 May 2022

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

Insert name

[Position title, eg Project Manager]

[Insert relevant Transport for NSW region/program]

Date:

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Terms and acronyms used in this REF

Term/ Acronym	Description
APP	APP Corporation Pty Ltd
AHD	Australian Height Datum
AS	Australian Standard
ASSMP	Acid Sulfate Soil Management Plan
BC Act	Biodiversity Conservation Act 2016 (NSW).
BCA	Building Code of Australia
BTs	Butyltins
CEMP	Construction environmental management plan
HR SEPP	State Environmental Planning Policy (Hazards and Resilience) 2021
DDA	Disability Discrimination Act 1992 (Cth)
DBYD	Dial Before You Dig
EIA	Environmental impact assessment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	Fisheries Management Act 1994 (NSW)
FRP	Fibre Reinforced Plastic
Gangway	A landing used by passengers to board or exit ships/vessels
HDPE	High Density Polyethylene
Heritage Act	Heritage Act 1977 (NSW)
TI SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
MHWM	Mean high water mark
MNES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Term/ Acronym	Description
NPW Act	National Parks and Wildlife Act 1974 (NSW)
PAHs	Polycyclic Aromatic Hydrocarbons
Piles	Foundations used to support marine structures and offshore platforms
POA	Priority Oyster Aquaculture
Pontoon	A floating structure serving as a dock
PVC	Polyvinyl chloride
RL	Reduced Level
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
TRH	Total Recoverable Hydrocarbons
TfNSW	Transport for New South Wales
TSC Act	Threatened Species Conservation Act 1995 (NSW) (repealed)
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
WOE	Weight of Evidence

Appendix A

Consideration of clause 228(2) factors

Consideration of matters of National Environmental Significance and Commonwealth land

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* (DUAP 1995/1996) guideline and the *Marinas and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a) Any environmental impact on a community? The proposal would have a net positive impact on the community, by reducing the likelihood of impacts to human health and the environment from site contamination.	Long-term, major, positive impact
b) Any transformation of a locality? The proposal would have a net positive impact on the locality.	Long-term, major, positive impact.
c) Any environmental impact on the ecosystems of the locality? The proposal would have a moderate impact to visual and landscape character. Impacts have been reduced through urban design principals implemented.	Long Term, moderate, positive impact
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? There would be minor impacts sediments and impacts from acid sulphate soils and sedimentation have the potential to harm marine life.	Short term, minor, negative impact
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The proposal would have a net positive impact on a locality having aesthetic significance as it would restore natural coastal environment.	Long term, moderate, positive impact
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974)?* The proposal is not likely to significantly impact threatened fauna species or their habitats. The implementation across the site with safeguard protected fauna and the outcome would improve the habitat.	Short-term, minor, positive impact
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Various impacts may affect the quality of the environment have been identified and assessed in the REF. These impacts would be mitigated by the implementation of safeguards across the site.	Short-term, minor, negative impact
h) Any long-term effects on the environment? The proposal would have a net positive impact on the built and natural environment.	Long-term, minor, positive impact

Factor	Impact
i) Any degradation of the quality of the environment? Various impacts that may affect the quality of the environment have been identified and assessed in the REF. These impacts would be mitigated by the implementation of safeguards across the site.	Short-term, moderate, negative impact
j) Any risk to the safety of the environment? The proposal would have a net positive impact on the safety of the environment.	Long-term, minor, positive impact
k) Any reduction in the range of beneficial uses of the environment? The proposal would not reduce the range of beneficial uses of the environment.	Long-term, minor, positive impact
l) Any pollution of the environment? Construction related activities may result in pollution of the environment through spills/leaks of fuel, oil or other chemicals. Impacts would be minor with implementation of the safeguards and management measures identified in section 7.1 of the REF.	Short-term, minor, negative impact
m) Any environmental problems associated with the disposal of waste? All wastes generated by the proposal would be disposed of at an off-site facility which is licenced to receive such waste. There would be no significant environmental problems associated with waste disposal.	Short-term, minor, negative impact
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? All resources required by the proposal are readily available except to the HDPE piles.	Short-term, moderate, negative impact
o) Any cumulative environmental effect with other existing or likely future activities? There may be a minor increase in marine traffic, and noise impacts. No other significant cumulative impacts have been identified for the proposal. The proposal design includes an allowance for sea level rise.	Short-term, minor, negative impact
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? There are localised impacts on coastal processes including reference to projected climate change conditions.	Short-term, minor, negative impact

Matters of National Environmental Significance and Commonwealth land

Guidance:

To satisfy these requirements, complete the matters of national environmental significance table included below. The table should be completed by the primary author of the REF.

Provide a discussion of the proposal in relation to each matter of national environmental significance heading in the table. Identify the level of impact under the "impact" column of the table. If an impact is likely, state whether it is likely to be minor or significant. If no impact is likely, write 'no impact'. If there is likely to be a significant impact on any matters of national environmental significance or direct or indirect impacts on the environment of Commonwealth land, contact the LEA immediately.

The discussion of the proposal in respect of the matters of national environmental significance and the environment of Commonwealth land should be a summary of the impacts and mitigation already provided in the REF. There should be no new or additional impacts in the tables that have not been addressed in the main body of the REF.

What is a significant impact under the EPBC Act?

A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not the proposal is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. All of these factors need to be considered when deciding whether the proposal is likely to have a significant impact on the environment. The significance of impacts should be decided in accordance with the Matters of National Environmental Significance Significant Impact Guidelines 1.1 and the Actions on, or impacting upon Commonwealth land and Actions by Commonwealth Agencies Significant Impact Guidelines 1.2.

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and Environment.

Factor	Impact
a) Any impact on a World Heritage property? The proposal would not impact on a World Heritage property.	No impact
b) Any impact on a National Heritage place? The proposal would not impact on a National Heritage property.	No impact
c) Any impact on a wetland of international importance? The proposal would not impact on a wetland of international importance if the mitigation measures described in this REF are fully implemented for the duration of the proposed works.	No impact
d) Any impact on a listed threatened species or communities? Impacts on listed threatened species or communities should be fully detailed in the body of the REF (refer section 6.8). These impacts would be mitigated by the implementation of safeguards across the site.	Short-term, minor, negative impact

Factor	Impact
e) Any impacts on listed migratory species? Impacts on listed migratory species should be fully detailed in the body of the REF (refer section 6.8). These impacts would be mitigated by the implementation of safeguards across the site.	Short-term, minor, negative impact
f) Any impact on a Commonwealth marine area? The proposal would not impact on a Commonwealth marine area	No impact
g) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	No impact
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposal would not impact (either directly or indirectly) on Commonwealth land	No impact

Appendix B

Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes/No	If 'yes' consult with	TISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	-	TISEPP cl. 2.111
Bus Depots	Does the project propose a bus depot?	No	-	TISEPP cl. 2.111
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	-	TISEPP cl. 2.111

Development within the Coastal Zone

Issue	Description	Yes/No/NA	If 'yes' consult with	TISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	-	TISEPP cl. 2.14

Note: See interactive map here: https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management.

Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Stormwater	Is the work likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	-	TISEPP cl.2.10(1)(a)
Traffic	Is the work likely to generate traffic to an extent that will *strain*	No	-	TISEPP cl.2.10(1)(b)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
	the capacity of the existing road system in a local government area?			
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	-	TISEPP cl.2.10(1)(c)
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a *substantial* volume of water?	No	-	TISEPP cl.2.10(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	-	TISEPP cl.2.10(1)(e)
Road & footpath excavation	Would the work involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	Southern Shire Council	TISEPP cl.2.10(1)(f)

Local heritage items

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than *minor* or *inconsequential?*	No	-	TISEPP cl.2.11

Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a *minor* extent?	No	-	TISEPP cl.2.12
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency work or routine maintenance	No	-	TISEPP cl.2.12

Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	Yes	Environment, Energy and Science, DPIE	TISEPP cl.2.15(2)(a)

Issue	Potential impact	Yes/No	If ‘yes’ consult with	ISEPP clause
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment, Energy and Science, DPIE	TISEPP cl. 2.15(2)(b)
Aquatic reserves	Is the work adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*?	Yes	Department of Planning, Industry and Environment	TISEPP cl.2.15(2)(c)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	-	TISEPP cl.2.15(2)(d)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	-	TISEPP cl. 2.15(2)(e)
Sydney Harbour foreshore	Is the work in the Sydney Harbour Foreshore Area as defined by the *Place Management NSW Act 1998?*	No		TISEPP cl.2.15(2)(d)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	-	TISEPP cl.2.15(2)(f)

Issue	Potential impact	Yes/No	If ‘yes’ consult with	ISEPP clause
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	-	ISEPP cl. 2.15(2)(i)

About this release

Reference number	EIA-P05-02-T05
Title	Project review of environmental factors template (maritime)
Parent procedure	EIA-P05-02
Prepared by	Environment Officer Senior Environment Specialist (Planning and Assessment)
Approved by	Director Environmental Policy, Planning and Assessment
Document location	Global Folder \ RMS Global Folder \ ENVIRONMENT \ Procedures \ Environment Planning and Assessment Procedures \ EIA-P05-2 Project REF
Document status	Version 2.4, 18 February 2020

Version	Date	Revision description
1.0	1/11/12	First issue trial
2.0	17/03/16	Review and update – integration of guidance, additional template text throughout and summary assessment option in chapter 6
2.1	24/04/18	Updated to incorporate EP&A Act and ISEPP changes, BC Act and CM SEPP
2.2	21/09/18	Updated to reflect legislative changes to ISEPP, including new statutory consultation requirements for certain development types, certain development within the coastal vulnerability area and certain works on flood liable land.
2.3	04/02/19	Updated executive summary guidance text
2.4	18/02/20	Rebranded to Transport for NSW document format, updated government agency names and other minor updates.

Your comments and suggestions to improve this or any of the EIA guidelines may be sent to:

Environmental Policy, Planning and Assessment

Environment and Sustainability Branch, Transport for NSW

Email: EIAprocedures@rms.nsw.gov.au

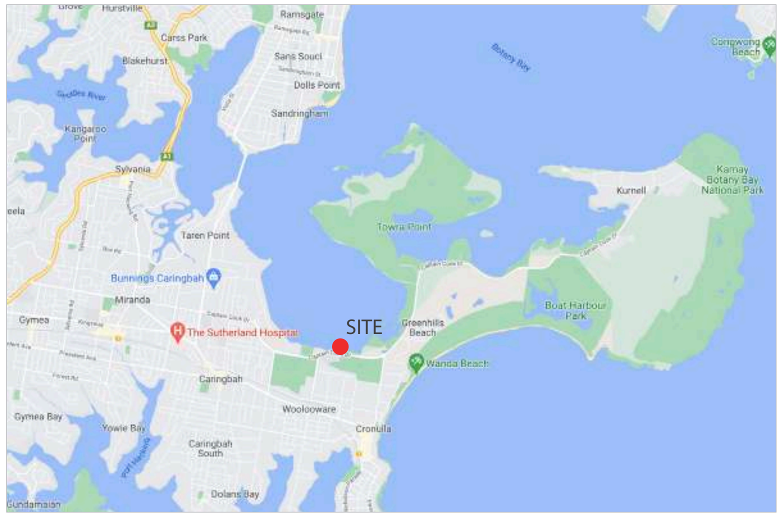
Or contact the Senior Environmental Specialist (Planning and Assessment)

Appendix C

Architectural and Engineering drawings

WOOLOOWARE BAY OYSTER FARM
LOT 2, CAPTAIN COOK DRIVE, WOOLOOWARE BAY NSW 2230
LANDSCAPE VISUALISATION STUDY

DRAWING LIST



LOCATION PLAN

EXISTING IMAGE - WOOLOOWARE BAY OYSTER FARM

DRAFT ONLY

Woolooware Bay Oyster Farm	DATE 21.09.2021	DWG NO LA-1	REV -	CLIENT Transport NSW	
COVER PAGE & LOCATION PLAN	Rev A — Description: For Information — Date 21.09.2021	Tel. 02 9452 4911 mob. 0419 501 681	admin@ pdsdesign.com.	ENGINEER Tonkin	

Paterson Design Studio
Landscape Architects / Urban Designers
Registered Landscape Architect: Garth Paterson FAILA
Reg#716 BLA (CANB) MLAUD (HARV)
T + 61 2 9452 4911 admin@pdsdesign.com.au

Image 1:
Existing birdseye view image of the existing Woolooware Bay Oyster Farm from the mangrove habitat area to the East. The image shows the close proximity of the site to the new Woolooware Bay development to the West.

The site contains the newly constructed hardstand area that will be used as the site for the onland structures and connection to the overwater structures. The site also contains the existing oyster farm buildings proposed for removal.

Image 2:
A visualisation of the proposed layout for the new Woolooware Bay Oyster Farm.

The visualisation contains the proposed onland structures and overwater structures that will allow for commercial oyster farming within Woolooware Bay on a day to day basis.

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-2

REV -

CLIENT Transport NSW

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Image 1:
Existing birdseye view image of the existing Woolooware Bay Oyster Farm from the southern boundary that runs parralell to Captain Cook Drive. The image captures the view looking north to the city from the proposed site.

The site contains the newly constructed hardstand area that will be used as the site for the onland structures and connection to the overwater structures. The site also contains the existing oyster farm buildings proposed for removal.

Image 2:
A visualisation of the proposed layout for the new Woolooware Bay Oyster Farm.

The visualisation contains the proposed onland structures and overwater structures that will allow for commercial oyster farming within Woolooware Bay on a day to day basis.

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-3

REV -

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Image 1:
An existing image of the current overwater structures that form the Woolooware Bay Oyster Farm. The image represents the visual impact of the existing structures from water level in Woolooware Bay.

The image contains several run down structures partially hidden by a line of large mangrove trees.

Image 2:
A visualisation of the proposed overwater structures for the new Woolooware Bay Oyster Farm from Woolooware Bay.

The visualisation captures the visual impact the proposed structures will have from an eye level water view within Woolooware Bay.

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Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021			DWG NO LA-4	REV -	CLIENT Transport NSW
Rev	Description	Date	Tel. 02 9452 4911	admin@	ENGINEER Tonkin
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Image 1:
An existing image of the current overwater structures that form the Woolooware Bay Oyster Farm. The image represents the visual impact of the existing structures from water level in Woolooware Bay.

The image contains several run down structures partially hidden by a line of large mangrove trees.

Image 2:
A visualisation of the proposed overwater structures for the new Woolooware Bay Oyster Farm from Woolooware Bay.

The visualisation captures the visual impact the proposed structures will have from an eye level water view within Woolooware Bay.

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Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

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WOOLOOWARE BAY OYSTER LEASE

OVERWATER STRUCTURES - BUILDING DESIGN
CONSTRUCTION CERTIFICATE

Landscape Drawing List

Drawing No.	Title
LA-000	COVER SHEET AND REFERENCE PLAN
LA-100	OVERWATER STRUCTURES SITE PLAN
LA-101	OVERWATER BUILDING 1 FLOOR PLAN
LA-102	OVERWATER BUILDING 1 ELEVATIONS
LA-103	OVERWATER BUILDING 1 ROOF & LIGHTING PLAN
LA-104	OVERWATER BUILDING 2 FLOOR PLAN
LA-105	OVERWATER BUILDING 2 ELEVATIONS
LA-106	OVERWATER BUILDING 2 ROOF & LIGHTING PLAN
LA-107	OVERWATER BUILDING 3 FLOOR PLAN
LA-108	OVERWATER BUILDING 3 ELEVATIONS
LA-109	OVERWATER BUILDING 3 ROOF PLAN
LA-110	OVERWATER BUILDING 3 LIGHTING PLAN
LA-111	OVERWATER BUILDING AMENITIES DETAILS
LA-112	OVERWATER BUILDING AMENITIES DETAILS
LA-113	OVERWATER BUILDING KITCHENETTE DETAILS

Site location Plan

NOTE: Landscape Plans must be read in conjunction with Tonkin's drawing package

NOTE: Plans are designed to be read and printed in colour

REFERENCE PLAN
Not To Scale

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-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

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NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

COVER SHEET AND REFERENCE PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE

DRAWING NO. LA-000 | REVISION -

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WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

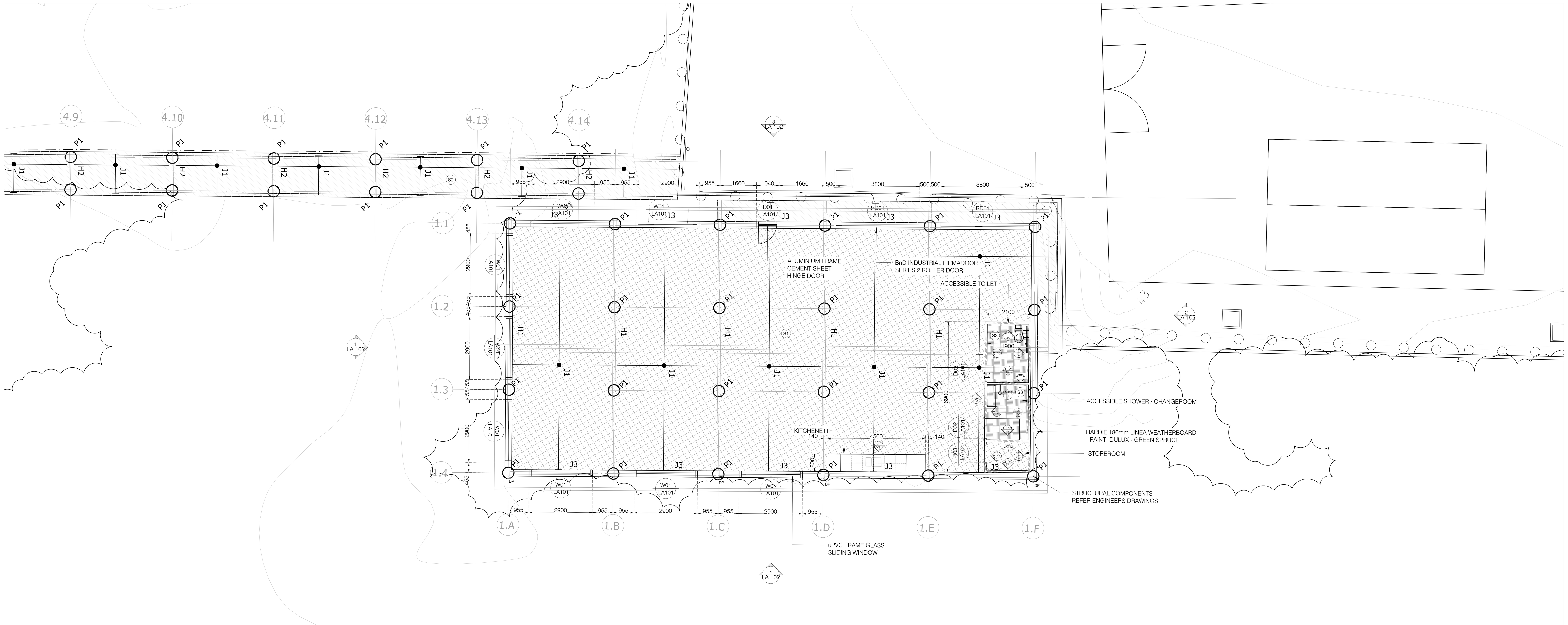
OYSTER LEASE SITE PLAN

DESIGNED:	DRAWN: DC	CHECK: DC

ISSUE	DATE:
CC ISSUE	06.12.21

SCALE

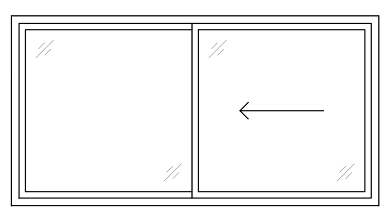
DRAWING NO.	REVISION
LA-100	-



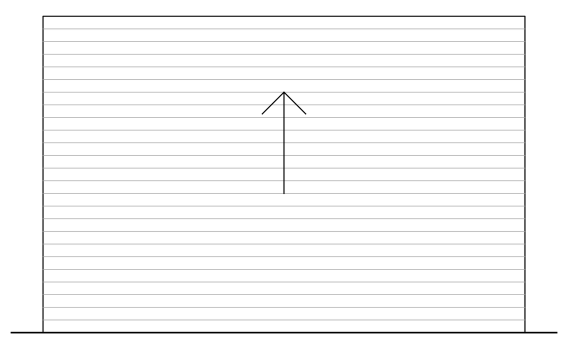
OVERWATER STRUCTURE - BUILDING 1 FLOOR PLAN

1:100

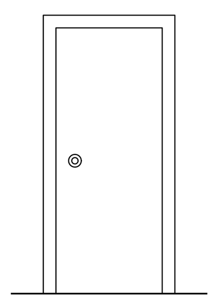
Overwater Structure - Building 1 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass sliding window	2900mm x 1500mm	900mm	2400mm	N/A	8
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3800mm	N/A	2600mm	N/A	2
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



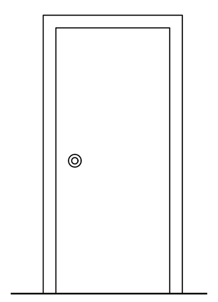
W01 Elevation
Scale: 1:20



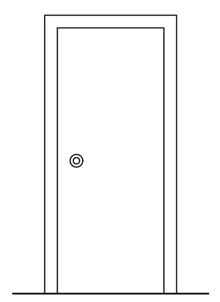
RD01 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
Scale: 1:20



D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 1 - DOOR & WINDOW SCHEDULE

1:100

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P1	STRUCTURAL PILONS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
H1	STRUCTURAL HEADSTOCKS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J1	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J2	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J3	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J4	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J5	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S1	38mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S3	FLOORING: POLYSAFE QUATTRO PUR FLOORING MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE INSTALL AS PER MANUFACTURER DETAILS
	STRUCTURAL WALL SYSTEM REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING ENGINEER: TONKIN ENGINEERS
	INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM REFER SPEC FOR INTERNAL CLADDING ENGINEER: TONKIN ENGINEERS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC INSTALL AS PER MANUFACTURER DETAILS

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-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 1 FLOOR PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

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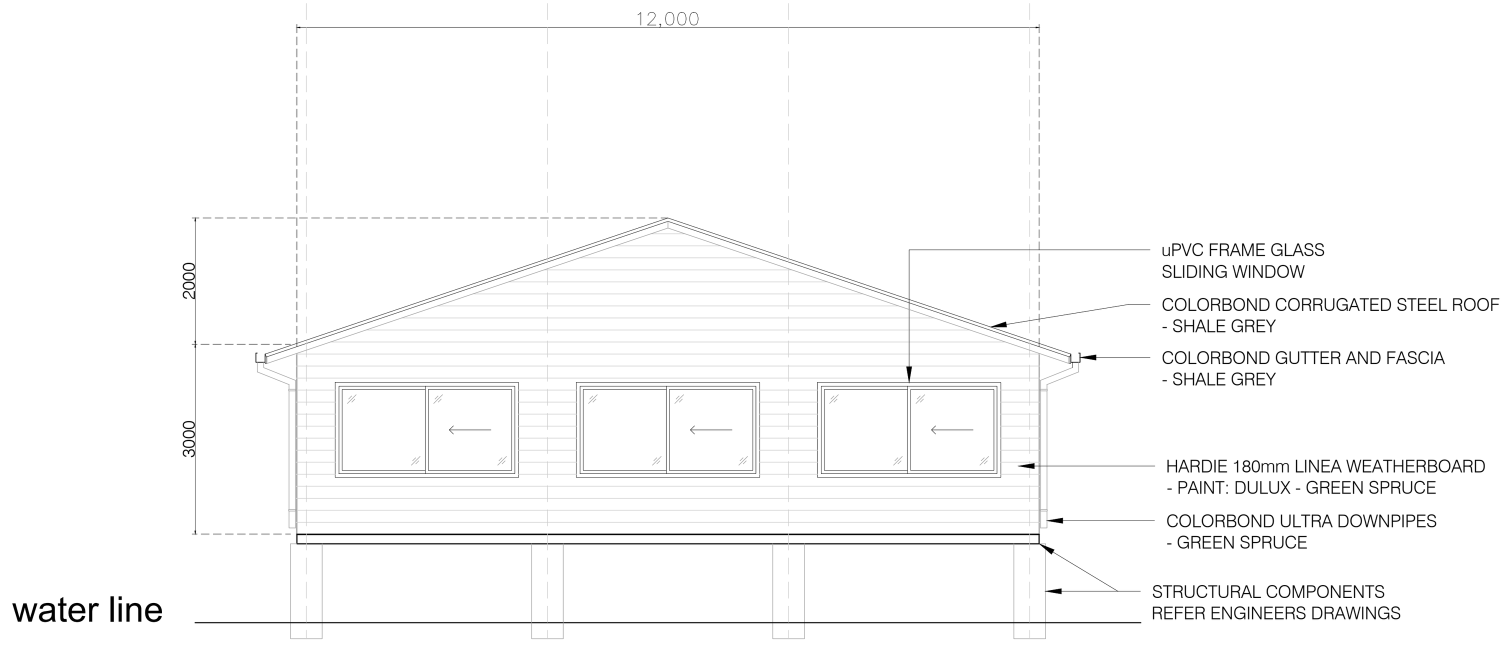
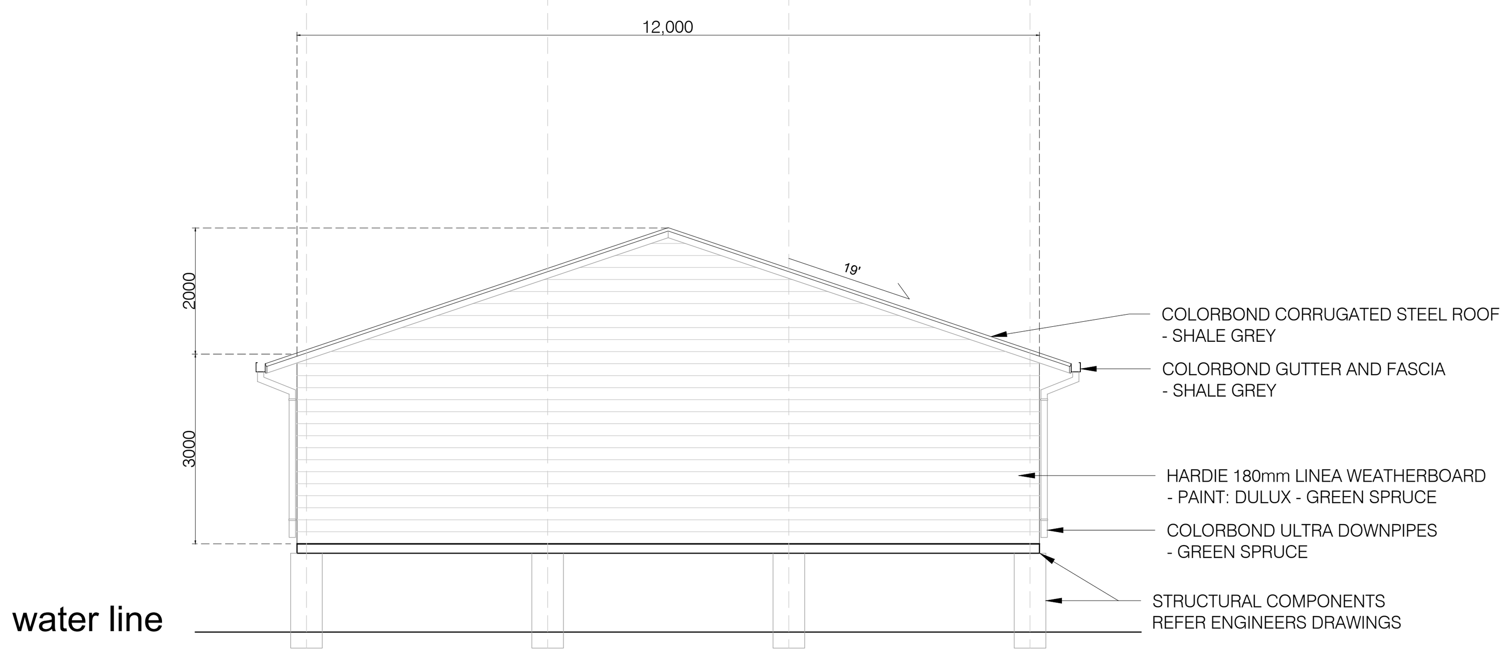
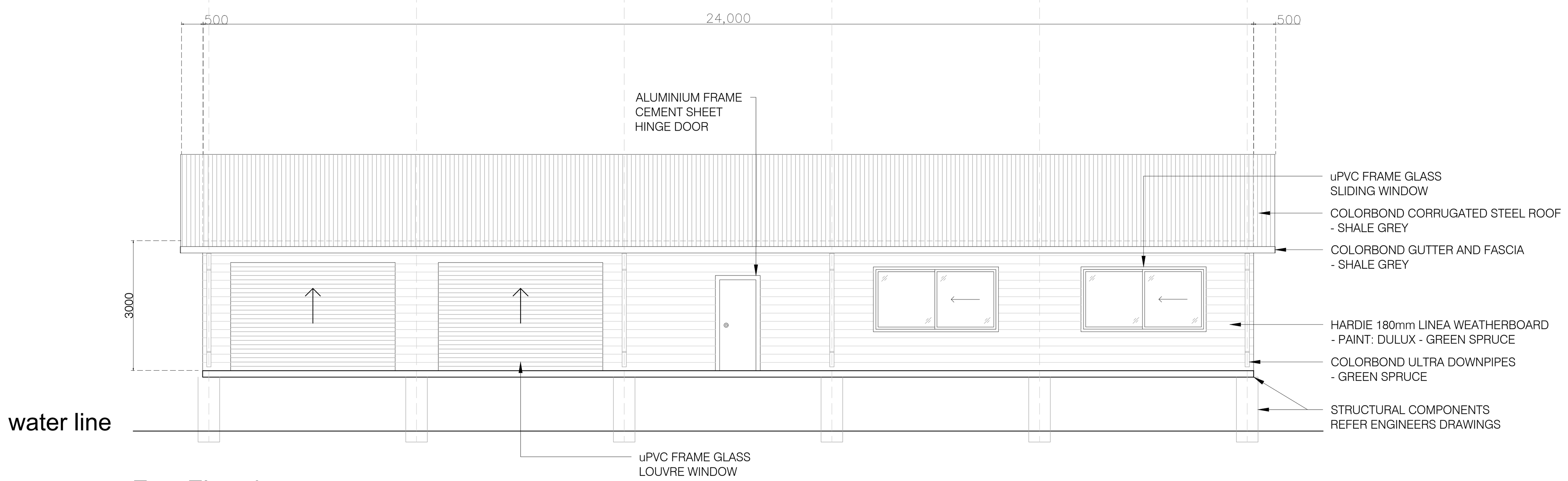


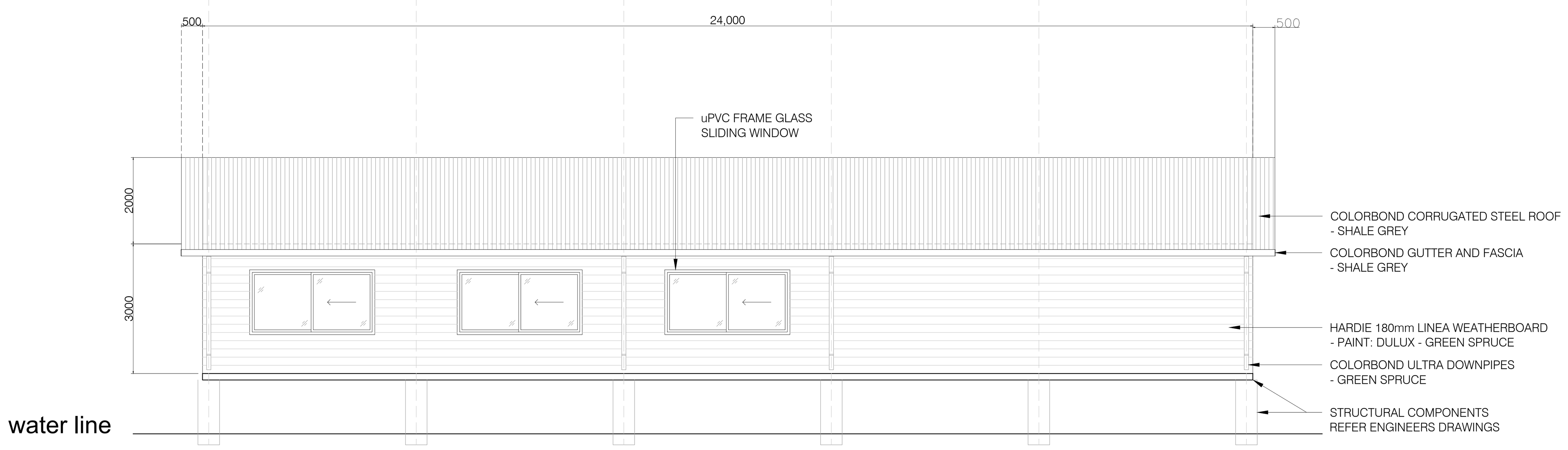
North Elevation



South Elevation



East Elevation



West Elevation

OVERWATER STRUCTURE - BUILDING 1 ELEVATIONS

1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated
Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 1 ELEVATIONS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

SCALE
1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

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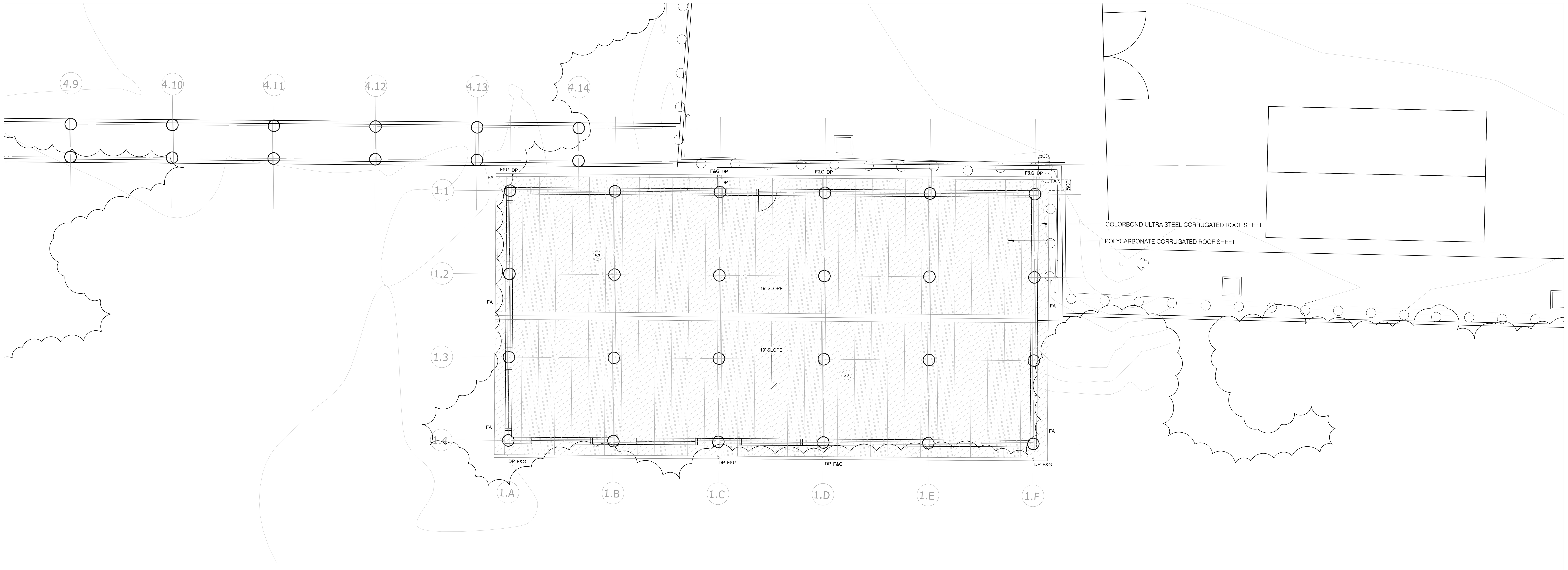
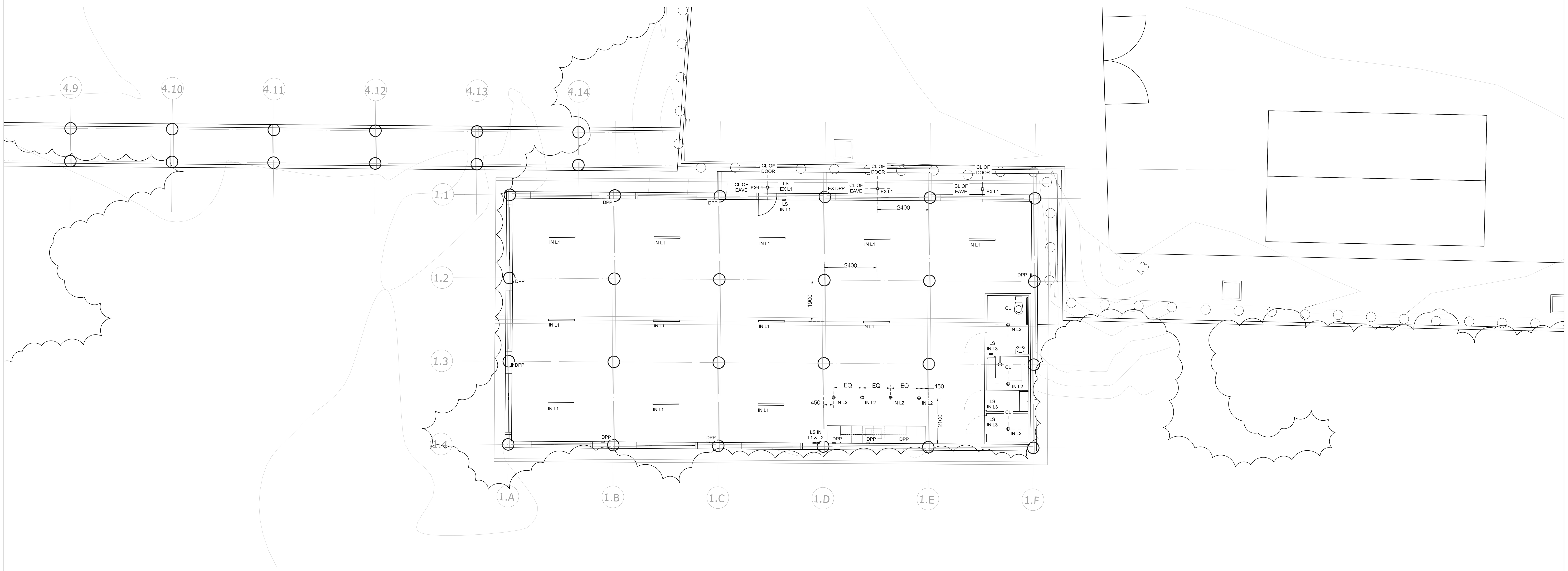
REVISION: -



OVERWATER STRUCTURE - BUILDING 1 ROOF PLAN

1:100



OVERWATER STRUCTURE - BUILDING 1 LIGHTING PLAN

1:100

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Any discrepancies shall be referred to the Superintendent for a written decision prior to ordering/ supply/ installation/ construction.

ENGINEER

tonkin

LEGEND

S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 1 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

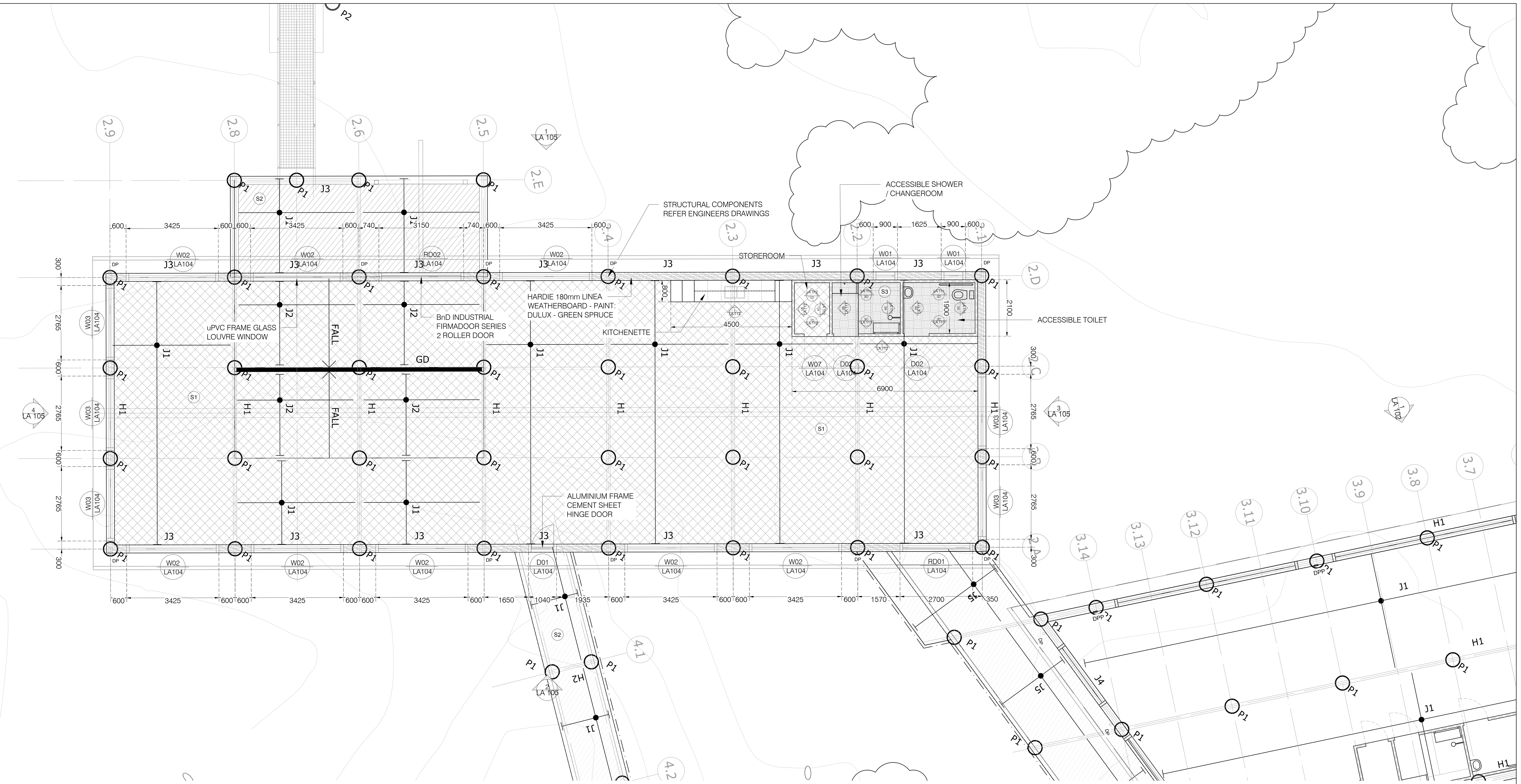
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

0 1 2 3 4 5[m]

N

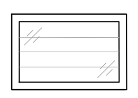
DRAWING NO.: LA-103 | REVISION: -



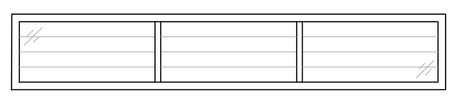
OVERWATER STRUCTURE - BUILDING 2

1:100

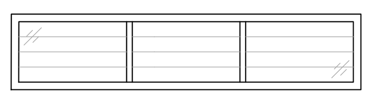
Overwater Structure - Building 2 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass louvre window	600mm x 900mm	1900mm	2500mm	N/A	2
W 02	uPVC Frame glass louvre window	900mm x 3430mm	1900mm	2500mm	N/A	8
W 03	uPVC Frame glass louvre window	900mm x 2770mm	1900mm	2500mm	N/A	5
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 2700mm	N/A	2500mm	N/A	1
RD 02	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3150mm	N/A	2500mm	N/A	1
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



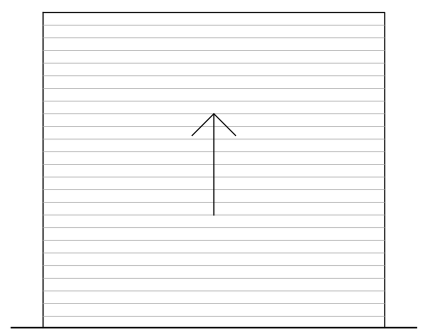
W01 Elevation
Scale: 1:20



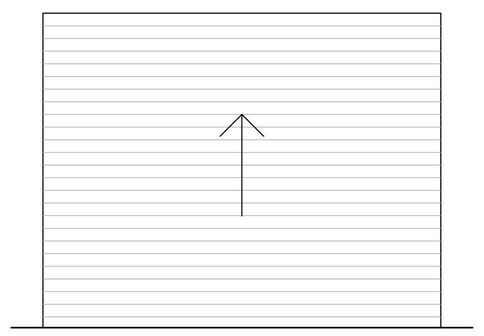
W02 Elevation
Scale: 1:20



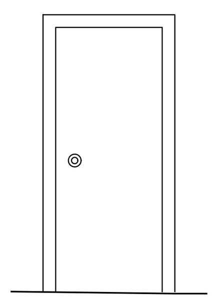
W03 Elevation
Scale: 1:20



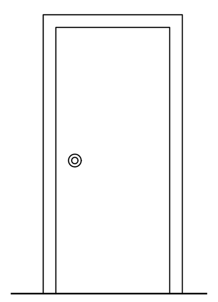
RD01 Elevation
Scale: 1:20



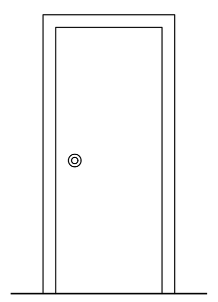
RD02 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
Scale: 1:20



D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 2 - DOOR & WINDOW SCHEDULE

1:100

Paterson Design Studio
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ENGINEER

tonkin

LEGEND

- P1 — STRUCTURAL PILONS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- H1 — STRUCTURAL HEADSTOCKS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- J1 — STRUCTURAL JOISTS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- J2 — STRUCTURAL JOISTS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- J3 — STRUCTURAL JOISTS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- J4 — STRUCTURAL JOISTS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- J5 — STRUCTURAL JOISTS; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- S1 — 38mm FRP 'WEBFORGE' MINI-MESH; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- S2 — 43mm FRP 'WEBFORGE' MINI-MESH; REFER ENGINEERS DRAWINGS; ENGINEER: TONKIN ENGINEERS
- S3 — FLOORING: POLYSAFE QUATTRO PUR FLOORING; MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE; INSTALL AS PER MANUFACTURER DETAILS
- STRUCTURAL WALL SYSTEM; REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING; ENGINEER: TONKIN ENGINEERS
- INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM; REFER SPEC FOR INTERNAL CLADDING; ENGINEER: TONKIN ENGINEERS
- DP — COLORBOND ULTRA DOWNPIPES; MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC; INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 2 FLOOR PLAN

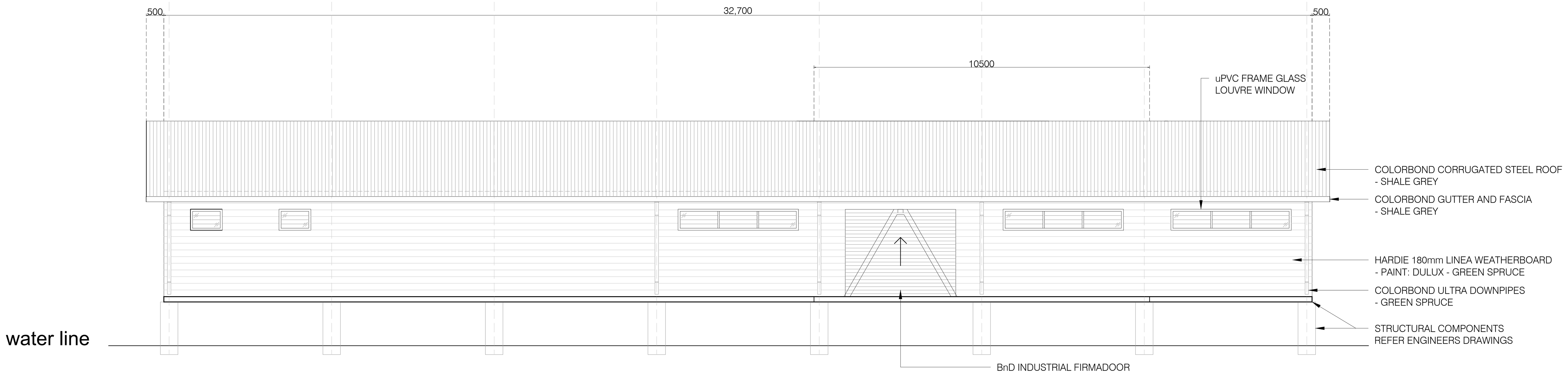
DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

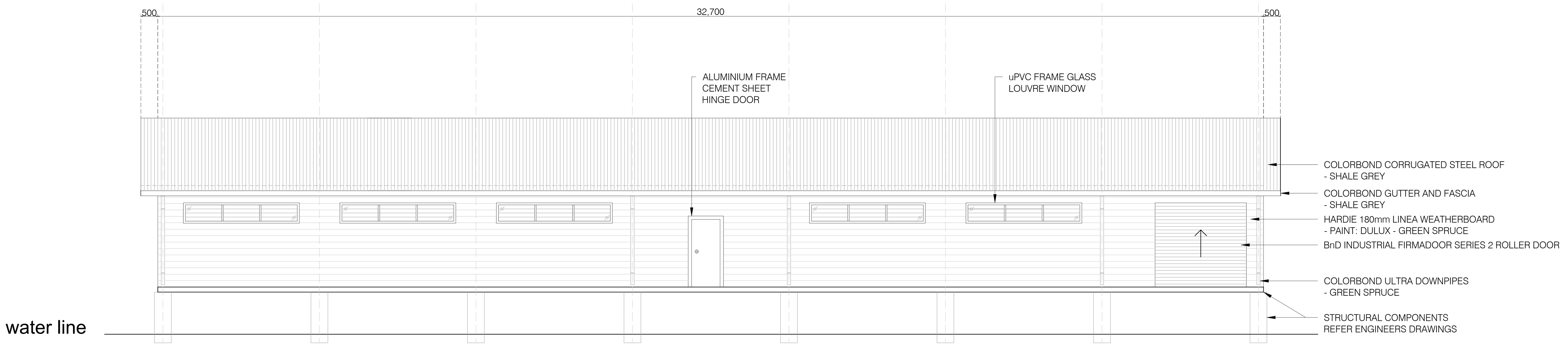
SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

N

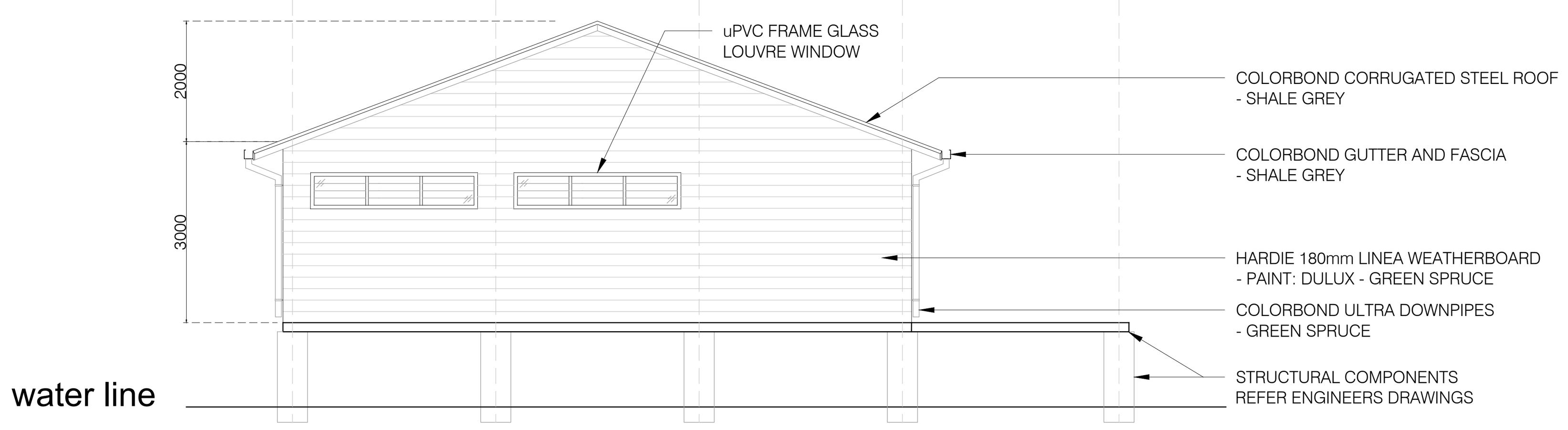
DRAWING NO.: LA-104
REVISION: -



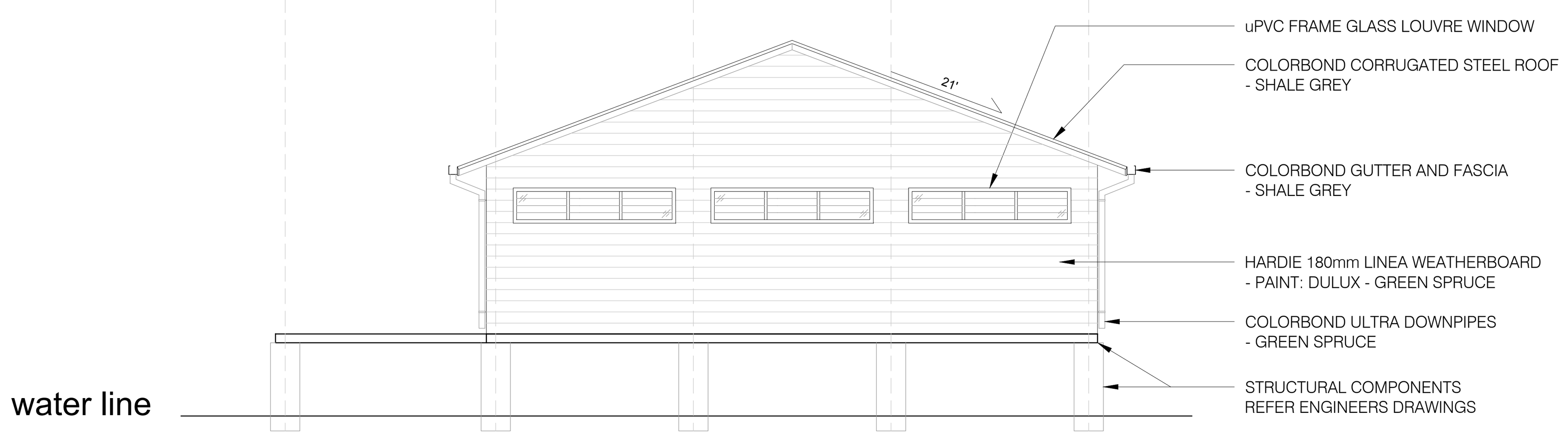
North Elevation



South Elevation



East Elevation



West Elevation

OVERWATER STRUCTURE - BUILDING 2 ELEVATIONS
1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated
Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

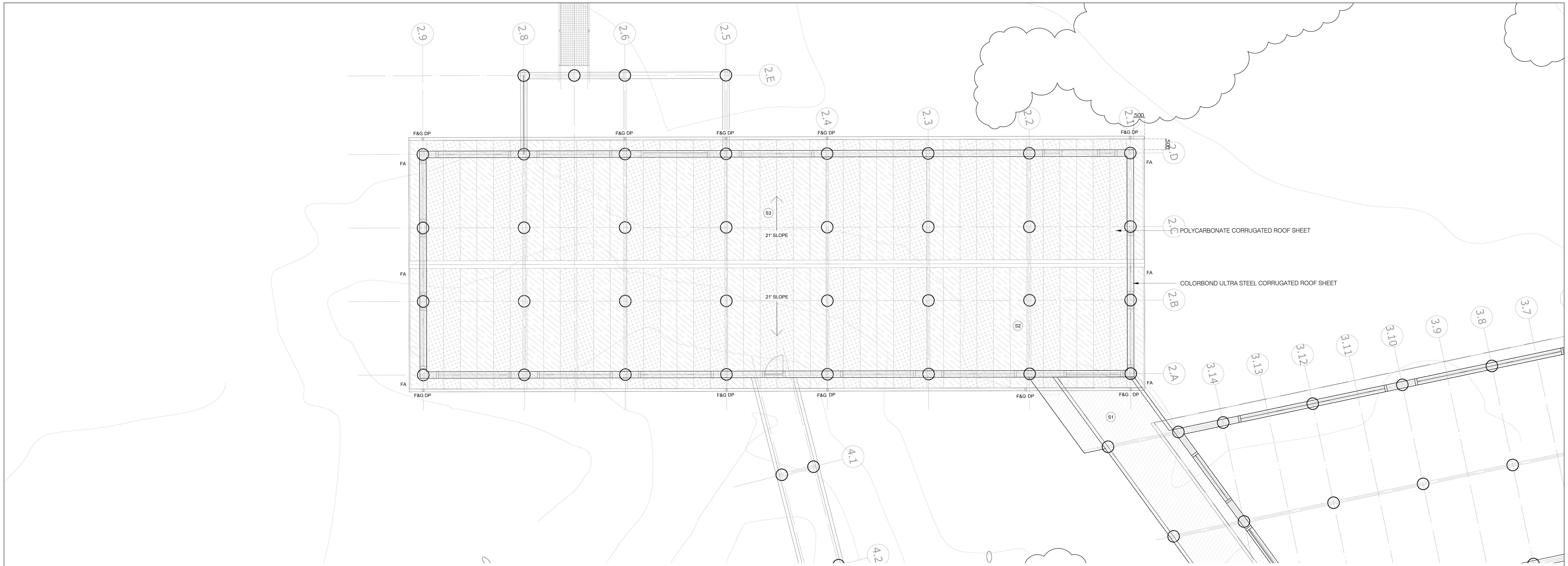
OVERWATER STRUCTURES
BUILDING 2 ELEVATONS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

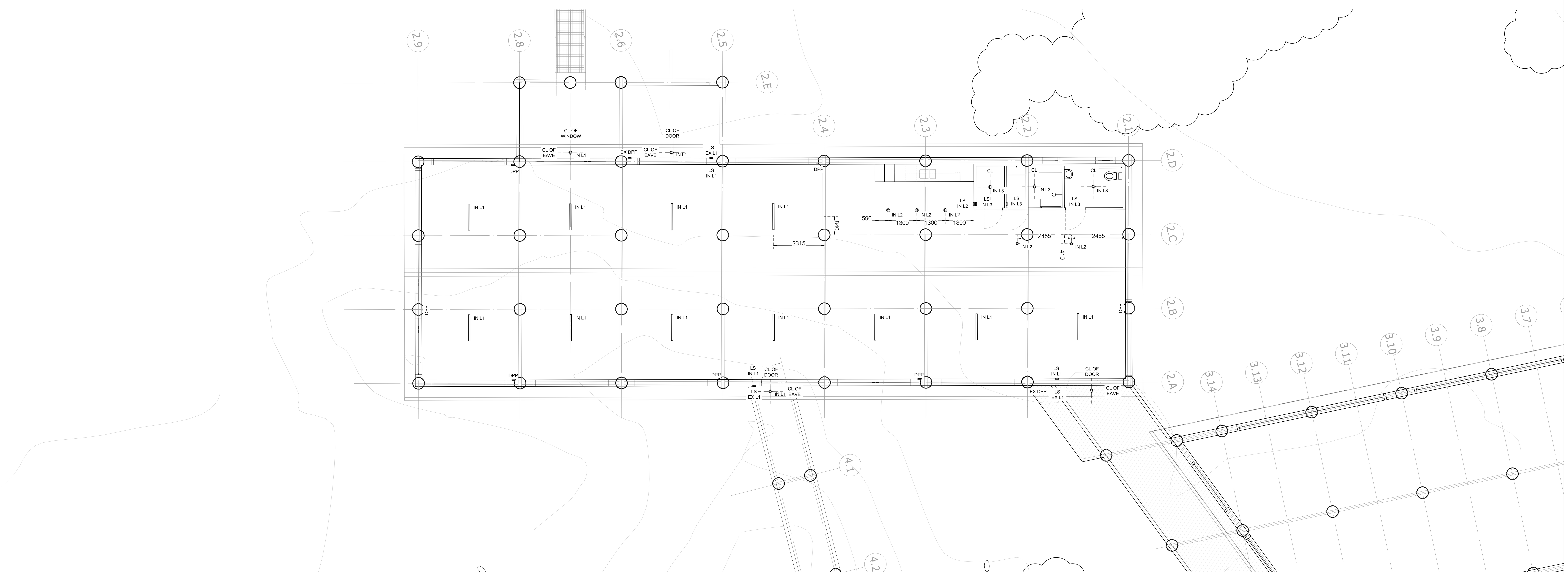
SCALE
1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

DRAWING NO.: LA-105
REVISION: -



OVERWATER STRUCTURE - BUILDING 2 ROOF PLAN

1:100



OVERWATER STRUCTURE - BUILDING 2 LIGHTING PLAN

1:100

Paterson Design Studio

Landscape Architects / Urban Designers

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ENGINEER

tonkin

LEGEND

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S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 2 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

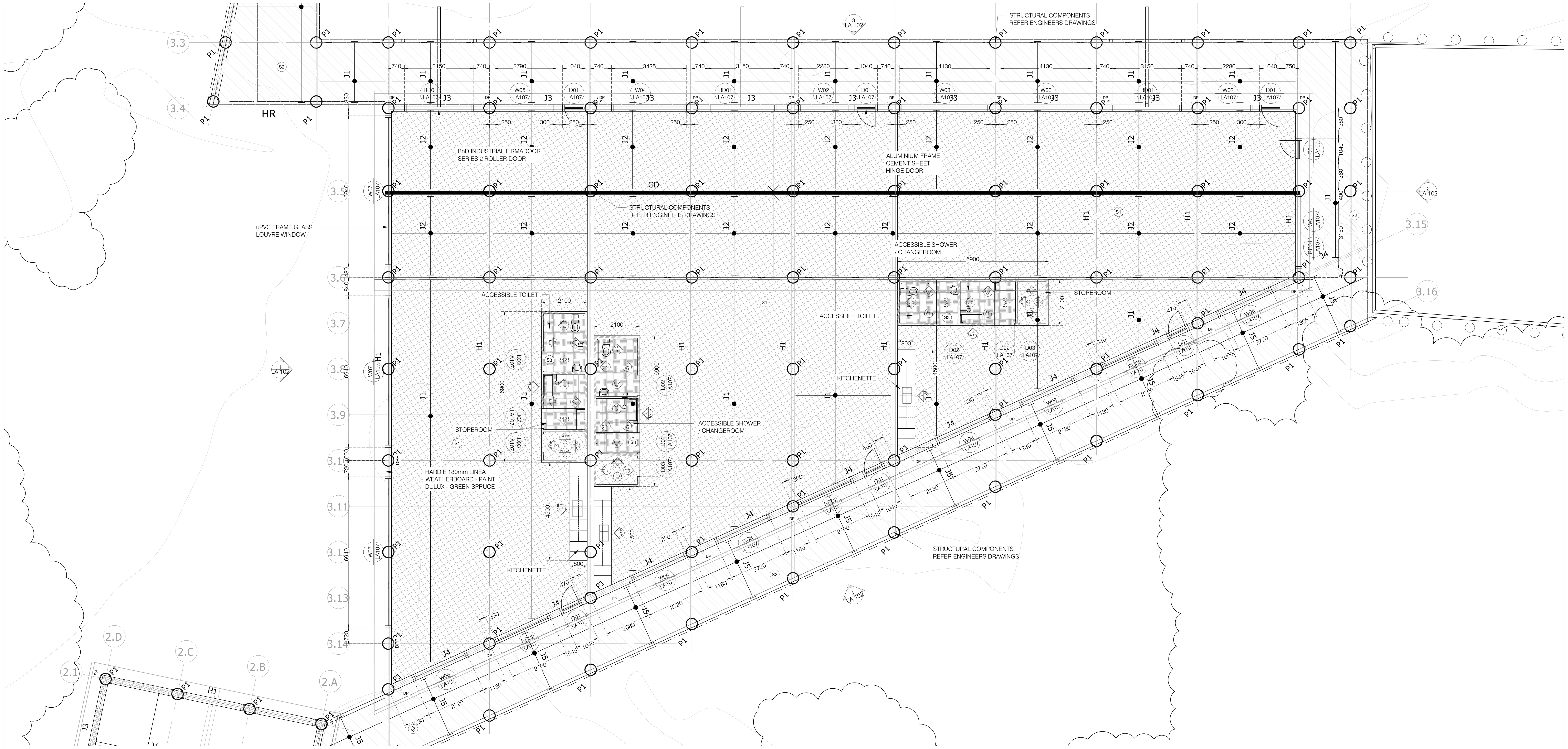
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

0 1 2 3 4 5[m]

N

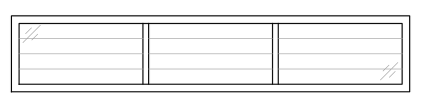
DRAWING NO. LA-106 | REVISION -



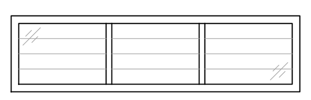
OVERWATER STRUCTURE - BUILDING 1

1:100

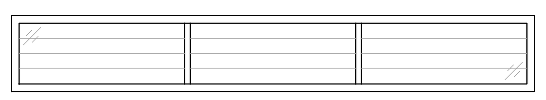
Overwater Structure - Building 3 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass sliding window	600mm x 3150mm	2780mm	3380mm	N/A	1
W 02	uPVC Frame glass louvre window	600mm x 2280mm	1900mm	2500mm	N/A	2
W 03	uPVC Frame glass louvre window	600mm x 4130mm	1900mm	2500mm	N/A	2
W 04	uPVC Frame glass louvre window	600mm x 3425mm	1900mm	2500mm	N/A	1
W 05	uPVC Frame glass louvre window	600mm x 2800mm	1900mm	2500mm	N/A	1
W 06	uPVC Frame glass louvre window	600mm x 2720mm	1900mm	2500mm	N/A	6
W 07	uPVC Frame glass louvre window	600mm x 6940mm	1900mm	2500mm	N/A	3
W 08	uPVC Frame glass louvre window	985mm x 4985mm	4915mm	5900mm	N/A	9
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3150mm	N/A	2500mm	N/A	4
RD 02	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 2700mm	N/A	2500mm	N/A	3
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



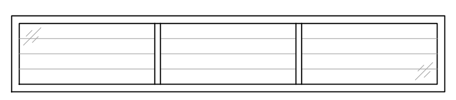
W01 Elevation
Scale: 1:20



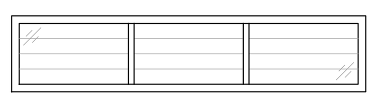
W02 Elevation
Scale: 1:20



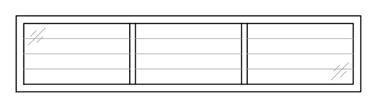
W03 Elevation
Scale: 1:20



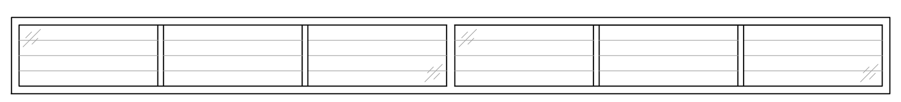
W04 Elevation
Scale: 1:20



W05 Elevation
Scale: 1:20

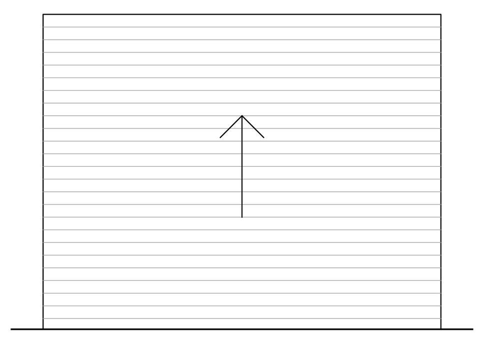


W06 Elevation
Scale: 1:20

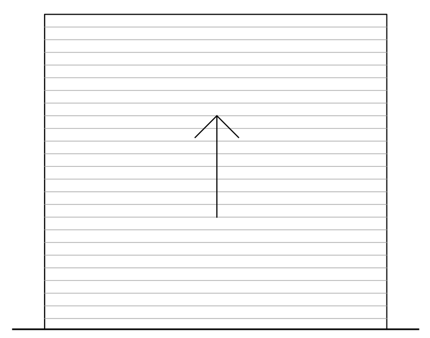


W07 Elevation
Scale: 1:20

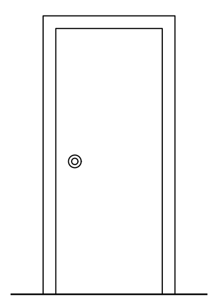
W08 Elevation
Scale: 1:20



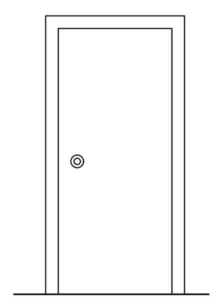
RD01 Elevation
Scale: 1:20



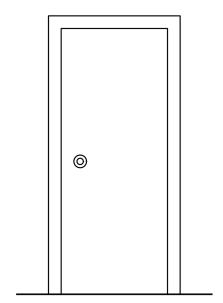
RD02 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
Scale: 1:20



D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 3 - DOOR & WINDOW SCHEDULE

1:100

Paterson Design Studio
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ENGINEER

tonkin

LEGEND

- P1 — STRUCTURAL PILONS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- H1 — STRUCTURAL HEADSTOCKS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- J1 — STRUCTURAL JOISTS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- J2 — STRUCTURAL JOISTS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- J3 — STRUCTURAL JOISTS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- J4 — STRUCTURAL JOISTS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- J5 — STRUCTURAL JOISTS / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- S1 — 38mm FRP 'WEBFORGE' MINI-MESH / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- S2 — 43mm FRP 'WEBFORGE' MINI-MESH / REFER ENGINEERS DRAWINGS / ENGINEER: TONKIN ENGINEERS
- S3 — FLOORING: POLYSAFE QUATTRO PUR FLOORING / MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE / INSTALL AS PER MANUFACTURER DETAILS
- STRUCTURAL WALL SYSTEM / REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING / ENGINEER: TONKIN ENGINEERS
- INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM / REFER SPEC FOR INTERNAL CLADDING / ENGINEER: TONKIN ENGINEERS
- DP — COLORBOND ULTRA DOWNPIPES / MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC / INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 3 FLOOR PLAN

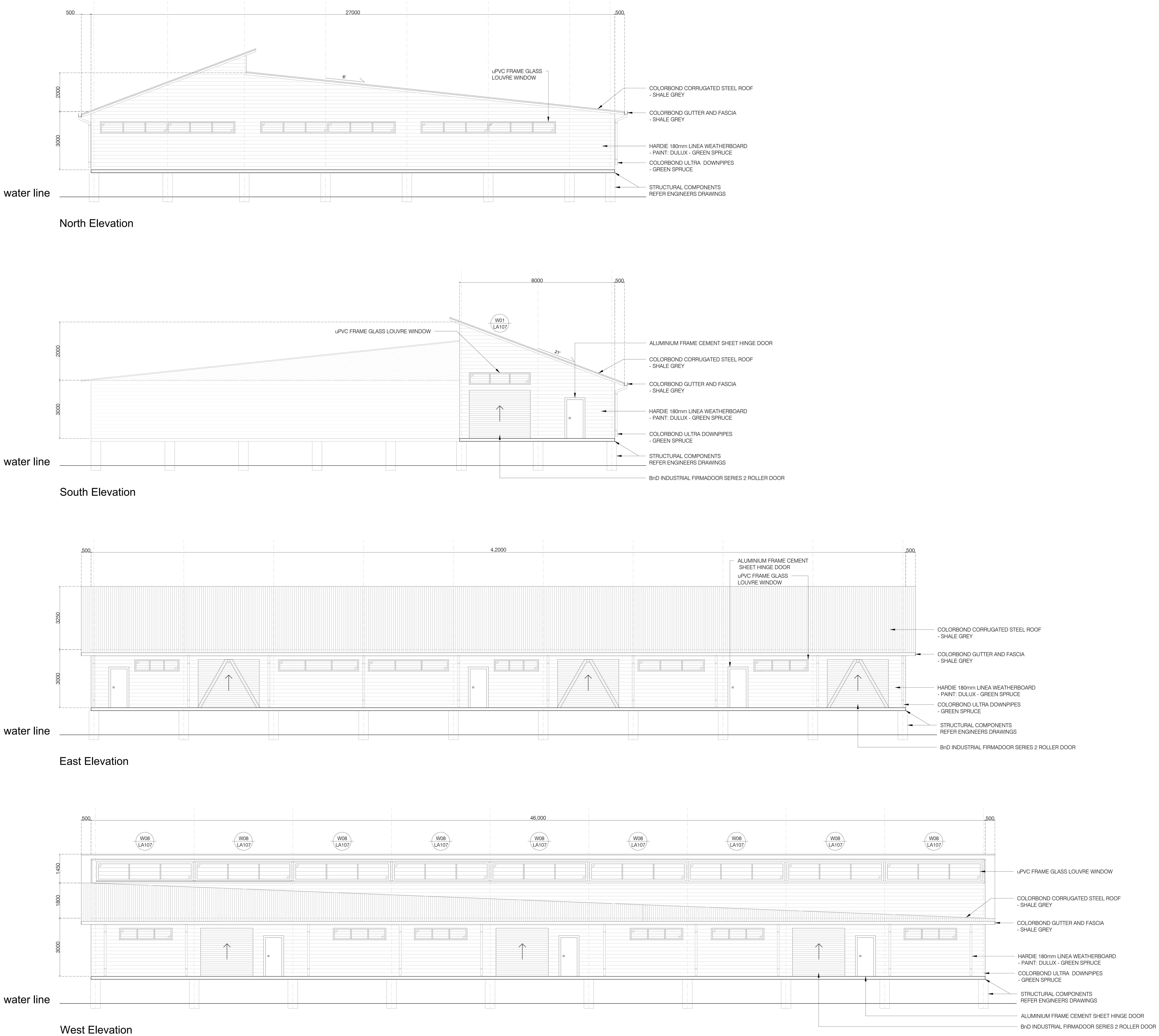
DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

N

DRAWING NO.: LA-107
REVISION: -



OVERWATER STRUCTURE - BUILDING 3 ELEVATIONS

1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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ENGINEER

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LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

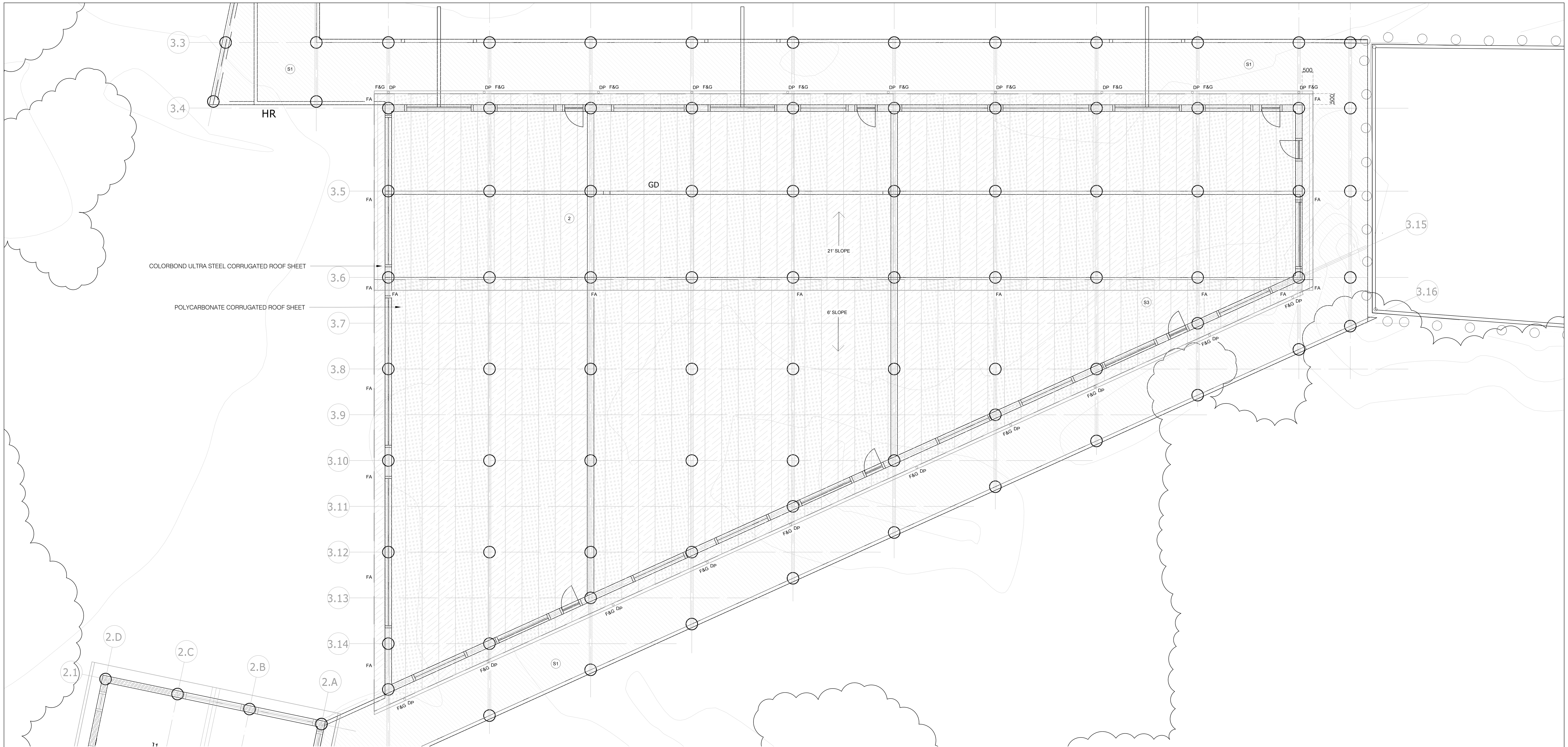
OVERWATER STRUCTURES BUILDING 3 ELEVATIONS

DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

DRAWING NO. LA-108
REVISION -



OVERWATER STRUCTURE - BUILDING 3 - ROOF PLAN

1:100

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LEGEND

S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

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NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 3 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

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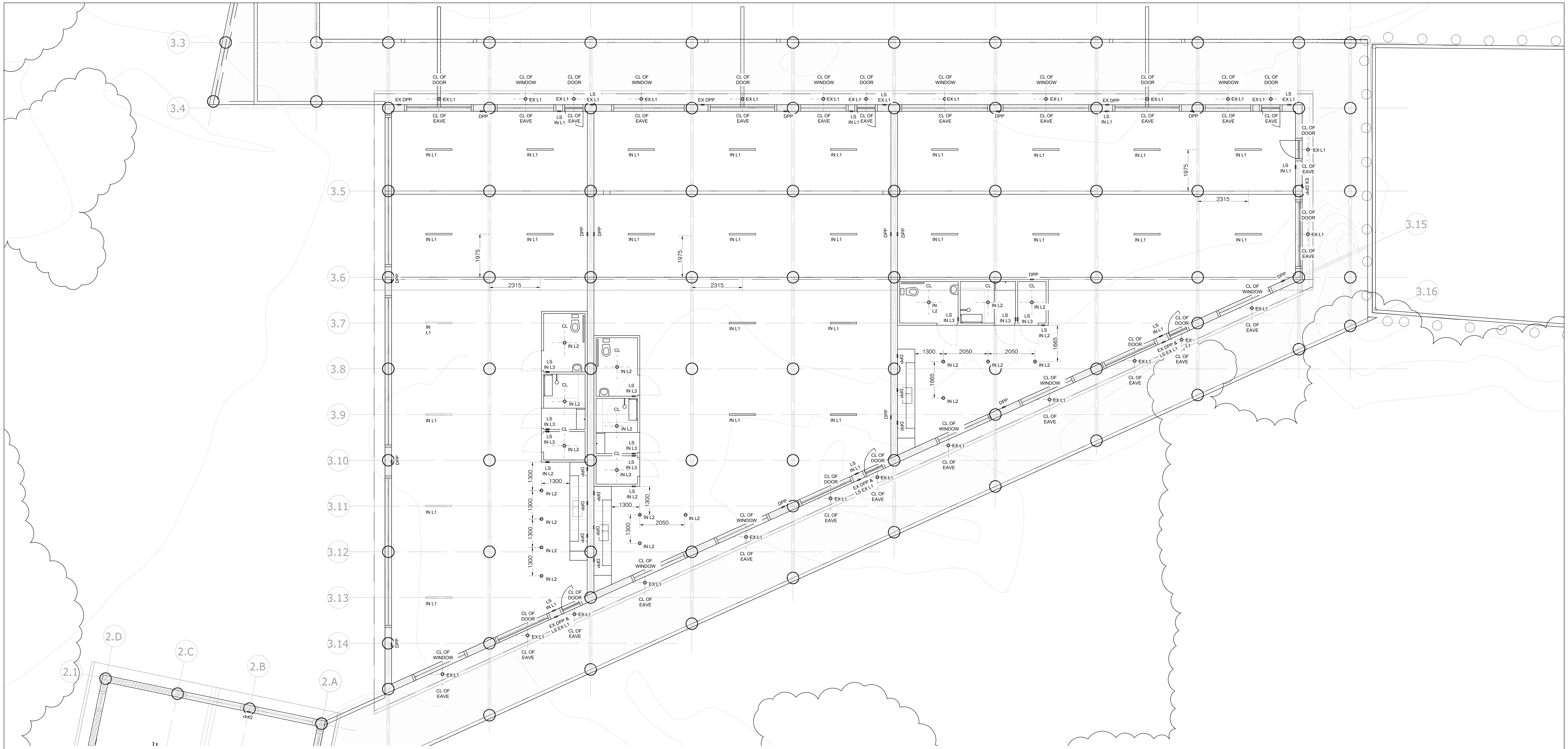
DRAWING NO.: LA-109 | REVISION: -



OVERWATER STRUCTURE - BUILDING 3 - LIGHTING PLAN

1:100

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Symbol	Description
S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

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NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 3 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

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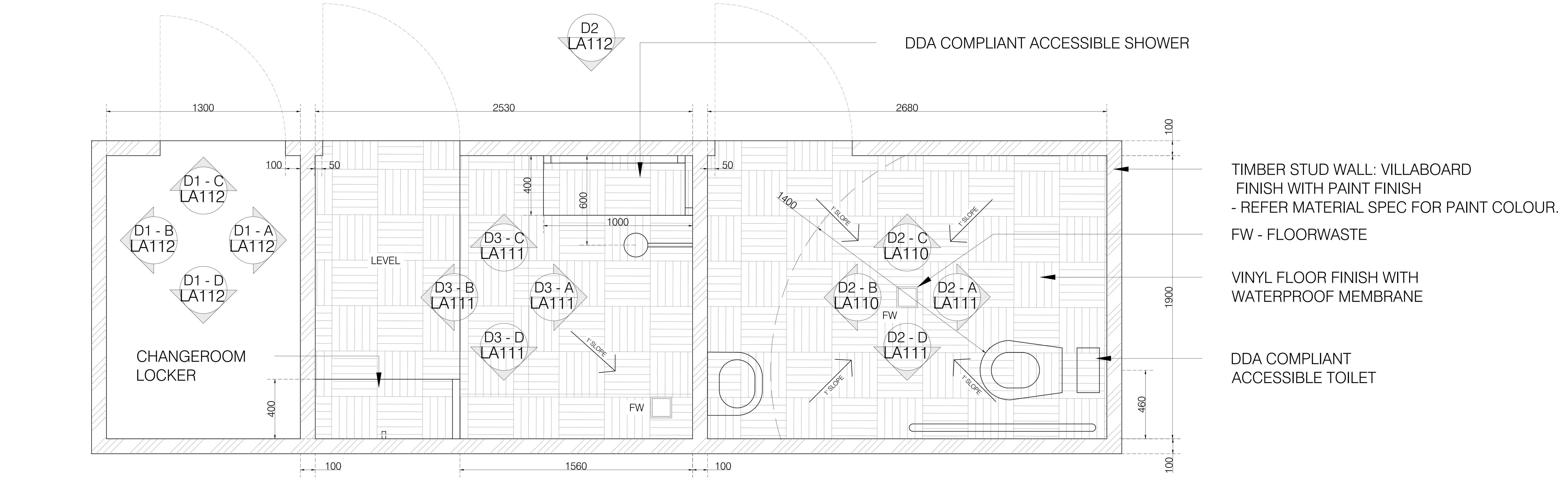
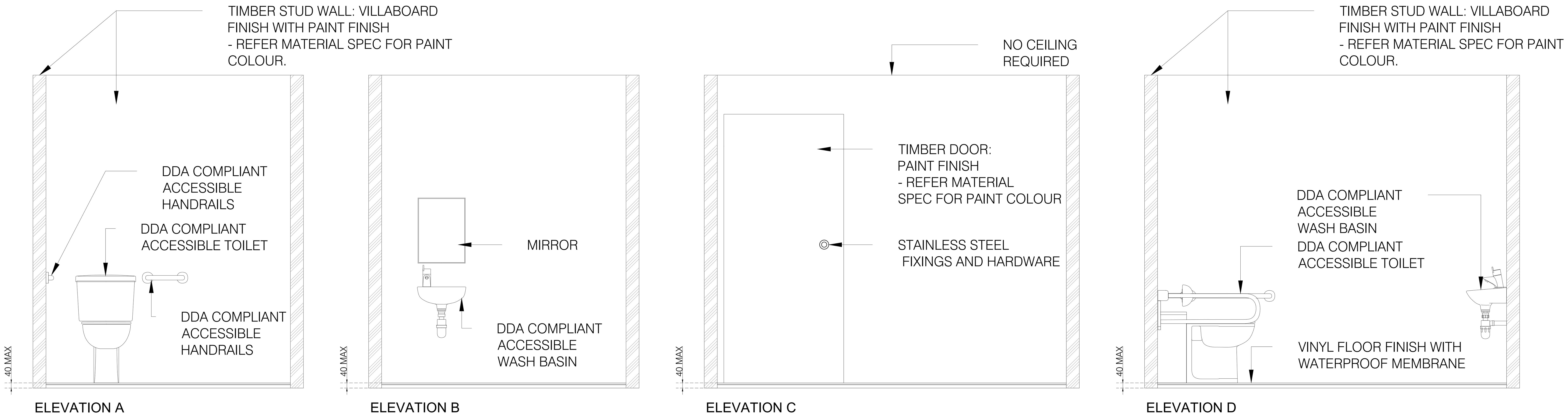
DRAWING NO. LA-110 | REVISION -



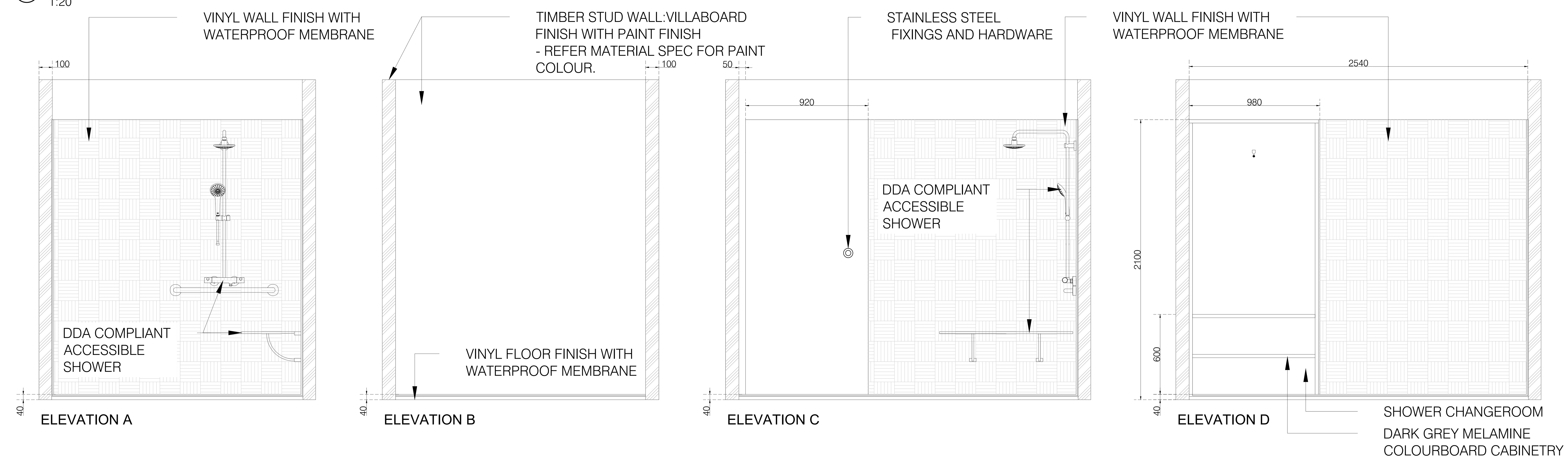
1 OVERWATER STRUCTURE - AMENITIES - AMENITIES BLOCK FLOOR PLAN

1:20



2 OVERWATER STRUCTURE - AMENITIES - TOILET ELEVATIONS

1:20



3 OVERWATER STRUCTURE - AMENITIES - SHOWER ELEVATIONS

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherboard 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated
Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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ENGINEER

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LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES AMENITIES DETAILS

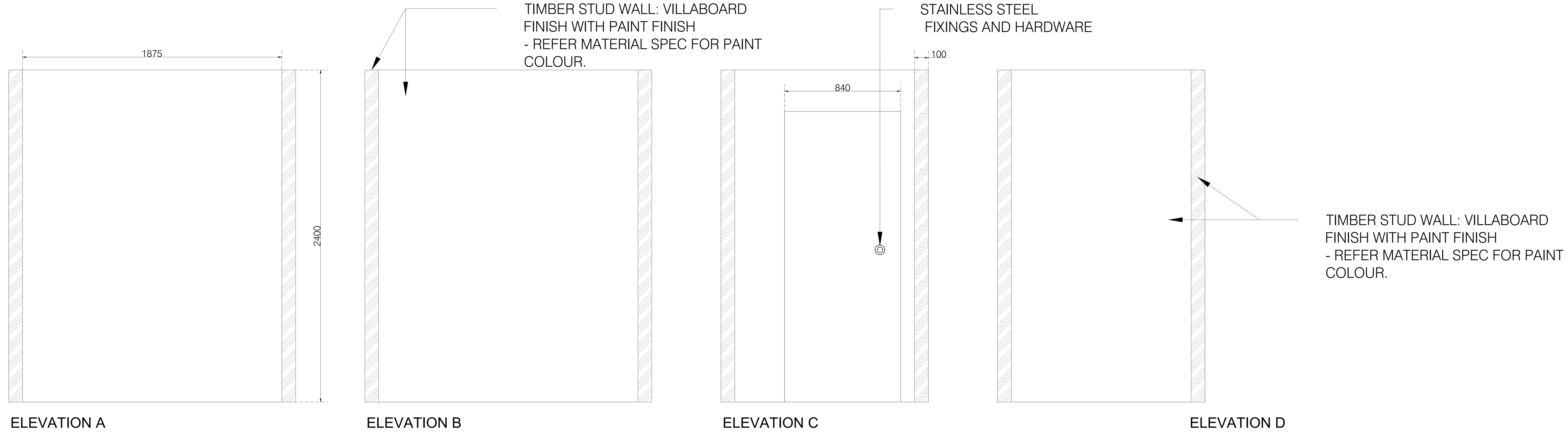
DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:20 @ A1 1:40 @ A3

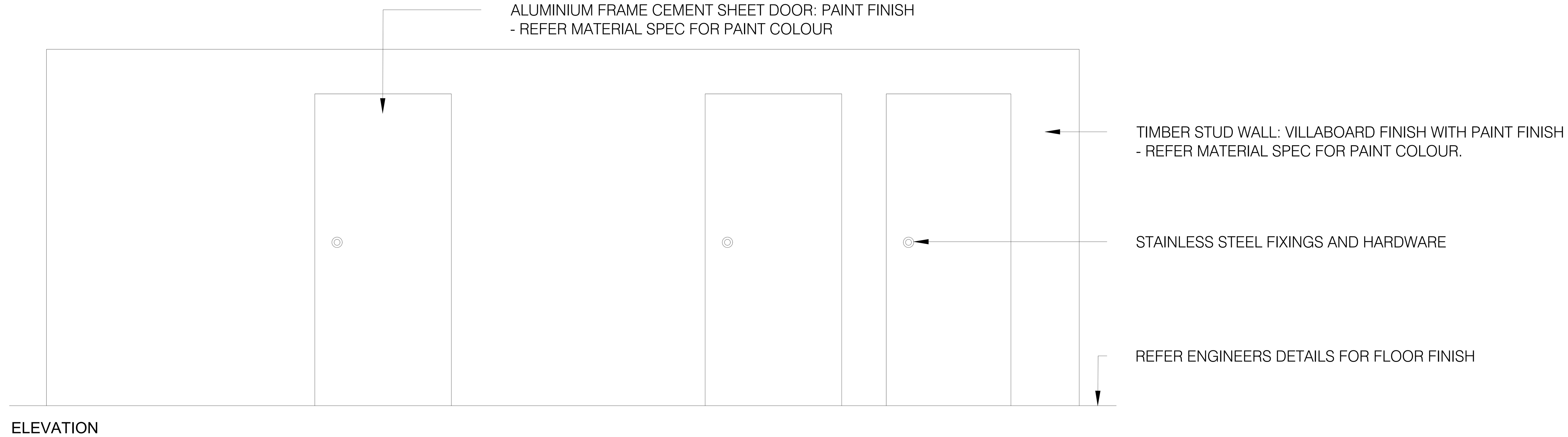
0 0.2 0.4 0.6 0.8 1[m]

DRAWING NO.: LA-111 | REVISION: -



1 OVERWATER STRUCTURE - AMENITIES - STORE ROOM ELEVATIONS

1:20



2 OVERWATER STRUCTURE - AMENITIES - AMENITIES BLOCK ELEVATION

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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ENGINEER

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LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

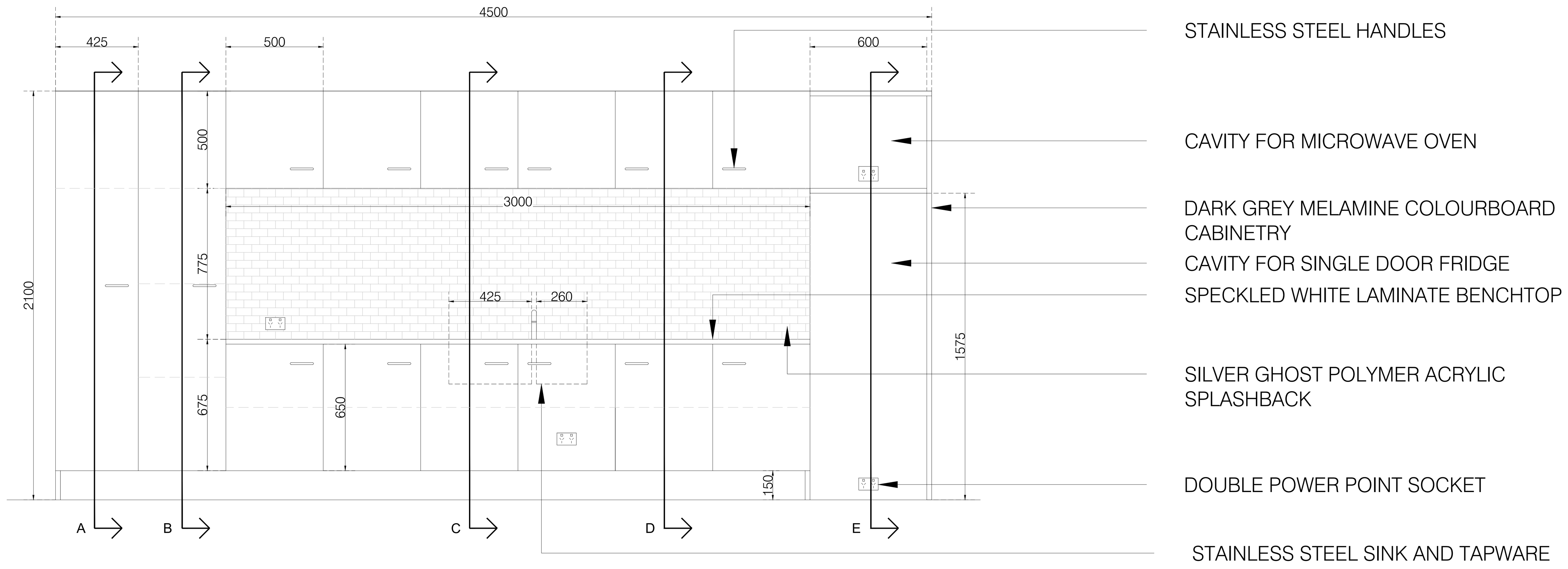
OVERWATER STRUCTURES AMENITIES DETAILS

DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

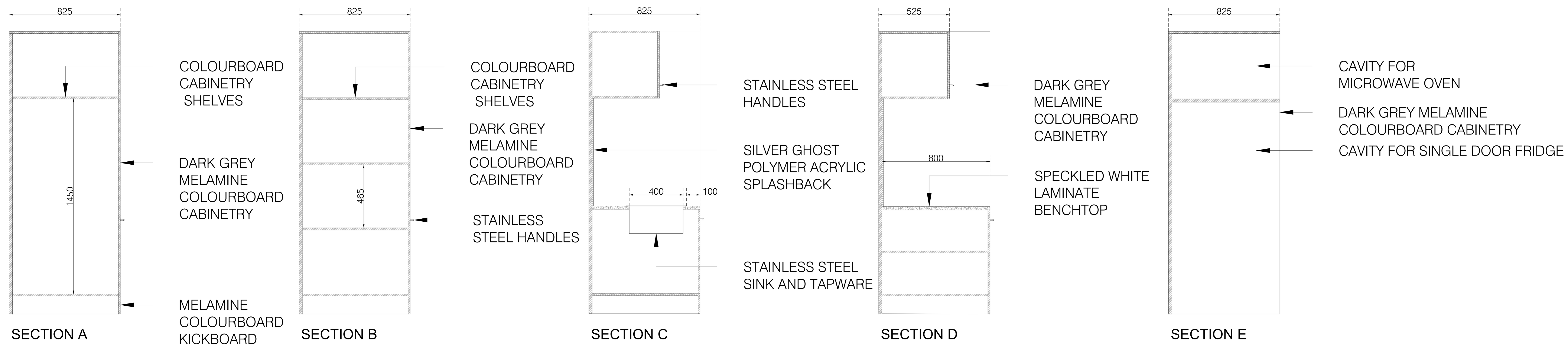
SCALE: 1:20 @ A1 1:40 @ A3
0 0.2 0.4 0.6 0.8 1[m]

DRAWING NO. LA-112
REVISION -



1 OVERWATER STRUCTURE - AMENITIES - KITCHEN ELEVATION

1:20



2 OVERWATER STRUCTURE - AMENITIES - KITCHEN SECTIONS

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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Landscape Architects / Urban Designers
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Use figured dimensions only. All dimensions to be verified on site before commencing work. All dimensions are in mm unless otherwise stated. The drawings are to be read in conjunction with the specification and any other written instructions issued.
Any discrepancies shall be referred to the Superintendent for a written decision prior to ordering/ supply/ installation/ construction.

ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES KITCHENETTE DETAILS

DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE

DATE: 06.12.21

SCALE: 1:20 @ A1 1:40 @ A3

0 0.2 0.4 0.6 0.8 1[m]

DRAWING NO.: LA-113

REVISION: -

CONTENTS

GENERAL NOTES

1. Do not obtain dimensions by scaling these drawings. Only principal structural dimensions are shown. All dimensions are in millimetres. Details are diagrammatic and may not be to scale.

2. Read these drawings in conjunction with all other contract documents and the requirements of the relevant Authorities. Before proceeding with work, clarify any discrepancies.

3. Refer to Schedule of Witness and Hold Points for relevant items.

4. Provide materials and workmanship in accordance with the relevant and current Standards Australia Codes (including Amendments) and the Specification.

5. A BCA Assessment by Group DLA dated 30 November 2021 has confirmed Type C construction and no building elements are required to achieve any FRL's.

6. All demolition work is to be undertaken in accordance with AS 2601.

7. Where proprietary products are specified on drawings equivalent alternatives may be used subject to approval by the engineer.

8. All proprietary products are to be supplied, stored, mixed, applied and cured in accordance with the manufacturer's specifications.

9. All flashing, membranes, and waterproofing elements shall be as specified in the architectural documents.

10. All work is to be undertaken in accordance with the conditions of Development Consent and Construction Consent.

11. All material testing and reporting is to be undertaken by a laboratory with NATA accreditation appropriate for each test.

12. Protect all workers against WHS risks. If in the opinion of the Contractor the structural details present unacceptable WHS risk levels then refer to Engineer for direction.

13. Prior to commencing any works on site contact "Dial Before You Dig" (Tel. 1100) and/or the appropriate service authorities to determine the details, locations and depths of all services on or near the site, and undertake on-site services searches. Any services shown on drawings are approximate in location and the Contractor shall be responsible for locating and protecting existing services.

14. Abbreviations used are as follows:

A.A.	All Around	MAX.	Maximum
ARCH	Architectural	MHWM	Mean High Water Mark
BDY	Boundary	MIN.	Minimum
BTM.	Bottom	N.F.	Near Face
c/s	Courses	N/A	Not Applicable
CL.	Centreline	NSOP	Not Shown On Plan
COS	Confirm On Site	NTS	Not To Scale
CTS.	Centres	O/A	Over All
DOW	Division of Waterways	o/o	Out Of
DP.	Deep	OAE	Or Approved Equivalent
E.E.	Each End	REINF'T	Reinforcement
E.F.	Each Face	S.S.	Stainless Steel
E.S.	Each Side	SOP	Setout Point
E.W.	Each Way	SPEC'N	Specification
EX.	Extra	STIFF.	Stiffener
F.F.	Far Face	SWL	Still Water Level
GALV.	Galvanised	TYP.	Typical
GR.	Grade	U/S	Underside
HAT	Highest Astronomical Tide Level	UNO.	Unless Noted Otherwise
HORIZ.	Horizontal	VERT.	Vertical
LAT	Lowest Astronomical Tide Level	WD.	Wide
		Ø; dia	Diameter

14. The documented design is for the permanent condition only and does not specifically cater for the interim arrangements during construction and erection unless noted otherwise.

15. The contractor shall be responsible for maintaining the structure and any adjacent structures in a safe and stable condition at all times during construction. The contractor is to engage a qualified and suitably experienced erection engineer to review and approve the contractors construction methodology and to provide the design of any temporary works (such as propping and temporary bracing) to suit the contractors construction sequence and methodology.

16. The contractor shall submit design calculations and drawings to the superintendent upon request as evidence that a safe erecting methodology has been put forward.

17. Design live loads are as follows:-

OCCUPANCY	SUPERIMPOSED DEAD LOAD (kPa)	LIVE LOAD (kPa/kN UNO)
Non-Trafficable Roofs	0.15 (PV Panels)	0.25
Internal floors	0.50	5.00/4.50
External decks and walkways	-	5.00/4.50
Hinged gangways	-	4.00/4.50
Floating pontoons	-	Strength: 3.00/4.50 Flotation: 3.00/- Stability: 2.00/-
Lifting beams	-	SWL: 2.0 Tonnes
Davits	-	SWL: 3.0 Tonnes
Trolley rails	-	-/4.50kN wheel load
Balustrades	-	Occupancy C3 of Table 3.3 of AS1170.1

Design Vessel	
Beam (m)	2.5
Displacement (t)	
Draft at Keel (m) (Fully Laden)	0.9
Length O/A (m)	8.0

WAVE DETAILS	HEIGHT (mm)	period (s)
VESSEL GENERATED WAVES (at sailing lines)		
Power Boat	400	2.0
WIND GENERATED WAVES		
Significant Wave	Hs =	Ts =

18. Wind Loads are in accordance with AS/NZS 1170.2 2011 as follows:
A. Terrain Category : 1

	Annual Probability of Exceedance	Vr (m/s)
For serviceability	1:20	37
For ultimate strength design of structures	1:500	45
For wave height assessment	1:50	39
For wind loads on vessels	1:100	41

19. The datum for all levels on the drawings is AHD

DATUM	TIDAL RANGE	
	HAT	LAT
Australian Height Datum (AHD)	+1.175	-0.925
Fort Denison Tide Gauge (ZFDTG)	+2.100	0.000

20. Annual Probability of Exceedance

Building Importance Level	2
Design Working Life (years)	50

Annual Probability of Exceedance		
	Ultimate Limit State	Service Limit State
Wind	1/500	1/25
Earthquake	1/500	-

21. Earthquake Loads are in accordance with AS 1170.4 as follows:

Sub-soil Class	De
Probability Factor kp	1.00
Hazard Factor Z	0.08
Structure Height hn (m)	6
Design Category	II

22. Site surveying and setting out shall be carried out by a registered surveyor.

23. Building materials shall not be stored on structural elements without prior written approval.

24. These notes shall be supplied to all sub-contractors.

BED CONTOURS

1. The bed contours shown on the drawings have been taken from a Hydrographic survey drawing prepared by CMS Surveyors dated 9/9/21 based on a hydrographic survey undertaken on 5/8/21.

CONCRETE

1. Conform to AS 3600 and the Specification except where varied by the contract documents.

2. Provide concrete to the performance criteria noted below with marine cement, maximum aggregate size 20, approved admixtures and strength grade as follows.

ELEMENT	EXPOSURE CLASSIFICATION TO AS3600	STRENGTH (MPa)
PILE FILL	C1	50
SEAWALL CAPPING BEAM	C1	50

3. Project Control Testing shall be carried out in accordance with AS 3600 and AS 1379.

4. Grade 50 concrete shall comply with the following :-
A. Water binder ratio : 0.40 max.
B. Binders : Blended cements for marine use conforming with Australian Standards. Supplementary binder materials are to be used to minimise the adiabatic temperature rise and there by minimise the risk of thermal cracking.
C. Rapid Chloride migration coefficient less than $4.0x10^{12}$ m²/s.
D. Effective Chloride diffusion coefficient less than $2.0x10^{12}$ m²/s.
E. Drying shrinkage at 56 days : Target value 550 microstrain with +15% variance for maximum shrinkage.
F. Density when cured : 2350 kg/m average.
G. Admixtures - Xypex C5000 at the rate of 0.6% of total binder content.

5. Clear concrete cover to all reinforcement for durability shall be 50mm UNO.

6. Beam depths are written first and include slab thickness. Maintain the slab and beam depths shown.

7. Do not make any construction joints, holes or chases in the concrete elements unless shown or approved by the Engineer.

8. Conduits and pipes cast into the plane of slabs and beams, or crossing beams :
A. shall be non-metallic unless wrapped in approved isolation tape and kept 30mm clear of all reinforcement,
B. in slabs shall be located between the bottom and top reinforcement,
C. in beams shall be located in the middle third of the depth and shall be 30mm clear of all reinforcement,
D. greater than 32mm in diameter shall not be placed unless shown or approved by the Superintendent, and
E. shall be spaced at minimum 3 x conduit diameters, but not less than 150mm UNO.

9. Reinforcement notation:

REINFORCEMENT NOTATION	
Example : 8N16.200.T denotes 8 Grade 500N deformed bars of 16 diameter at 200 centres placed in the top of the element.	
N	Grade 500N deformed bar to AS/NZS 4671
RL	Grade 500L deformed wire rectangular reinforcing fabric to AS/NZS 4671
SL	Grade 500L deformed wire squared reinforcing fabric to AS/NZS 4671
L TM	Grade 500L deformed wire trench mesh to AS/NZS 4671
R	Grade 250N hot-rolled plain bars to AS/NZS 4671
S	Grade 250N deformed bars to AS/NZS 4671

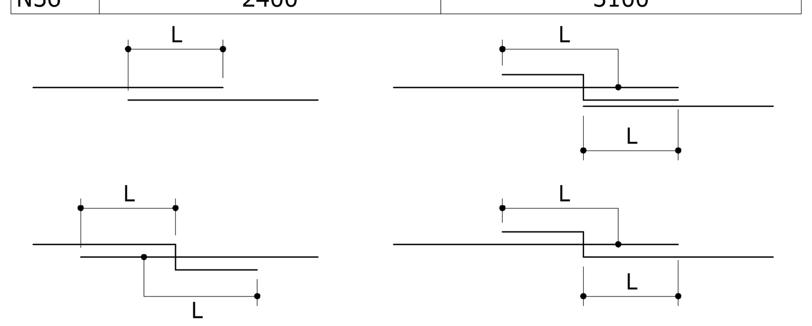
10. A 3rd party processor certification (ACRS or equivalent) must be supplied with all steel reinforcement at procurement to guarantee conformance to Australian Standards and before any concrete is poured.

11. Reinforcement is represented diagrammatically and not necessarily in true projection.

12. Use maximum bar chair spacings of 750. Use only plastic bar chairs for surfaces exposed to ground or weather. Prevent damage to vapour barriers and membranes.

13. Provide laps only at locations shown and of dimensions as follows unless detailed otherwise or approved in writing by the Engineer.

BAR SIZE	LAP LENGTH 'L' (mm)	
	Bar with 300mm or less depth of concrete under the bar.	Bar with more than 300mm depth of concrete under the bar.
N10	400	550
N12	550	700
N16	800	1050
N20	1100	1400
N24	1400	1800
N28	1700	2200
N32	2000	2600
N36	2400	3100



14. Do not heat, weld or site bend starters or other reinforcement unless shown or approved by the Engineer.

15. Tie all unsupported bars to N12.300.B or N12.450.T crossrods, lapped 550 where required.

16. Do not pour on hot and/or windy days when the bleed water evaporation rate may exceed 0.5kg/m² per hour.

17. Apply an aliphatic alcohol to freshly placed & screeded concrete to reduce evaporation & protect against finishing difficulties & plastic shrinkage cracking. Re-apply aliphatic alcohol as needed to maintain coverage until final setting of concrete has commenced.

18. Prop, cure and strip in accordance with AS 3600, AS 3610 and the Specification.

19. Curing shall be achieved by the application of water to, or the retention of water in, the freshly cast concrete, and shall commence as soon as practicable after the finishing of any unformed surfaces has been completed. Where retention of water in the fresh concrete relies on the application to exposed surfaces of sprayed membrane-forming curing compounds, the compounds used shall comply with AS 3799.

20. MINIMUM STRENGTH & CURING REQUIREMENTS FOR CONCRETE

Exposure classification to AS3600	Minimum initial curing requirements (continuous)	Minimum average compressive strength at the time of stripping of forms or removal from moulds (MPa)
B1	Wet cure continuously for at least 7 days	20
B2	Wet cure continuously for at least 7 days	25
C1	Wet cure continuously for at least 7 days	32
C2	Wet cure continuously for at least 7 days	32

21. All galvanised reinforcement is to be galvanised in accordance with AS 1650 with a coating mass of not less than 700g/m²

22. All proprietary chemical and mechanical anchors are to be installed at spacings, edge distances and depths as indicated on the drawings. Installation shall be in accordance with manufacturer's recommendations including drilling method, hole diameter, cleaning, curing, and tightening.

23. Formwork shall be in accordance with AS 3610. The contractor is responsible for the design of all formwork, associated propping and capacity of the structure under construction to carry the loading.

24. MINIMUM FORMWORK STRIPPING TIMES FOR INSITU CONCRETE (Subject to concrete test results)

STRIPPING SCHEDULE			
# : Single storey construction only. Refer to Formwork Engineer and/or AS3610-1995 for multi storey construction.			
FORMED SURFACE	HOT CONDITIONS >20°C	AVERAGE CONDITIONS ≤20°C>12°C	COLD CONDITIONS ≤12°C≥5°C
Vertical faces (beams & slabs)	1 day	2 days	3 days
Vertical faces (columns & walls)	5 days	6 days	7 days
Beam & slab soffits - Forms	4 days	6 days	8 days
Beam & slab soffits - Supporting members # (shores or backprops)	12 days	18 days	24 days

SLABS ON GRADE

1. All slabs on ground and integral footings shall have a damp proof membrane to AS 2870 unless noted otherwise.

2. Cut sawn joints once concrete has hardened sufficiently to not be damaged and prior to the formation of shrinkage cracks.

3. As a guide, the recommended time for sawing is :

Daily maximum temperature	Recommended time for sawing
≤25°C	14-16 hours
>25°C	10 hours

BASE PREPARATION FOR SLABS ON GRADE

1. All earthworks shall be supervised and certified by the Geotechnical Engineer in accordance with AS 3798 to the following Level :

Supervision & Certification Level	2

2. Carry out compaction testing to Geotechnical Engineer's direction and in accordance with AS 3798.

3. Cut to bulk excavation level as required.

4. Proof roll sub-grade under the supervision of the Geotechnical Engineer.

5. Compact sub-grade material to achieve a uniform minimum of 98% of standard density as determined by the laboratory test procedure 1289.E1.1 as described in AS 1289 : 'Methods of Testing Soils for Engineering Purposes', or as directed by the Geotechnical Engineer.

6.

Sub-grade minimum CBR value	10%

7. Sub-base material to be compacted to the following standard dry density on compacted Sub-grade

Sub-base compaction	98%

CONCRETE SURFACE FINISH

1. The finish for all trafficable surfaces shall be broomed concrete UNO.

2. The finish for all trafficable surfaces is to be slip resistant in accordance with AS/NZS 4586 : 2013 and HB 197 : 2014 from Standards Australia.

3. The slip resistance of all trafficable surfaces is to satisfy :-
A. Classification 'W' (BPN ≥ 45) using the Wet Pendulum Test, or
B. Classification 'B' using the Wet Barefoot Ramp Test, or
C. R11 using the Oil-Wet Ramp Test.

4. The slip resistance of all trafficable surfaces is to have a friction angle of not less than 18°.

ALUMINIUM

1. All work is to be carried out in accordance with AS 1664, AS 1665 & the specification except where varied by the contract documents.

2. The contractor is to ensure as early as possible that the specified sections are available in the specified grades.

3. Abbreviations - Refer to 'Structural Steel Notes'.

4. Use the following alloys of aluminium, UNO:
A. Sections :- 6082 - T6
B. Plates :- 5083 - H321
C. Weld filler rods :- 5356

5. If the specified sections are not available in the specified grades, alloys or tempers, the contractor is to submit proposals for review, with alternative grades having similar mechanical properties and durability to those specified.

6. All welding shall be carried out using MIG or TIG processes.

7. All welds shall be continuous 6mm fillet welds UNO. and all hollow sections are to be effectively sealed by welding to prevent ingress of moisture.

8. All connections between all members are to be continuous fillet welds around all faces of the interconnecting elements of each member at the joint.

9. Where stainless steel fixings are in contact with aluminium surfaces, plates and the like apply 'TEF-GEL' or an approved equivalent, over all surfaces which could come into contact with the aluminium.

WALL & ROOF FRAMING

1. Unless specifically detailed on the structural drawings, all wall and roof framing, bracing and fixing shall be designed, detailed and certified by the Contractor's engineer and shall be installed in accordance with the Contractor's details and specification.

2. Timber species selected is to be Durability Class 1 in accordance with AS 5604.

3. All timber to be treated to at least Hazard Class H3 in accordance with AS 1604.

4. Roof framing is to allow for the possible future installation of PV panels.

DEMOLITION & CONSTRUCTION

1. Refer to the constructability report dated 12/11/21 by Tonkin. The construction and demolition are to be finalised by the Contractor taking into account the constraints noted in this report.

2. All demolition work is to be undertaken in accordance with AS 2601.

3. The Contractor is to submit details of its demolition license.

4. The Contractor is to prepare a demolition plan and a certificate from an experienced Engineer on the institution of Engineers National Professional Engineers Register, certifying that the demolition plan is in accordance with Australian Standard AS 2601-2001 Demolition of Structures.

5. The existing piles are to be fully removed from the bed of Sydney Harbour unless agreed with Transport for NSW.

6. Piles which are agreed to be left embedded, shall be cut off 300mm below the bed level.

7. The locations of all piles which are not fully removed from the bed, are to be marked on the "as constructed" drawings.

8. All extracted and demolished materials awaiting removal from the site, shall remain covered at all times. The Contractor shall minimise the length of time that extracted piles are stored on site.

FLOATING SEDIMENT/TURBIDITY CURTAINS

1. Prior to commencement of each stage of work, the adjacent marine environment is to be protected by approved floating sediment/turbidity curtains.

2. The curtains are to encapsulate the entire work section length with no gap at the seawall at each end.

3. The curtains are to be anchored or weighted to the bed, are to extend to the bed and are to allow for the full range of tidal water levels while maintaining full protection.

FOUNDATIONS

1. Refer to Schedule of Witness and Hold Points for relevant items.

2. Refer to site investigation report no. 31381Rrpt2 dated 3/10/2019 by JK Geotechnics.

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE :
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

tonkin.com.au

NOT FOR CONSTRUCTION

TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
CONSTRUCTION NOTES - SHEET 1

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0010	0

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NON-SLIP RESILIENT FLOORING

1. Where an applied non slip finish is specified (threshold angle, gangway cover plate, gangway toe flap). It shall be in accordance with these notes.

2. Product : Comcork Aquedek 3.2mm thick

3. Pattern : Round

4. Colour : Storm Grey

5. Installation shall be in accordance with AS1884-1995 "Laying of Resilient Sheet and Tile Floor Coverings" with seams butt joined and all sheets laid in brick bond fashion. Adhesive to be 'Mapei' G19.

FLOATING STRUCTURE

GENERAL
1. The flotation units, the floating structure as a whole and the piles providing lateral restraint to the floating structure are to comply with the requirements of:
   A. AS 3962 - Marina Design.
   B. Roads and Maritime Services Engineering Standards.
   C. Other sections of these notes.

2. The floating structure and the piles providing lateral restraint to the floating structure are to be designed to withstand the loads arising from:
   A. Vessel impact;
   B. Wind and wave loads on vessels;
   C. Wave loads on the floating structure.

3. The floating structure is to have a design life of no less than 25 years.

4. The Flotation units are to consists of HDPE floats connected together with aluminium framing, unless otherwise agreed.

5. Services ducts shall be incorporated within the flotation units. Provide access hatches as required.

6. The walking surface of the floating structure shall be FRP mesh, unless otherwise agreed.

7. The walking surface service access covers and corner bracket covers shall achieve a slip resistance of class P4 to AS/NZS4586.

8. The services access covers in the top surface of the pontoons are to be well clear of the gangway and toe flap at all tide levels.

FENDERING, MOORING CLEATS & SERVICES BOLLARDS.
1. Fendering is to be provided continuously along all walers and around all pile guide brackets.

2. All fendering is to be soft and durable 'D' fenders coloured light grey.

3. Mooring cleats are to be provided to suit the vessels shown.

4. Services Bollards are to contain a light, water outlet, and power outlets as specified by the Services Engineer and in the locations shown on the drawings.

WALERS
1. The flotation units are to be connected together aluminium frames, unless otherwise agreed.

BUOYANCY CHARACTERISTICS

Loading Characteristics	Freeboard (mm)
Self weight of floats, frames, timber deck, attachments and ramp	450

PILE GUIDES
1. Pile guides are be positioned to suit pile locations determined by the contractor.

2. At pile guides, rubbing blocks or rollers are to be provided to keep floating in position.

3. All rubbing blocks in pile guides are to be have 2mm folded stainless steel plates fixed to the face of the rubbing block and where it will come into contact with the HDPE sleeve.

4. On completion of installation of the floating structure the average gap at any pile between the face of the stainless steel plate or the rubbing block and the HDPE sleeve around the pile is to be 6mm.

ON COMPLETION
1. On completion of the work, the contractor is to submit to the Superintendent:
   A. As Constructed drawings for the structure, ramp and piles.
   B. A maintenance plan for all elements of the floating structure and ramps.
   C. Structural certification of the floating structure, restraint piles and gangway.

FRP (FIBRE REINFORCED POLYMER)

1. All material and workmanship shall comply with 'Wagners' composite fibre technologies manufacturing work instructions and quality assurance standards.

2. Unless otherwise noted or approved, composite materials for use in this project shall be manufactured from ECR Glass and Vinyl Ester Resin conforming with ISO 9002 standards.

3. All members shall be in sound condition free from pitting, de-laminations and other defects which are likely to impair the structural capacity of the members.

4. All bolted connections are to have anticrush blocks installed in the factory and glued inside the sections UNO.

5. Bolts are to be installed through anticrush blocks.

6. Apply a waterproofing compound (Highbuild Enduroseal) to seal any end cut fibres, as a result of drilling, cutting or damage to the composite fibre profiles.

7. All exposed ends of composite shall have endcaps.

8. Colour : Composite Members = dark grey

9. The properties of FRP members shall be as setout in the following tables :

MECHANICAL PROPERTIES FROM FRP MEMBERS (GRADE GV36-S SHS)	
The values in this table are characteristic values to be used for design in normal ambient conditions. It does not include adjustment factors to account for temperature, humidity & chemical environments.	
PROPERTY	CHARACTERISTIC STRENGTH (MPa)
In-plane shear modulus of sections ASTM: D7078	4280
In-plane shear strength of sections ASTM: D7078	84
Interlaminar shear strength between FRP members (if bonded assemblies are used) ASTM: D2344 3 POINT BEND TEST-refer Test Report	44
Longitudinal compressive modulus of sections ASTM : D6641	33300
Longitudinal compressive strength of sections ASTM : D6641	485
Longitudinal tensile modulus of sections ISO 527-4	36300
Longitudinal tensile strength of sections ISO 527-4	610

PHYSICAL PROPERTIES FOR FRP MEMBERS (GRADE GV36-S SHS)	
The values in this table are mean values obtained from tests at ambient temperature and relative humidity.	
PROPERTY	VALUE
Longitudinal CTE ISO 11359-2	5.03 x 10-6m/m/°C
Density of FRP (sections) ASTM D792	2030kg/m³
Glass transition temperature of FRP sections ASTM D7029	130°C (Derakane 640-900)
Glass transition temperature of any adhesives used in fabrication of the FRP sections	85°C (ATL Composites HPR 26)
Cure schedule for FRP bonded elements	24hrs at ambient + 8hrs at 80°C

10. FRP Notation :
    A. WCFT - 'Wagners' composite fibre technology
    B. RB - bonded rectangular beam

PILES - GENERAL

1. Piles are to be supplied, installed & finished in accordance with the Specification & AS 2159 - Piling Code UNO.

2. Steel piles are to be fabricated in accordance with AS 4100, the steelwork specification & the steel notes on these drawings.

3. Piles are to be installed to the following tolerances:

Pile Mark	Deviation from Specified Plan Position at RL +3.500 (ZFDTG) UNO.	Deviation from Vertical
All UNO.	75mm	1 Horiz. to 50 Vert.
Pontoon Restraint Piles	25mm	1 Horiz. to 100 Vert.

4. Piles shall be supplied in one continuous length unless otherwise approved. Splicing of sections to achieve pile length will be permitted. Splice locations and details are to be submitted to the Superintendent for approval. No spliced pile shall be installed until such approval has been given.

5. All weld splices in all piles are to be inspected using Ultrasonic inspection techniques in accordance with AS 1554.

6. All lengths of defective welds are to be gouged out & rewelded prior to transport of piles from the fabricator's yard.

7. Piles are to be driven into holes drilled in the rock which are a smaller diameter than the pile which will result in the socketed length of the steel pile hard against the rock all around and for the full length of the socket.

8. Alternatively piles may be driven into rock, or screwed into rock with cutting teeth on the base of the pile angled to result in a maximum distance of 20mm from the outside of the pile to the rock face. On completion of drilling, piles are to be driven to refusal.

9. During socketing of the piles in rock the rate of progress of the piling is to be monitored such that seams and unsuitable layers of material are identified. If seams and unsuitable material are encountered advise the Superintendent who will advise on the course of action to be taken.

10. Advise Superintendent of overburden thickness to rock. Obtain confirmation of rock socket length for each pile before moving piling rig to the next pile.

11. Piles not socketed into rock shall be driven over a single uninterrupted period to achieve the embedment specified. Jetting of these piles is not permitted without approval from the Superintendent.

PILES - PROTECTIVE TREATMENT

STEEL PILES.
1. All piles are to be uncoated UNO.

2. All piles are to be protected from corrosion with black HDPE sleeves driven into the bed.

STRUCTURAL STEEL - GENERAL

1. Comply with AS/NZS 1163, AS/NZS 1594, AS/NZS 3678, AS/NZS 3679.1, AS/NZS 3679.2, AS/NZS 1554, AS 4100 and the Specification except where varied by the contract documents.

2. Acceptable manufacturers of structural steel must hold a valid certificate of approval issued by the Australasian Certification Authority for Reinforcing and Structural Steels Ltd (ACRS). Evidence of compliance with this clause must be submitted at tender, supply and completion.

3. Comply with AS/NZS 5131 Appendix C using the following categories (UNO):

Importance Level	2
Service Category	SC1
Fabrication Category	FC1
Construction Category	CC2

4. Abbreviations used are as follows:

B.W.	Butt Weld (Full Penetration)	RHS	Rectangular Hollow Section
CHS	Circular Hollow Section	SHS	Square Hollow Section
EA	Equal Angle	UA	Unequal Angle
F.W.	Fillet Weld	UB	Universal Beam
LLH	Long Leg Horizontal	UC	Universal Column
LLV	Long Leg Vertical	WB	Welded Beam
PFC	Parallel Flange Channel	WC	Welded Column
PL.	Plate		

5. Provide upward camber to beams where shown. Pre-cambers may be achieved by pre-setting subject to approval from the Engineer.

6. Stability of the structure during construction is the Builder's responsibility. Provide any temporary bracing that may be required for this purpose.

7. Use the following grades of steel, UNO:

STEEL MEMBER TYPE	GRADE
Circular hollow sections	350
Plates & Rods	250
Rectangular hollow sections	450
Rolled Sections	300
Square hollow sections (greater than 50mm)	450
Square hollow sections (less than or equal to 50mm)	350
Welded Sections	300

8. Unless noted otherwise all bolts shall be M20 Grade 8.8/S. No connection shall have less than 2 bolts. Washers shall be installed under all bolt heads & nuts. Bolt designation is as follows :

BOLT TYPE	COMMENTS
4.6/S	Commercial bolts of grade 4.6 to AS 1111 & AS 1112 snug tightened to AS 4100.
8.8/S	High strength structural bolts of grade 8.8 to AS 1252 snug tightened to AS 4100.
8.8/TB	High strength structural bolts of grade 8.8 to AS 1252 fully tensioned to AS 4100 as bearing joint.
8.8/TF	High strength structural bolts of grade 8.8 to AS 1252 fully tensioned to AS 4100 as friction joint with facing surfaces left uncoated UNO.

9. TB and TF bolts to be installed using an approved direct tension indication device such as "Hobson Squirter Washers".

10. Where slotted holes are specified, bolts are to be at mid length of slot at completion of erection.

11. All welds shall be Category SP UNO. All welds shall be 6mm continuous fillet using E49XX electrodes UNO. Butt welds shall be complete penetration butt welds to AS 1554.

12. The extent of non-destructive weld examination shall be as shown in the table below. Visual scanning, visual examination, and radiographic or ultrasonic examination shall be in accordance with AS/NZS 1554.1, AS 2177.1, and AS 2207 as appropriate.

TYPE OF WELD AND CATEGORY	EXTENT (% of total length of weld type) Visual Scanning	Visual Examination	Radiographic or ultrasonic inspection
Fillet welds, SP	100%	50%	-
Fillet welds, GP	100%	25%	-
Butt welds, SP	100%	50%	10%
Butt welds, GP	100%	25%	-

13. All plates including but not limited to cap, base and gusset plates to be fully welded to steel members UNO.

14. All plates shall be minimum 10 thick UNO.

15. Provide 14Ø holes as required for affixed timber members UNO.

16. Use non-shrink grout with a minimum compressive strength of 30MPa, tightly packed under all bearings and base plates. Provide seal plates to all hollow sections.

17. Provide seal plates to all hollow sections.

18. All proprietary chemical and mechanical anchors are to be installed at spacings, edge distances and depths as indicated on the drawings. Installation shall be in accordance with manufacturer's recommendations including drilling method, hole diameter, cleaning, curing, and tightening

STAINLESS STEEL PINS, ROLLERS, WHEELS, PLATES, SECTIONS & BOLTS

1. All pins, rollers, wheels, plates, sections and bolts shall be:
   A. Grade 316 or 316L UNO.
   B. All handrails, balustrades and welded attachments are to be fabricated from grade 316L.
   C. Supplied in accordance with ASTM A240M/A480M and ASTM A276.
   D. Manufactured and installed in accordance with AS 4100, AS 4673 and AS 1554.
   E. Pins to be Grade SAF 2205 UNO.
   F. Bolts to be Class A4-70 UNO in accordance with ISO 3506-1.
   G. Protected during fabrication, transportation & installation to minimise the risk of iron or carbon steel particles becoming embedded in the surface.

2. All rollers and pins shall be fabricated within a tolerance for the diameter of ±0.25mm.

3. All stainless steel plates, sections, pins, rollers and wheels shall be pickled and passivated.

4. All stainless steel exposed to view shall be machine polished to 600 grit followed by electro polishing.

5. All stainless steel shall be supplied & fabricated in accordance with the notes & the Steelwork notes.

6. Immediately prior to installation, all stainless steel pins, rollers, and plates shall be subject to a Ferroxyl test. Any embedded iron found as a result of this test is to be removed.

7. All welding shall be in accordance with AS 1554.6.

8. All welds to be Category SP UNO. All welds shall be 5mm continuous fillet using an "over alloyed" electrode compatible with the strength grade of the stainless steel plate at the weld UNO.

9. Welds shall be tested in accordance with the weld testing specified in the Steelwork notes.

10. Where stainless steel pins are surrounded by a bearing, prior to installing the bearing, apply a light oil to the inside of the bearing which is in contact with the stainless pin.

11. Where stainless steel fixings are in contact with aluminium surfaces, passivate the stainless steel by coating with "TEF-GEL", or an approved equivalent, over all surfaces which could come into contact with the aluminium.

12. Stainless steel shall be fabricated by a specialist Stainless Steel Fabricator accredited by the Australian Stainless Steel Development Association (ASSDA).

STRUCTURAL STEEL - PROTECTIVE TREATMENTS

CORROSION PROTECTION
1. Surface preparation and corrosion protection of the steelwork is to be provided to satisfy the following atmospheric corrosivity categories and years to first maintenance in accordance with AS 2312.1 and/or AS/NZS 2312.2

Steelwork Elements	Atmospheric Corrosivity Category (excluding micro-environments)	Years to First Maintenance
All	C4	25+

2. Steelwork in an internal environment subject to cross ventilation of outside air is to be classified as being in an external environment.

3. The coating system shall be HDG900 to AS/NZS 4680.

4. Surface preparation and application procedures are to be in accordance with AS 2312.1, AS/NZS 2312.2 and the supplier's specification.

5. Unless noted otherwise, provide bolts in the completed structure with equivalent corrosion protection as for the steel members they connect.

6. In addition to the finish specified any steelwork in contact with the concrete is to be coated with a bitumen paint to a minimum dry film thickness of 0.4mm, to 100mm above ground level UNO.

7. When galvanising hollow sections of steelwork provision for adequate venting and draining shall be made during the galvanising process in accordance with galvaniser's requirements and AS/NZS 4680. The location and size of holes should be shown on the fabrication shop drawings for review by the Structural Engineer. Venting holes in external and/or architecturally exposed members are to be suitably plugged and sealed prior to the steel arriving on site.

8. Refer to the Architectural specifications for top coat finishes and colours. All corrosion protection coatings are to be compatible with any applied finishes and top coats, including any fire rated coatings.

9. Any coating repairs shall be undertaken to provide the same level of protection as the original surface treatment.

10. Restore damaged or untreated surfaces on site after erection to their specified shop treatment condition only with the approval of the Superintendent.

11. All edges and corners of all steel sections and plates are to be rounded to a minimum radius of 3mm.

12. The contractor is to appoint an approved independent surface preparation and coating inspector prior to commencement of fabrication.

13. The level of inspection & testing is to satisfy Level 2 Inspections in accordance with AS 2312.1

14. Where stainless steel is welded to mild steel which is painted, the paint coating is to extend 20mm onto the stainless steel.

15. No welding, cutting or modifying of painted steelwork shall be undertaken unless approved by the Superintendent.

16. Any defects found in the coating by this procedure shall be repaired by the Coating Contractor in accordance with the manufacturer's recommended repair procedure.

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

SHEET SIZE A1

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE :
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

NOT FOR CONSTRUCTION

tonkin.com.au

TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
CONSTRUCTION NOTES - SHEET 2

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0011	0

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SAFETY IN DESIGN

1. Tonkin has assessed the health and safety risks related to the structural design. Tonkin has not identified any unusual or unique hazards and so has not prepared a Safety in Design Report.

2. Tonkin's assessment does not relieve any other party from undertaking their own Safety in Design review, and does not relieve any other party of their obligations under the Work Health & Safety Act.

DESIGN AND CONSTRUCT ITEMS

1. Marina piles (with no changes to the corrosion protection as documented).

2. Proprietary floating structure (with no significant changes to the layout as documented) and attachments including (but not limited to):

- Flotation units
- Walers or frames
- Fenders
- Pile brackets
- Corner brackets
- Rubbing blocks or rollers
- Mooring cleats
- Ladders
- Life rings

3. Access gangway (with no significant changes to the layout as documented), including (but not limited to):

- Gangway framing and decking.
- Clearance from floating units at high tide.
- Rollers and wearing plates on pontoon surface.
- Connection plates and brackets off jetty.
- Hinged toe flap and cover plate, including wearing plates.

WARRANTIES

1. Warranty periods for the following items are to be provided as part of the tender. Warranty periods are to be at least 10 years.

   A. Floating structure including all attachments
   B. Access gangway and attachments
   C. Marina piles
   D. Life rings

2. Warranties are to be provided at completion

SCHEDULE OF WITNESS AND HOLD POINTS

(SUBMISSIONS TO STRUCTURAL ENGINEER U.N.O)

DESIGN DRAWINGS AND DETAILS

Description	Witness Point	Hold Point
Piles including design assumptions, details, strength & settlement calculations, & details of connection to structure.		Submit for review prior to fabrication.
Proprietary floating systems including certification for flotation, stability and strength.		Submit for review prior to fabrication.
Proprietary gangway systems.		Submit for review prior to fabrication.
Details of attachments - fenders - rubbing strips - mooring cleats - mooring bollards - services pedestals - ladders and life rings		Submit prior to ordering

SHOP DRAWINGS

Description	Witness Point	Hold Point
Structural steelwork (Including stainless) Structural timberwork Structural aluminium Floating structures Structural composite material elements Piles and attachments		Submit for review prior to fabrication.

SITE REVIEW - (PROVIDE MIN. 24 HOURS NOTICE)

Description	Witness Point	Hold Point
Piling installation	During installation	
HDPE sleeve installation	During installation	
Reinforcement for reinforced concrete elements.		Site review and approval.
Completed structural steel, aluminium and timber framing including grouting of base plates & tightening of bolts. Do not cover until approved.		Site review and approval.
Completed timber works		Prior to placement of decking
Completed installation of ramp, pontoon, floating structure & services.		Site review and approval.

CONSTRUCTION RECORDS

Description	Witness Point	Hold Point
Founding level of piles.	Submit piling records each day.	Submit for review prior to removal of piling rig from site.
Founding level of HDPE sleeves	Submit records each day	Submit for review prior to removal of piling rig from site.
Piling installation and testing records, and engineering certification.	Submit on completion of each test & after each pile installed.	Submit for review prior to removal of piling tig from site.
Free board measurements for floating structures.		Submit for review after all attachments have been installed and floating structure is in place on site.
Third Party Certification for the following items: - structural steel -structural timber - structural aluminium - reinforcement -structural bolts - structural composite material		Submit before ordering materials.
Fabricator Accreditation - stainless steel		Submit prior to commencing fabrication.
Coating for structural steelwork dry film thickness and holiday detection tests.		Submit before coated steelwork leaves contractor's yard.
Weld tests and inspection records.		Submit before steelwork leaves fabricator's yard.
Concrete mix characteristic shrinkage.		Submit prior to delivery to site.
Concrete test certificates for strength and slump.	Submit progressivel y.	Submit on completion.
Monitoring of turbidity consisting of sampling and measurements at agreed locations on site.	Submit weekly	
Protective treatment other than paint coating: inspection and testing records.		Submit before treated materials leave contractor's yard

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH

SHEET SIZE
A1

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE :
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

tonkin
tonkin.com.au

NOT FOR CONSTRUCTION

TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
CONSTRUCTION NOTES - SHEET 3

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0012	0

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MARK	DESCRIPTION
UB	
001	150 UB 14.0
002	150 UB 18.0
003	180 UB 16.1
004	180 UB 18.1
005	180 UB 22.2
006	200 UB 18.2
007	200 UB 22.3
008	200 UB 25.4
009	200 UB 29.8
010	250 UB 25.7
011	250 UB 31.4
012	250 UB 37.3
013	310 UB 32.0
014	310 UB 40.4
015	310 UB 46.2
016	360 UB 44.7
017	360 UB 50.7
018	360 UB 56.7
019	410 UB 53.7
020	410 UB 59.7
021	460 UB 67.1
022	460 UB 74.6
023	460 UB 82.1
024	530 UB 82.0
025	530 UB 92.4
026	610 UB 101
027	610 UB 113
028	610 UB 125
UC	
030	100 UC 14.8
031	150 UC 23.4
032	150 UC 30.0
033	150 UC 37.2
034	200 UC 46.2
035	200 UC 52.2
036	200 UC 59.5
037	250 UC 72.9
038	250 UC 89.5
039	310 UC 96.8
040	310 UC 118
041	310 UC 137
042	310 UC 158
PFC	
050	75PFC
051	100PFC
052	125PFC
053	150PFC
054	180PFC
055	200PFC
056	230PFC
057	250PFC
058	300PFC
059	380PFC

MARK	DESCRIPTION
WB	
060	700 WB 115
061	700 WB 130
062	700 WB 150
063	700 WB 173
064	800 WB 122
065	800 WB 146
066	800 WB 168
067	800 WB 192
068	900 WB 175
069	900 WB 218
070	900 WB 257
071	900 WB 192
072	1000 WB 215
073	1000 WB 258
074	1000 WB 296
075	1000 WB 322
076	1200 WB 249
077	1200 WB 278
078	1200 WB 317
079	1200 WB 342
080	1200 WB 392
081	1200 WB 423
082	1200 WB 455
WC	
090	350 WC 197
091	350 WC 230
092	350 WC 258
093	350 WC 280
094	400 WC 144
095	400 WC 181
096	400 WC 212
097	400 WC 270
098	400 WC 303
099	400 WC 328
100	400 WC 361
101	500 WC 228
102	500 WC 267
103	500 WC 290
104	500 WC 340
105	500 WC 383
106	500 WC 414
107	500 WC 440

MARK	DESCRIPTION
EA	
110	25 x 25 x 3 EA
111	25 x 25 x 5 EA
112	25 x 25 x 6 EA
113	30 x 30 x 3 EA
114	30 x 30 x 5 EA
115	30 x 30 x 6 EA
116	40 x 40 x 3 EA
117	40 x 40 x 5 EA
118	40 x 40 x 6 EA
119	45 x 45 x 3 EA
120	45 x 45 x 5 EA
121	45 x 45 x 6 EA
122	50 x 50 x 3 EA
123	50 x 50 x 5 EA
124	50 x 50 x 6 EA
125	50 x 50 x 8 EA
126	55 x 55 x 5 EA
127	55 x 55 x 6 EA
128	65 x 65 x 5 EA
129	65 x 65 x 6 EA
130	65 x 65 x 8 EA
131	65 x 65 x 10 EA
132	75 x 75 x 5 EA
133	75 x 75 x 6 EA
134	75 x 75 x 8 EA
135	75 x 75 x 10 EA
136	90 x 90 x 6 EA
137	90 x 90 x 8 EA
138	90 x 90 x 10 EA
139	100 x 100 x 6 EA
140	100 x 100 x 8 EA
141	100 x 100 x 10 EA
142	100 x 100 x 12 EA
143	125 x 125 x 8 EA
144	125 x 125 x 10 EA
145	125 x 125 x 12 EA
146	125 x 125 x 16 EA
147	150 x 150 x 10 EA
148	150 x 150 x 12 EA
149	150 x 150 x 16 EA
150	150 x 150 x 19 EA
151	200 x 200 x 13 EA
152	200 x 200 x 16 EA
153	200 x 200 x 18 EA
154	200 x 200 x 20 EA
155	200 x 200 x 26 EA

MARK	DESCRIPTION
UA	
160	65 x 50 x 5 UA
161	65 x 50 x 6 UA
162	65 x 50 x 8 UA
163	75 x 50 x 5 UA
164	75 x 50 x 6 UA
165	75 x 50 x 8 UA
166	100 x 75 x 6 UA
167	100 x 75 x 8 UA
168	100 x 75 x 10 UA
169	125 x 75 x 6 UA
170	125 x 75 x 8 UA
171	125 x 75 x 10 UA
172	125 x 75 x 12 UA
173	150 x 90 x 8 UA
174	150 x 90 x 10 UA
175	150 x 90 x 12 UA
176	150 x 90 x 16 UA
177	150 x 100 x 10 UA
178	150 x 100 x 12 UA
BT	
180	75 BT 7.0
181	75 BT 9.0
182	90 BT 8.1
183	90 BT 9.1
184	90 BT 11.1
185	100 BT 9.1
186	100 BT 11.2
187	100 BT 12.7
188	100 BT 14.9
189	125 BT 12.9
190	125 BT 15.7
191	125 BT 18.7
192	155 BT 16.0
193	155 BT 20.2
194	155 BT 23.1
195	180 BT 22.4
196	180 BT 25.4
197	180 BT 28.4
198	205 BT 26.9
199	205 BT 29.9
200	230 BT 33.6
201	230 BT 37.3
202	230 BT 41.1
203	265 BT 41.0
204	265 BT 46.3
205	305 BT 50.5
206	305 BT 56.5
207	305 BT 62.5
CT	
210	50 CT 7.4
211	75 CT 11.7
212	75 CT 15.0
213	75 CT 18.6
214	100 CT 23.1
215	100 CT 26.1
216	100 CT 29.8
217	125 CT 36.5
218	125 CT 44.8
219	155 CT 48.4
220	155 CT 59.0
221	155 CT 68.5
222	155 CT 79.0
Rod/Brace	
230	10 DIA. ROD WITH GRADE 'S' TURNBUCKLES
231	12 DIA. ROD WITH GRADE 'S' TURNBUCKLES
232	16 DIA. ROD WITH GRADE 'S' TURNBUCKLES
233	20 DIA. ROD WITH GRADE 'S' TURNBUCKLES
234	24 DIA. ROD WITH GRADE 'S' TURNBUCKLES
235	PRYDA SB123 - 32 x 1.2mm WITH TENSIONERS.

MARK	DESCRIPTION
TFB	
240	100 TFB
241	125 TFB
SHS	
250	20 x 20 x 1.6 SHS
251	20 x 20 x 2.0 SHS
252	25 x 25 x 1.6 SHS
253	25 x 25 x 2.0 SHS
254	25 x 25 x 2.5 SHS
255	25 x 25 x 3.0 SHS
256	30 x 30 x 1.6 SHS
257	30 x 30 x 2.0 SHS
258	30 x 30 x 2.5 SHS
259	30 x 30 x 3.0 SHS
260	35 x 35 x 1.6 SHS
261	35 x 35 x 2.0 SHS
262	35 x 35 x 2.5 SHS
263	35 x 35 x 3.0 SHS
264	40 x 40 x 1.6 SHS
265	40 x 40 x 2.0 SHS
266	40 x 40 x 2.5 SHS
267	40 x 40 x 3.0 SHS
268	40 x 40 x 4.0 SHS
269	50 x 50 x 1.6 SHS
270	50 x 50 x 2.0 SHS
271	50 x 50 x 2.5 SHS
272	50 x 50 x 3.0 SHS
273	50 x 50 x 4.0 SHS
274	50 x 50 x 5.0 SHS
275	50 x 50 x 6.0 SHS
276	65 x 65 x 1.6 SHS
277	65 x 65 x 2.0 SHS
278	65 x 65 x 2.5 SHS
279	65 x 65 x 3.0 SHS
280	65 x 65 x 4.0 SHS
281	65 x 65 x 5.0 SHS
282	65 x 65 x 6.0 SHS
283	75 x 75 x 2.0 SHS
284	75 x 75 x 2.5 SHS
285	75 x 75 x 3.0 SHS
286	75 x 75 x 3.5 SHS
287	75 x 75 x 4.0 SHS
288	75 x 75 x 5.0 SHS
289	75 x 75 x 6.0 SHS
290	89 x 89 x 2.0 SHS
291	89 x 89 x 3.5 SHS
292	89 x 89 x 5.0 SHS
293	89 x 89 x 6.0 SHS
294	100 x 100 x 2.0 SHS
295	100 x 100 x 2.5 SHS
296	100 x 100 x 3.0 SHS
297	100 x 100 x 4.0 SHS
298	100 x 100 x 5.0 SHS
299	100 x 100 x 6.0 SHS
300	100 x 100 x 8.0 SHS
301	100 x 100 x 9.0 SHS
302	100 x 100 x 10.0 SHS
303	125 x 125 x 4.0 SHS
304	125 x 125 x 5.0 SHS
305	125 x 125 x 6.0 SHS
306	125 x 125 x 8.0 SHS
307	125 x 125 x 9.0 SHS
308	125 x 125 x 10.0 SHS
309	150 x 150 x 5.0 SHS
310	150 x 150 x 6.0 SHS
311	150 x 150 x 8.0 SHS
312	150 x 150 x 9.0 SHS
313	150 x 150 x 10.0 SHS
314	200 x 200 x 5.0 SHS
315	200 x 200 x 6.0 SHS
316	200 x 200 x 8.0 SHS
317	200 x 200 x 9.0 SHS
318	200 x 200 x 10.0 SHS
319	200 x 200 x 12.5 SHS
320	200 x 200 x 16.0 SHS
321	250 x 250 x 6.0 SHS
322	250 x 250 x 8.0 SHS
323	250 x 250 x 9.0 SHS
324	250 x 250 x 10.0 SHS
325	250 x 250 x 12.5 SHS

MARK	DESCRIPTION
326	250 x 250 x 16.0 SHS
327	300 x 300 x 8.0 SHS
328	300 x 300 x 10.0 SHS
329	300 x 300 x 12.5 SHS
330	300 x 300 x 16.0 SHS
331	350 x 350 x 8.0 SHS
332	350 x 350 x 10.0 SHS
333	350 x 350 x 12.5 SHS
334	350 x 350 x 16.0 SHS
335	400 x 400 x 10.0 SHS
336	400 x 400 x 12.5 SHS
337	400 x 400 x 16.0 SHS
RHS	
340	50 x 20 x 1.6 RHS (GR. 350)
341	50 x 20 x 2.0 RHS (GR. 350)
342	50 x 20 x 2.5 RHS (GR. 350)
343	50 x 20 x 3.0 RHS (GR. 350)
344	50 x 25 x 1.6 RHS (GR. 350)
345	50 x 25 x 2.0 RHS (GR. 350)
346	50 x 25 x 2.5 RHS (GR. 350)
347	50 x 25 x 3.0 RHS (GR. 350)
348	65 x 35 x 2.0 RHS (GR. 350)
349	65 x 35 x 2.5 RHS (GR. 350)
350	65 x 35 x 3.0 RHS (GR. 350)
351	65 x 35 x 4.0 RHS (GR. 350)
352	75 x 25 x 1.6 RHS (GR. 350)
353	75 x 25 x 2.0 RHS (GR. 350)
354	75 x 25 x 2.5 RHS (GR. 350)
355	75 x 50 x 1.6 RHS
356	75 x 50 x 2.0 RHS
357	75 x 50 x 2.5 RHS
358	75 x 50 x 3.0 RHS
359	75 x 50 x 4.0 RHS
360	75 x 50 x 5.0 RHS
361	75 x 50 x 6.0 RHS
362	100 x 50 x 1.6 RHS
363	100 x 50 x 2.0 RHS
364	100 x 50 x 2.5 RHS
365	100 x 50 x 3.0 RHS
366	100 x 50 x 3.5 RHS
367	100 x 50 x 4.0 RHS
368	100 x 50 x 5.0 RHS
369	100 x 50 x 6.0 RHS
370	125 x 75 x 2.0 RHS
371	125 x 75 x 2.5 RHS
372	125 x 75 x 3.0 RHS
373	125 x 75 x 4.0 RHS
374	125 x 75 x 5.0 RHS
375	125 x 75 x 6.0 RHS
376	150 x 50 x 2.0 RHS
377	150 x 50 x 2.5 RHS
378	150 x 50 x 3.0 RHS
379	150 x 50 x 4.0 RHS
380	150 x 50 x 5.0 RHS
381	150 x 50 x 6.0 RHS
382	150 x 100 x 4.0 RHS
383	150 x 100 x 5.0 RHS
384	150 x 100 x 6.0 RHS
385	150 x 100 x 8.0 RHS
386	150 x 100 x 9.0 RHS
387	150 x 100 x 10.0 RHS
388	200 x 100 x 4.0 RHS
389	200 x 100 x 5.0 RHS
390	200 x 100 x 6.0 RHS
391	200 x 100 x 8.0 RHS
392	200 x 100 x 9.0 RHS
393	200 x 100 x 10.0 RHS
394	250 x 150 x 5.0 RHS
395	250 x 150 x 6.0 RHS
396	250 x 150 x 8.0 RHS
397	250 x 150 x 9.0 RHS
398	250 x 150 x 10.0 RHS
399	250 x 150 x 12.5 RHS
400	250 x 150 x 16.0 RHS
401	300 x 200 x 6.0 RHS
402	300 x 200 x 8.0 RHS
403	300 x 200 x 10.0 RHS
404	300 x 200 x 12.5 RHS
405	300 x 200 x 16.0 RHS
406	350 x 250 x 8.0 RHS

MARK	DESCRIPTION
407	350 x 250 x 10.0 RHS
408	350 x 250 x 12.5 RHS
409	350 x 250 x 16.0 RHS
410	400 x 200 x 8.0 RHS
411	400 x 200 x 10.0 RHS
412	400 x 200 x 12.5 RHS
413	400 x 200 x 16.0 RHS
414	400 x 300 x 8.0 RHS
415	400 x 300 x 10.0 RHS
416	400 x 300 x 12.5 RHS
417	400 x 300 x 16.0 RHS
CHS	
420	26.9Ø x 2.0 CHS
421	26.9Ø x 2.3 CHS
422	26.9Ø x 2.6 CHS (GR 250)
423	26.9Ø x 3.2 CHS (GR 250)
424	26.9Ø x 4.0 CHS (GR 250)
425	33.7Ø x 2.0 CHS
426	33.7Ø x 2.6 CHS
427	33.7Ø x 3.2 CHS (GR 250)
428	33.7Ø x 4.0 CHS (GR 250)
429	42.4Ø x 2.0 CHS
430	42.4Ø x 2.6 CHS
431	42.4Ø x 3.2 CHS (GR 250)
432	42.4Ø x 4.0 CHS (GR 250)
433	48.3Ø x 2.3 CHS
434	48.3Ø x 2.9 CHS
435	48.3Ø x 3.2 CHS (GR 250)
436	48.3Ø x 4.0 CHS (GR 250)
437	60.3Ø x 2.3 CHS
438	60.3Ø x 2.9 CHS
439	60.3Ø x 3.6 CHS (GR 250)
440	60.3Ø x 4.5 CHS (GR 250)
441	60.3Ø x 5.4 CHS (GR 250)
442	76.1Ø x 2.3 CHS
443	76.1Ø x 3.2 CHS
444	76.1Ø x 3.6 CHS (GR 250)
445	76.1Ø x 4.5 CHS (GR 250)
446	76.1Ø x 5.9 CHS (GR 250)
447	89.9Ø x 2.6 CHS
448	89.9Ø x 3.2 CHS
449	89.9Ø x 4.0 CHS (GR 250)
450	89.9Ø x 5.0 CHS (GR 250)
451	89.9Ø x 5.9 CHS (GR 250)
452	101.6Ø x 2.6 CHS
453	101.6Ø x 3.2 CHS
454	101.6Ø x 4.0 CHS (GR 250)
455	101.6Ø x 5.0 CHS (GR 250)
456	114.3Ø x 3.2 CHS
457	114.3Ø x 3.6 CHS
458	114.3Ø x 4.5 CHS (GR 250)
459	114.3Ø x 5.4 CHS (GR 250)
460	139.7Ø x 3.0 CHS
461	139.7Ø x 3.5 CHS
462	139.7Ø x 5.0 CHS (GR 250)
463	139.7Ø x 5.4 CHS (GR 250)
464	165.1Ø x 3.0 CHS
465	165.1Ø x 3.5 CHS
466	165.1Ø x 5.0 CHS (GR 250)
467	165.1Ø x 5.4 CHS (GR 250)
468	168.3Ø x 4.8 CHS
469	168.3Ø x 6.4 CHS
470	168.3Ø x 7.1 CHS
471	219.1Ø x 4.8 CHS
472	219.1Ø x 6.4 CHS
473	219.1Ø x 8.2 CHS
474	273.1Ø x 4.8 CHS
475	273.1Ø x 6.4 CHS
476	273.1Ø x 9.3 CHS
477	273.1Ø x 12.7 CHS
478	323.9Ø x 6.4 CHS
479	323.9Ø x 9.5 CHS
480	323.9Ø x 12.7 CHS
481	355.6Ø x 6.4 CHS
482	355.6Ø x 9.5 CHS
483	355.6Ø x 12.7 CHS
484	406.4Ø x 6.4 CHS
485	406.4Ø x 9.5 CHS

MARK	DESCRIPTION
486	406.4Ø x 12.7 CHS
487	457.0Ø x 6.4 CHS
488	457.0Ø x 9.5 CHS
489	457.0Ø x 12.7 CHS
490	508.0Ø x 6.4 CHS
491	508.0Ø x 9.5 CHS
492	508.0Ø x 12.7 CHS
Cee	
500	C10010
501	C10012
502	C10015
503	C10019
504	SC15010
505	SC15012
506	SC15015
507	SC15019
508	SC15024
509	SC20012
510	SC20015
511	SC20019
512	SC20024
513	SC25015
514	SC25019
515	SC25024
516	SC30019
517	SC30024
518	SC30030
519	SC35024
520	SC35030
Zed	
530	Z10010
531	Z10012
532	Z10015
533	Z10019
534	SZ15010
535	SZ15012
536	SZ15015
537	SZ15019
538	SZ15024
539	SZ20012
540	SZ20015
541	SZ20019
542	SZ20024
543	SZ25015
544	SZ25019
545	SZ25024
546	SZ30019
547	SZ30024
548	SZ30030
549	SZ35024
550	SZ35030

Member Prefix's

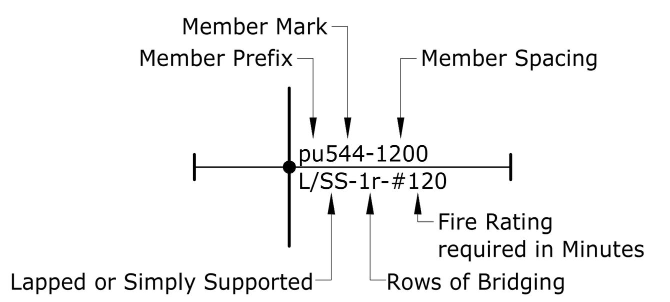
Prefix	Member Type
bk	Bracket
bl	Balustrade
cp	Ceiling Purlin
cw	Capwale
df	Door Frame
ep	Eaves Purlin
fr	Welded Frame
fy	Fly Brace
g	Girt
gp	Gutter Purlin
h	Hanger
hb	Horizontal Brace
hr	Handrail
hs	Headstock
j	Joist
kr	Kickrail
li	Lintel, Shelf Angle
mr	Midrail
np	Nailing Plate
or	Outrigger
ow	Operable Wall Beam
pr	Prop
pu	Purlin
sb	Steel Beam
sc	Steel Column
sp	Stub Post
sr	Strut
ss	Stair Stringer
tb	Timber Beam
tbr	Temporary Brace
tp	Timber Post
tr	Truss
ub	Underpinning Beam
vb	Vertical Brace
wb	Wind Beam
ws	Wall Stiffener

SPECIAL MEMBER SCHEDULE

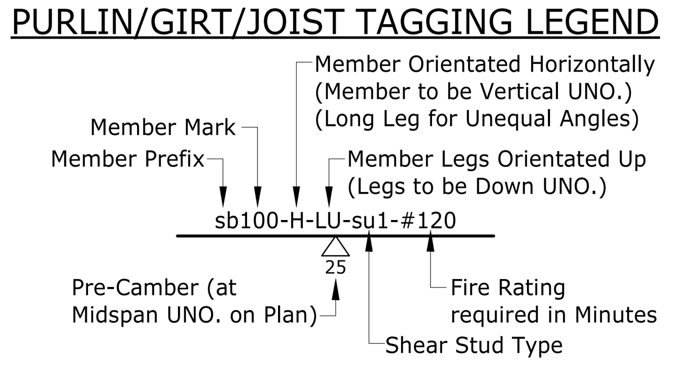
MARK	DESCRIPTION
	POST TO SUPPORT MIDSPAN OF TR3 OVER TBC
RL1	41kg RAIL TO AS 1085.1

SHEAR STUD SCHEDULE

MARK	DESCRIPTION
su--	--dia Shear studs at --- max. cts.



PURLIN/GIRT/JOIST TAGGING LEGEND



MEMBER TAGGING LEGEND

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE :
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
MEMBER SCHEDULE

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0020	0

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SCALE 1 : 400

EXISTING SITE PLAN

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD

SCALE : 1 : 400

SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21

APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW

WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES

EXISTING SITE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0100	0

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SCALE 1 : 200

DEMOLITION PLAN

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REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 200
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
DEMOLITION PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0200	0

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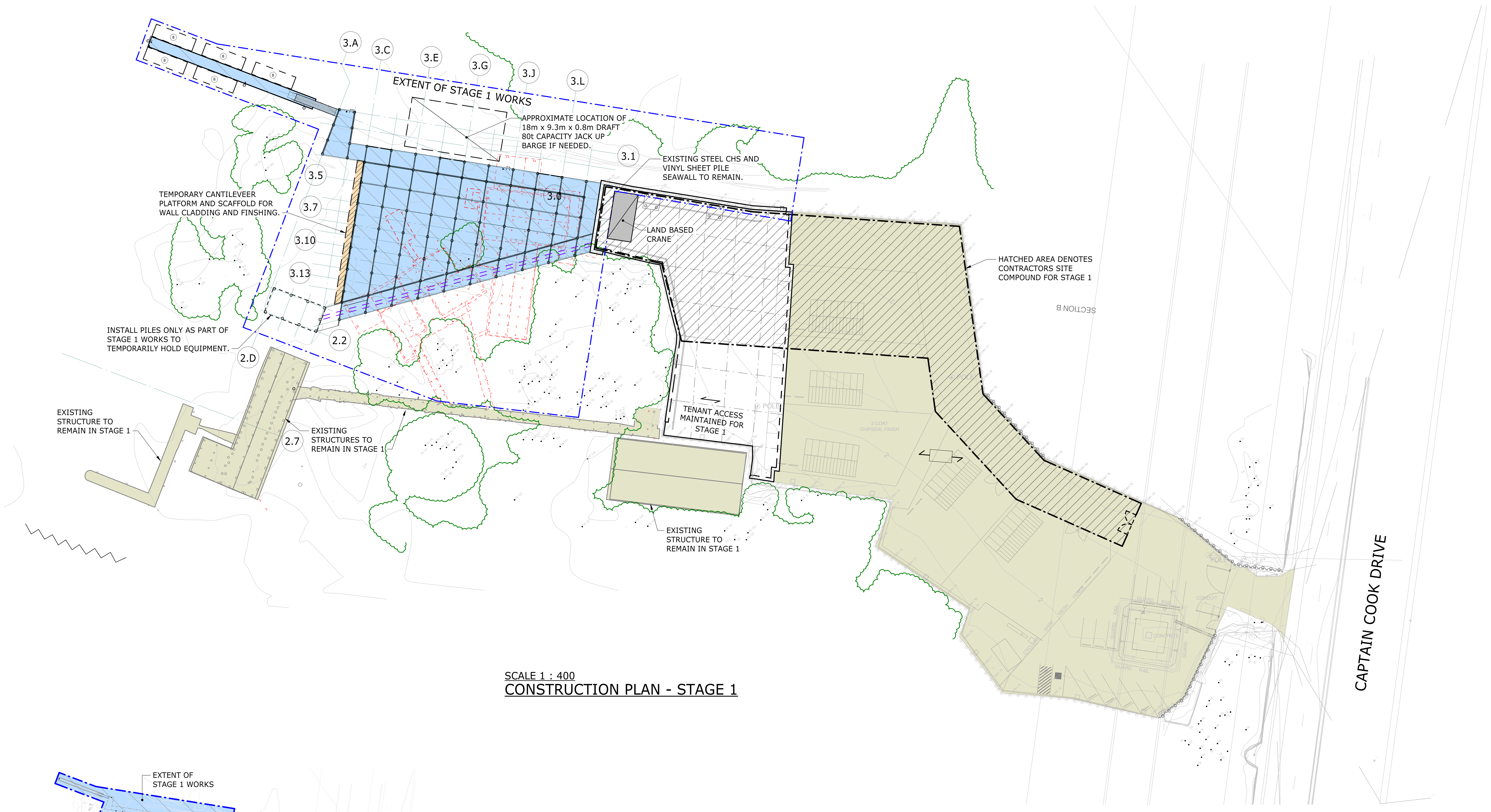
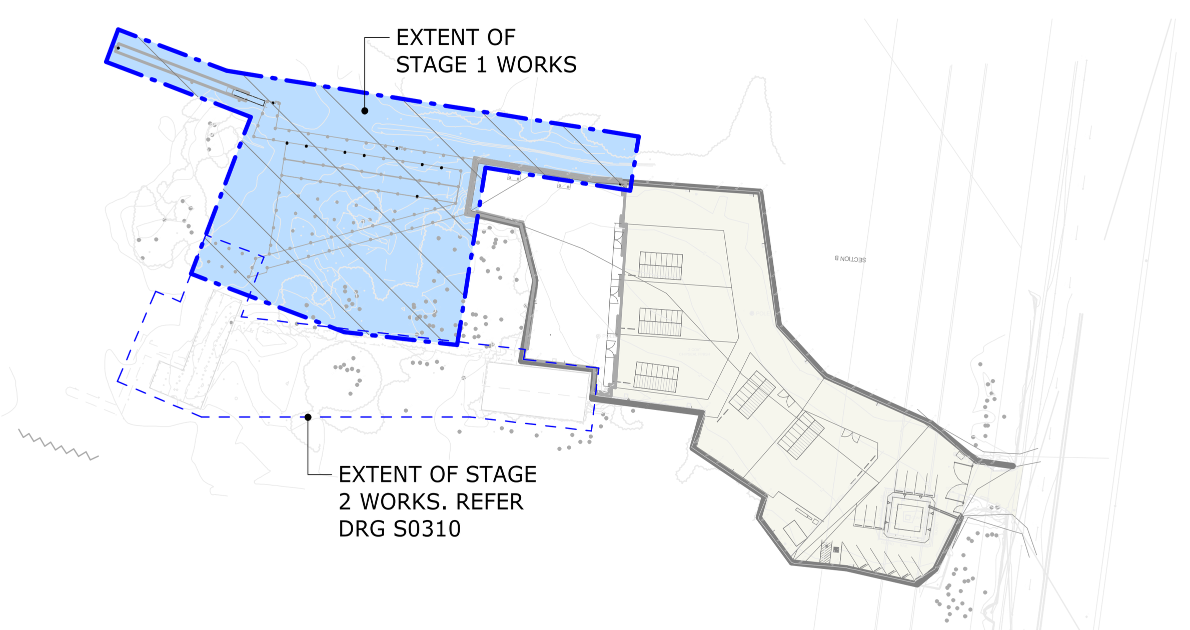


SCALE 1 : 400
CONSTRUCTION PLAN - STAGE 1



SCALE 1 : 1500
CONSTRUCTION STAGING KEY PLAN STAGE 1

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : As indicated
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
CONSTRUCTION STAGING PLAN - STAGE 1

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0310	0

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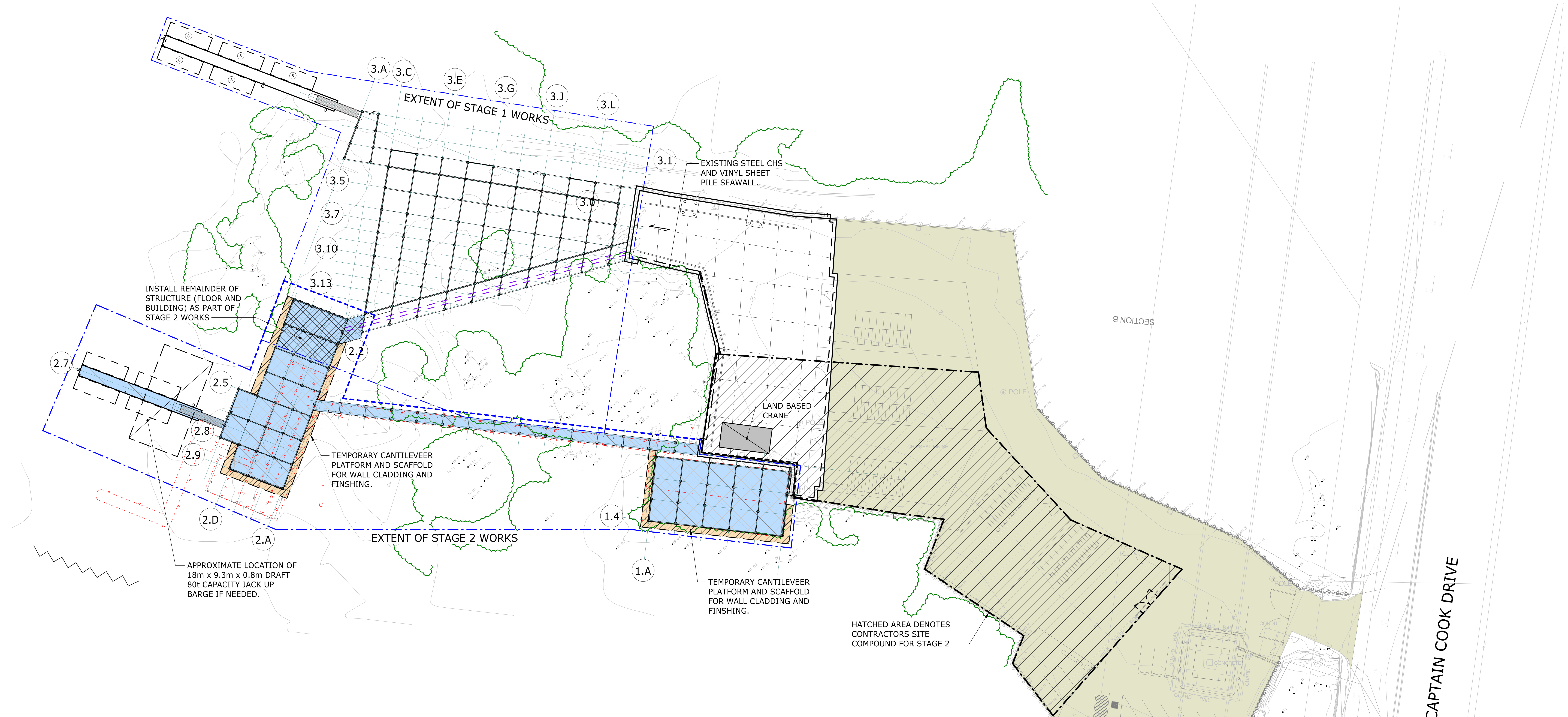
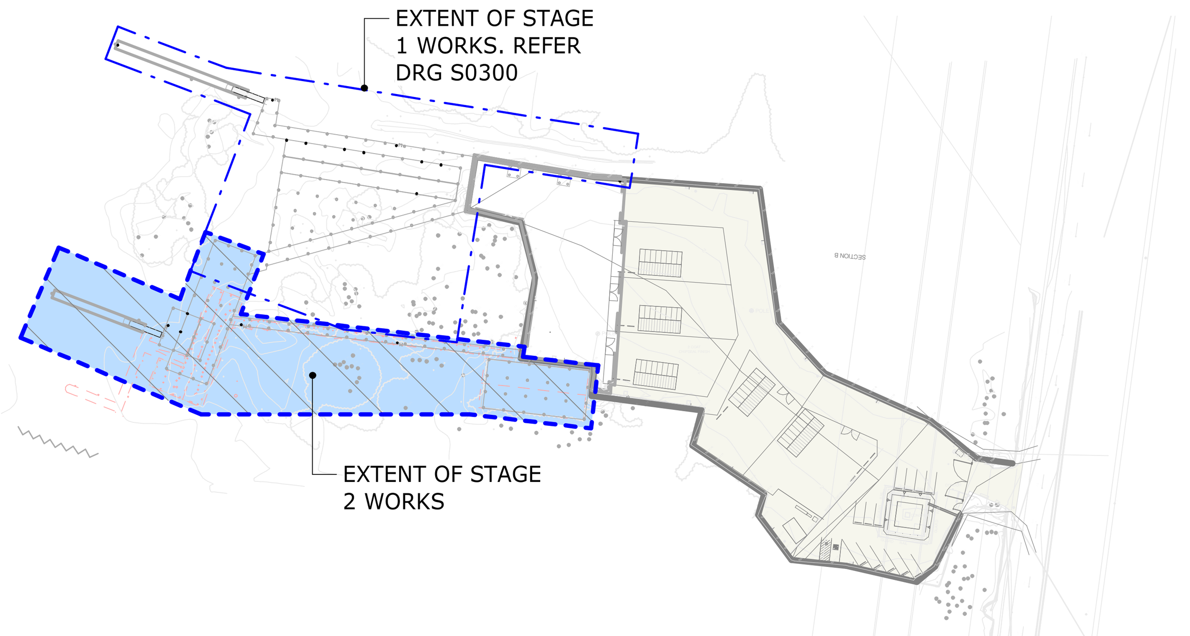
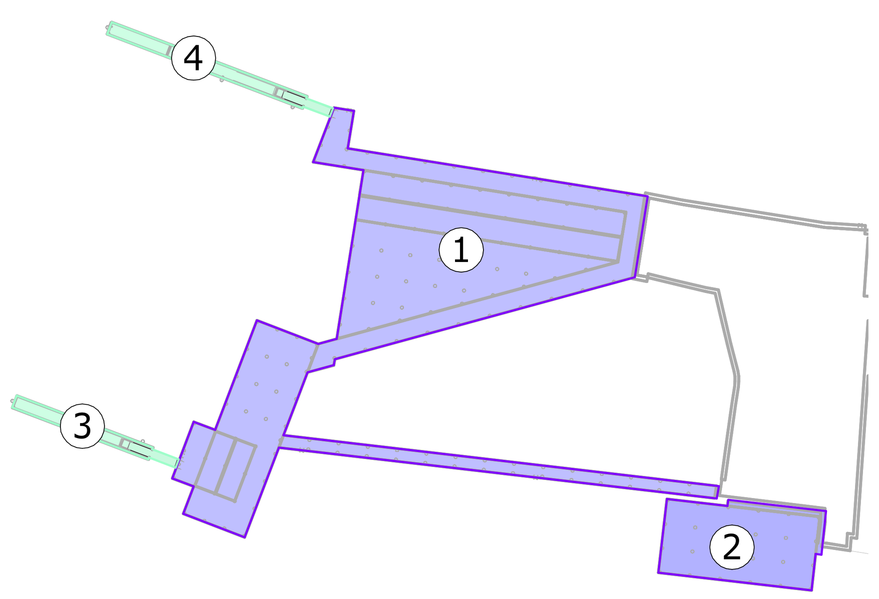


SCALE 1 : 400
CONSTRUCTION PLAN - STAGE 2



SCALE 1 : 1500
CONSTRUCTION STAGING KEY PLAN STAGE 2



SCALE 1 : 1000
DEVELOPMENT AREAS

DEVELOPMENT AREAS	
AREA No.	AREA
1	1613 m²
2	306 m²
TOTAL AREA OF NEW OVERWATER FIXED STRUCTURES - STAGE 1 & STAGE 2	1920 m²
3	52 m²
4	72 m²
TOTAL AREA OF NEW FLOATING STRUCTURES & GANGWAYS - STAGE 1 & STAGE 2	125 m²

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
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A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : As indicated
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
CONSTRUCTION STAGING PLAN - STAGE 2

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0320	0

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CONSTRUCTION SEQUENCE - SUBSTRUCTURE DEMOLITION AND PILING

STAGE 1

1. INSTALL STEEL CHS PILES AT 3.4/3.M & 3.5/3.M
2. INSTALL HDPE SLEEVES OVER PILES AT 3.4/3.M & 3.5/3.M
3. INSTALL PILING MAT TO SPAN FROM LAND TO PILES ON GRID 3.M
4. POSITION RIG ON PILING MAT
5. DEMOLISH FLOOR STRUCTURE & PILES AHEAD.
6. INSTALL STEEL CHS PILES AT 3.4/3.L & 3.5/3.L
7. INSTALL HDPE SLEEVES OVER PILES AT 3.4/3.L & 3.5/3.L
8. INSTALL SECOND PILING MAT SPANNING FROM PILES ON GRID 3.M TO PILES ON GRID 3.L
9. MOVE RIG FORWARD

REPEAT STEPS 5-9

MOVE SIDEWAYS IN A SIMILAR FASHION. INTRODUCE NEW PILING MATS TO SUIT GEOMETRY AS NEEDED. ON COMPLETION OF STAGE 1, PARK RIG ON EASTERN PILES OF BUILDING 2. ALTERNATIVELY, LIFT RIG OFF USING JACK UP BARGE.

STAGE 2

SIMILAR TO STAGE 1. WORK BACK TO LAND OR OUT FROM SEAWALL.

CONSTRUCTION SEQUENCE - FLOOR, WALL & ROOF FRAMING

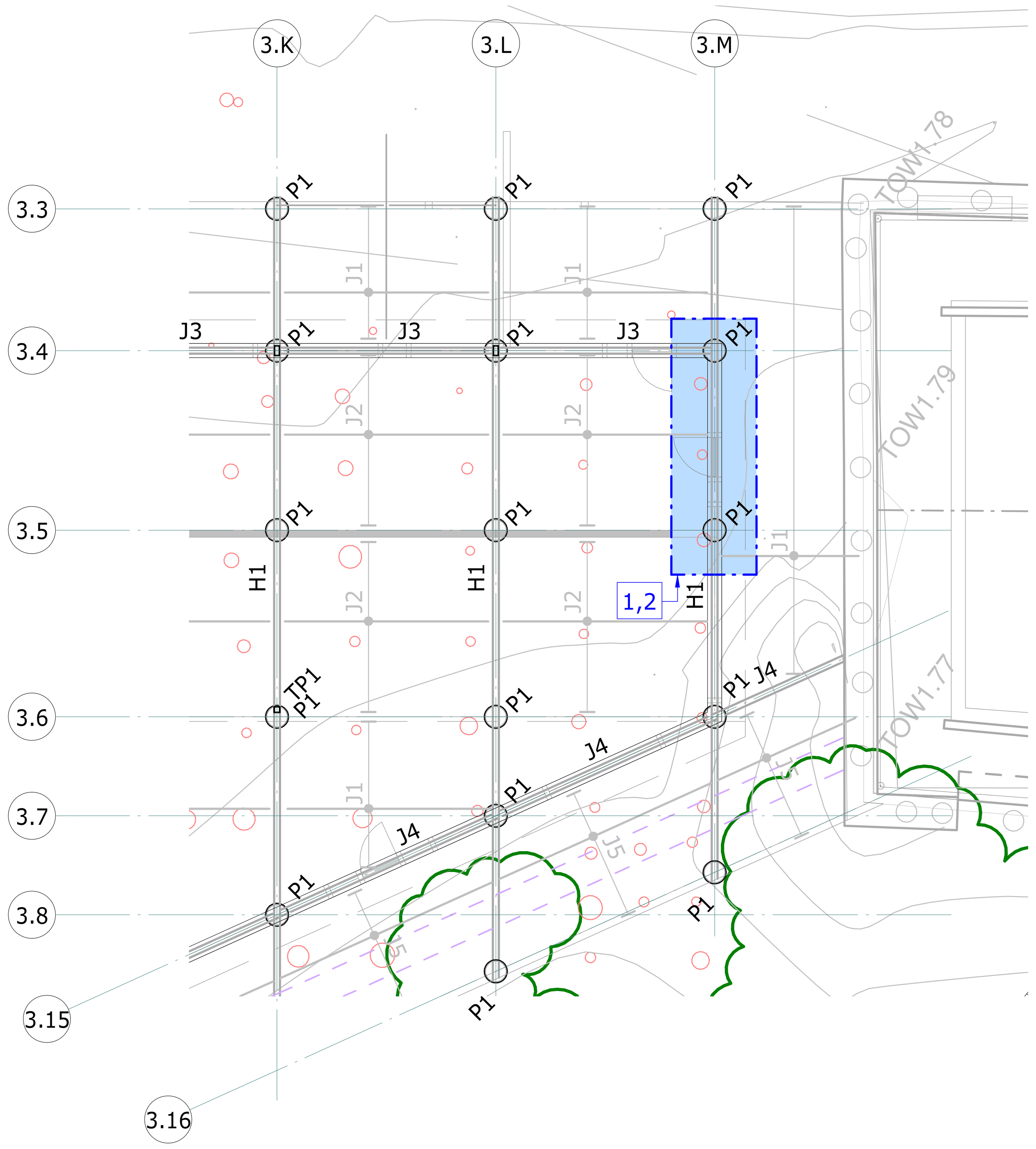
10. CONCRETE FILL PILES ON GRID 3.M
11. INSTALL HEADSTOCKS 3.M
12. INSTALL JOISTS AND DECKING OUT TO GRID 3.M
13. USING TEMPORARY SUPPORT BEAM FOR THE CONCRETE PUMP LINE, CONCRETE FILL PILES ON GRID 3.L.
14. INSTALL HEADSTOCKS ON GRID 3.L
15. INSTALL JOISTS AND DECKING OUT TO GRID 3.L

REPEAT STEPS 13-15

LIFTING CAN BE DONE USING A SMALL MAEDA CRAWLER CRANE OR SIMILAR ON THE FINISHED DECKING.

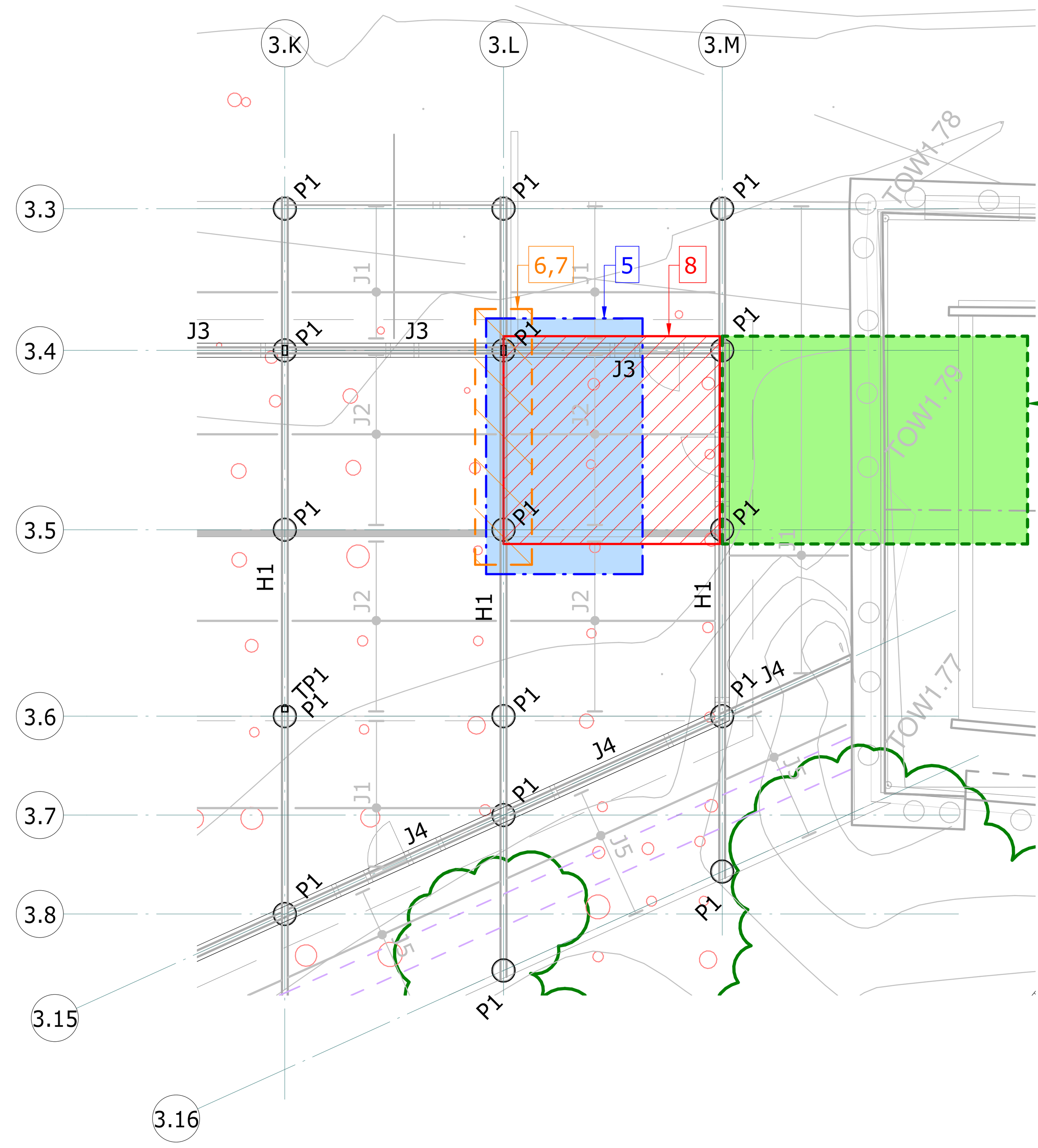
ALTERNATIVELY, LIFTING CAN BE DONE USING LAND BASED AND/OR JACK-UP BARGE BASED CRANES.

WALL AND ROOF FRAMING TO BE CONSTRUCTED USING LAND BASED AND JACK UP BARGE BASED CRANES.



SCALE 1 : 100

CONSTRUCTION SEQUENCE PLAN No. 1-2



SCALE 1 : 100

CONSTRUCTION SEQUENCE PLAN No. 3-8

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SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
A	70% ISSUE	11.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
CONSTRUCTION SEQUENCE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0350	0

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SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 200
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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SCALE 1 : 200
FLORA IMPACT PLAN

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
FLORA IMPACT PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0400	0

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REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD

SCALE : 1 : 200

SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21

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SCALE 1 : 200
OVERWATER STRUCTURE SITE PLAN

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TRANSPORT FOR NSW

WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES

OVERWATER STRUCTURE SITE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1000	0

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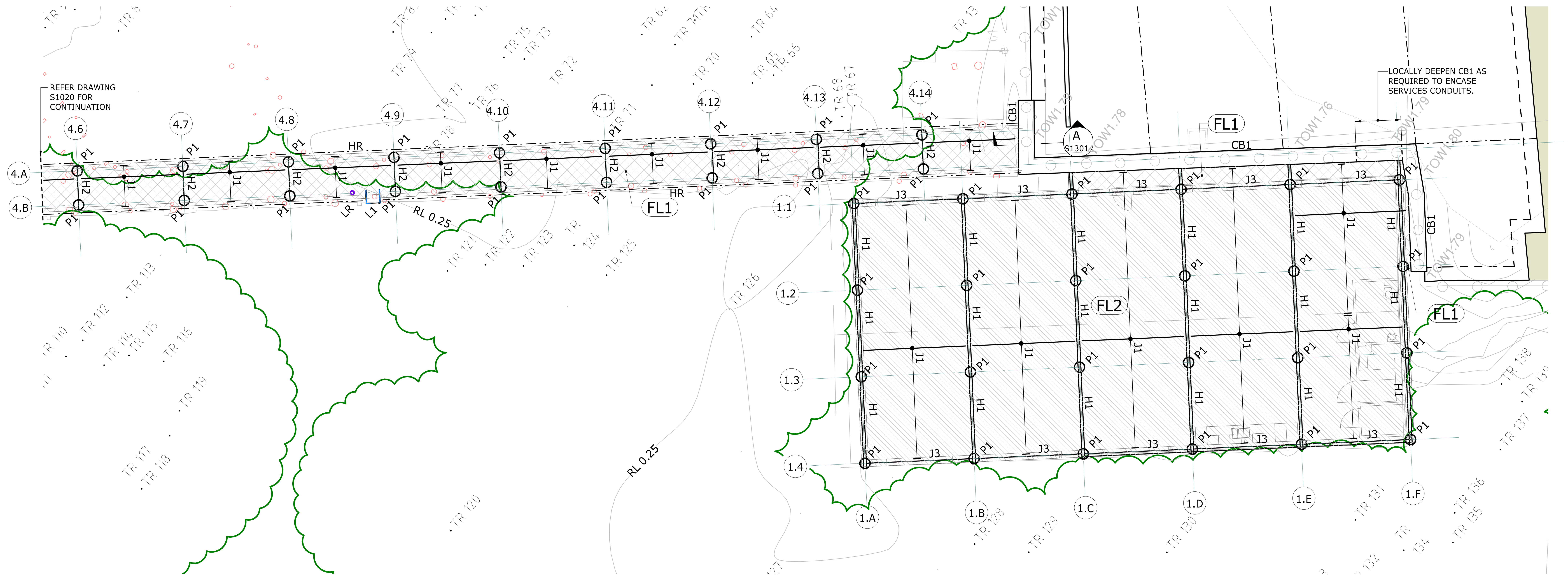

SCALE 1 : 100

FLOOR FRAMING PLAN - BUILDING 1

LEGEND

MANGROVE CANOPY (FROM SURVEY)

TR 99 — MANGROVES (FROM SURVEY)

EXISTING PILE TO BE DEMOLISHED

HR — WEBFORGE BAL-1D BALUSTRADE WITH HANDRAIL TO COMPLY WITH AS1170.1 TABLE 3.3 OCCUPANCY C3 LOADING AND AS1428

8 — BERTH LENGTH

PONTOON. HDPE FLOATS, ALUMINIUM FRAMING AND FRP MINIMESH DECKING. REFER PLAN FOR SIZE

GW — 8m LONG HINGED GANGWAY:
- ALUMINIUM FRAMED
- FRP MINIMESH DECKING
- TRUSSES AND HANDRAILS EACH SIDE
- 1000MIN. INTERNAL WIDTH BETWEEN HANDRAILS. (1400 APPROX. OVERALL WIDTH).

REFER DRAWING S1310 FOR DETAILS

Prefix Legend - Foundations

PREFIX	DESCRIPTION	DETAIL & SCHEDULE REFERENCE
CB	Capping Beam	S1301
P	Pile	S1300
PC	Pile Cap	S1301

MEMBER SCHEDULE

MARK	SIZE	NOTES
FL1	38mm FRP 'WEBFORGE' MINI-MESH	COLOUR TBC
FL2	43mm FLAT TOP FRP 'WEBFORGE' MINI-MESH	COLOUR TBC. PROVIDE SUITABLE WATERPROOF AND COLOUR MATCHED FLEXIBLE SEALANT BETWEEN SHEETS.
H1	2/375x125x6.5 WAGNERS BRB	HEADSTOCKS. 1 SPAN
H2	2/250x125x6.5 WAGNERS BRB	HEADSTOCKS. 1 SPAN
J1	250x125x6.5 WAGNERS BRB	JOISTS AT 600 MAX. CTS.
J2	250x125x6.5 WAGNERS BRB	JOISTS AT 600 MAX. CTS. LAID TO SUIT FALL IN FLOOR
J3	375(250)x125x6.5 WAGNERS BRB	JOISTS
J4	2/375(250)x125x6.5 WAGNERS BRB	JOISTS
J5	250x125x6.5 WAGNERS BRB	JOISTS AT 600 MAX. CTS.
L1	LADDER	REFER DETAILS ON S1320
L2	LADDER	REFER TO DETAILS ON S1320
L3	LADDER	DETAILS BY PONTOON SUPPLIER.
LB1	360UB50.7	LIFTING BEAM. SWL 2 TONNES
LR	LIFE RING ON STAND	
RL1	41kg RAIL TO AS 1085.1	
SB1	300 x 200 x 6.0 RHS	
SC1	100 x 100 x 6.0 SHS	INCLINED COLUMN
SC2	200 x 100 x 6.0 RHS	COLUMN
SP	SERVICES PEDESTAL (LIGHT/POWER/WATER)	
TP1	POST TO SUPPORT MIDSPAN OF TR3 OVER TBC	BY CONTRACTOR

TRUSS SCHEDULE

MARK	SIZE
TR1	PARALLEL CHORD TRUSS BY CONTRACTOR
TR2	PARALLEL CHORD TRUSS BY CONTRACTOR
TR3	PARALLEL CHORD TRUSS BY CONTRACTOR
TR4	TRIANGULAR TRUSSES BY CONTRACTOR
TR5	TRIANGULAR TRUSSES BY CONTRACTOR
TR6	PITCHED TRUSSES BY CONTRACTOR
TR7	PITCHED TRUSSES BY CONTRACTOR

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REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 1

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1010	0

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Prefix Legend - Foundations

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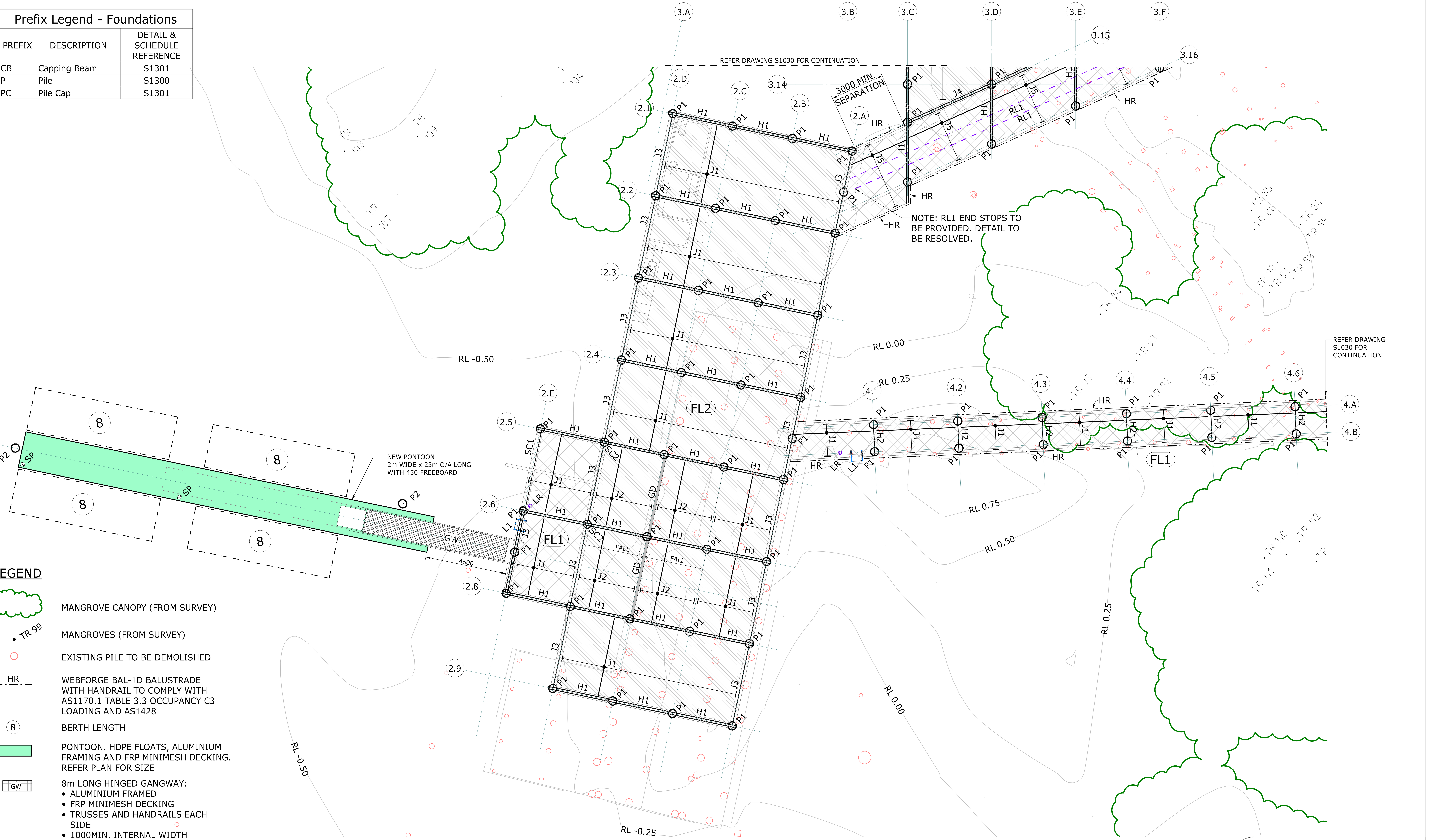
PC	Pile Cap	S1301



LEGEND

	MANGROVE CANOPY (FROM SURVEY)
TR 99	MANGROVES (FROM SURVEY)
	EXISTING PILE TO BE DEMOLISHED
HR	WEBFORGE BAL-1D BALUSTRADE WITH HANDRAIL TO COMPLY WITH AS1170.1 TABLE 3.3 OCCUPANCY C3 LOADING AND AS1428
8	BERTH LENGTH
	PONTOON. HDPE FLOATS, ALUMINIUM FRAMING AND FRP MINIMESH DECKING. REFER PLAN FOR SIZE
GW	8m LONG HINGED GANGWAY: • ALUMINIUM FRAMED • FRP MINIMESH DECKING • TRUSSES AND HANDRAILS EACH SIDE • 1000MIN. INTERNAL WIDTH BETWEEN HANDRAILS. (1400 APPROX. OVERALL WIDTH). REFER DRAWING S1310 FOR DETAILS

SCALE 1 : 100

FLOOR FRAMING PLAN - BUILDING 2

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REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE A1

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0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 2

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1020	0

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FLOOR FRAMING PLAN - BUILDING 3

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

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B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

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DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 3

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1030	0

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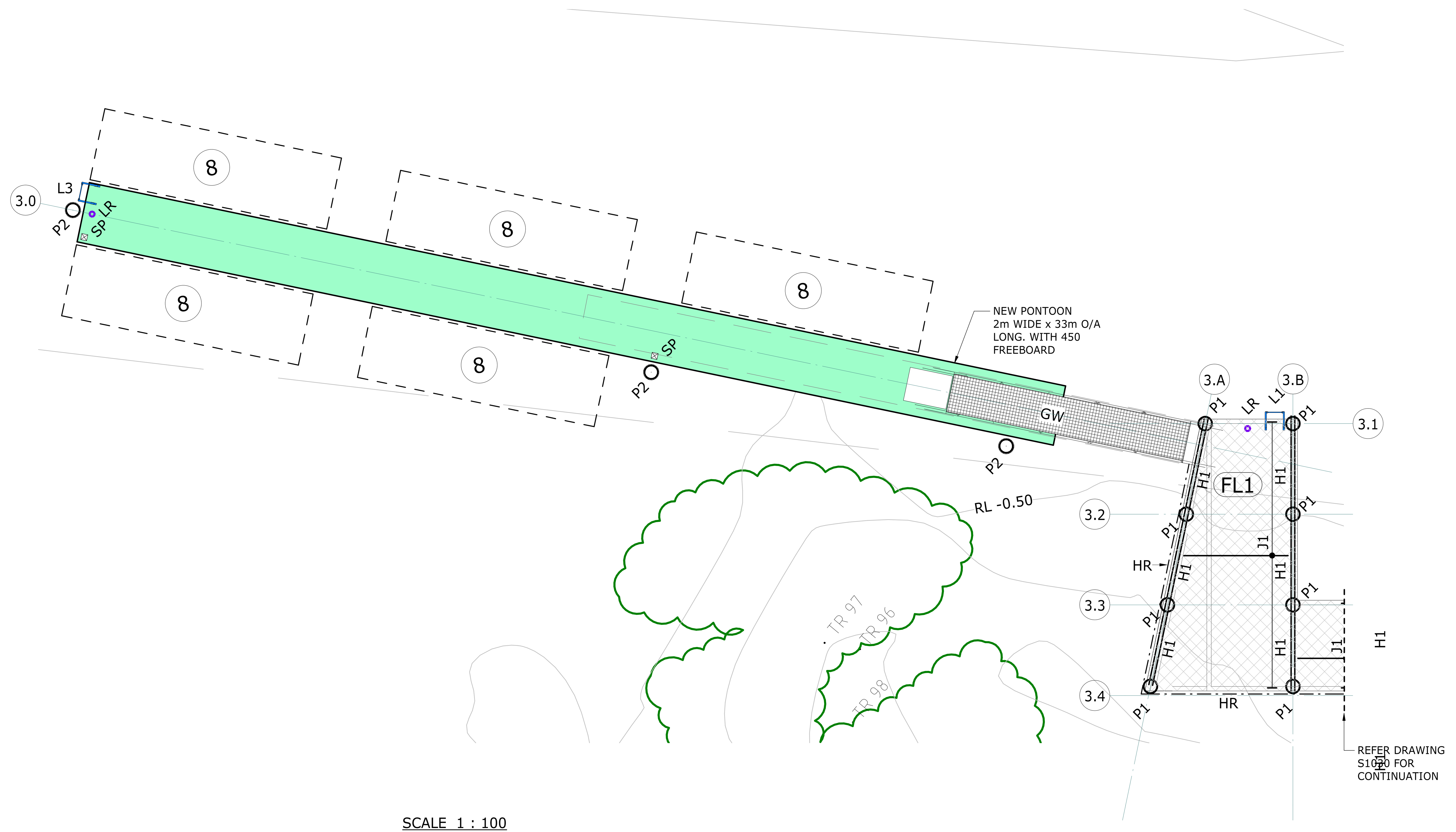

SCALE 1 : 100
OVERWATER STRUCTURE - BUILDING 3 PONTOON

LEGEND

MANGROVE CANOPY (FROM SURVEY)

TR 99 MANGROVES (FROM SURVEY)

EXISTING PILE TO BE DEMOLISHED

HR WEBFORGE BAL-1D BALUSTRADE WITH HANDRAIL TO COMPLY WITH AS1170.1 TABLE 3.3 OCCUPANCY C3 LOADING AND AS1428

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REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
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A	70% ISSUE	11.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : As indicated
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 3 GANGWAY

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1031	0

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Appendix D

Biodiversity Impact Assessment

Transport for NSW

Oyster Farm Project, Woolooware Bay

Removal of Overwater Structures & Construction

FINAL

Biodiversity Impact Assessment

March 2022

Alison Hunt and Associates Pty Ltd

TERRESTRIAL | MARINE | AQUATIC

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GLOSSARY

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GLOSSARIES

Definitions

Construction footprint	The area to be directly impacted by the proposal during construction activities (see definition for subject land).
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat, and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020)
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020).
Local population	Local population: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area. • The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area. • The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year. (OEH 2018)
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act.
Mitigation	Action to reduce the severity of an impact.

Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality or injury.
Native vegetation	(a) trees (including any sapling or shrub or any scrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020).
Proposal area/site/ footprint	The area of land that is directly impacted on by the proposal that is being assessed under the EP&A Act, including access roads, and areas used to store construction materials. It includes the construction and operational areas for the proposal.
Study area	The area directly affected by the proposal and any additional areas likely to be affected by the proposal, either directly or indirectly. See also definition of local population.
Target species	A species has been identified within the study area or is considered to have a moderate to high likelihood of occurrence and may be impacted by the proposal.

Abbreviation	
AHD	Australian Height Datum
AH Ecology	Alison Hunt & Associates Pty Ltd
APP	APP Corporation Pty Ltd
ASL	Above Sea Level
BC Act	NSW *Biodiversity Conservation Act 2016*
°C	Degrees Celsius
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DAWE	Department of Agriculture, Water and the Environment
DBH	Diameter at breast height (1.4 m from ground level)
DECC	NSW Department of Environment and Climate Change (now known as the NSW Office of Environment and Heritage).
DoEE	Former Commonwealth Department of the Environment and Energy
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
E	Endangered
EEC	Endangered Ecological Communities
EP	Endangered Population
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation.*
EPA Act	NSW *Environmental Planning and Assessment Act 1979*
ESCP	Erosion and Sedimentation Control Plan
FM Act	NSW *Fisheries Management Act 1994*
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
LGA	Local Government Area
Mar	Marine
M	Migratory
MEM Act	*Marine Estate Management Act 2014*
MNES	Matter of National Environmental Significance.
mm/cm/m/km/ha	Millimetres, centimetres, metres, kilometres, hectares
NSW	New South Wales
NPW Act	NSW *National Parks and Wildlife Act 1974*

OEH	Former NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	EPBC Act Protected Matters Search Tool
REF	Review of Environmental Factors
RMS	Roads and Maritime Services
RoTAP	Rare or Threatened Australian Plant
SIS	Species Impact Statement.
TEC	Threatened Ecological Communities
TPZ	Tree protection zone
V	Vulnerable
VEC	Vulnerable Ecological Community
VIS	Vegetation information system

EXECUTIVE SUMMARY

Alison Hunt & Associates Pty Ltd (AH Ecology) was commissioned by APP Corporation Pty Ltd (APP) on behalf of Transport for NSW (TfNSW) to undertake a biodiversity assessment of the impacts of the removal of the existing overwater structures and construction of new facilities (Lot 3 DP1165618) at the Oyster Farm, located along Captain Cook Drive, fronting Woolooware Bay, NSW (the 'Site'). This impact assessment has been prepared to accompany a Review of Environmental Factors (REF) being prepared to satisfy TfNSW duties under s. 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), an application for consent of the Minister to carry out activities in the Towra Point Aquatic Reserve as required to under the *Marine Estate Management Act 2014*, and an application to the Department of Primary Industries for a Part 7 *Fisheries Management Act 1994* permit to harm marine vegetation.

The Site currently comprises a series of raised wooden walkways, and a number of large sheds and smaller buildings all constructed on piers, which support these above the intertidal and subtidal zones. Several wooden walkways, piers and small pontoons extend, from these buildings into Woolooware Bay. A channel and loading dock area extends along the eastern boundary and provides access for barges and boats to Woolooware Bay. New facilities would be constructed across the Site. These would be constructed to meet current design requirements and to facilitate the ongoing oyster farm operations. To achieve these outcomes the current overwater structures would be demolished and removed off-site. These would be replaced with newly constructed facilities broadly covering the same footprint area. The proposal is for staged demolition and construction.

Ecological studies have been undertaken across the Site since 2016, to support other stages of the Oyster Farm Project, including the remediation of the soils of the Site and removal and replacement of the seawall. Those studies have been used to provide the basis of the studies undertaken for this phase. Additional studies for this phase included updated estuarine and marine ecology, dedicated bird surveys, incidental fauna surveys and targeted bat surveys. Our assessment of impacts was based on the Constructability Assessment undertaken by Tonkin Consulting Pty Ltd (2021). As noted in their report, the Constructability Assessment was based on a 70 % design package as details are yet to be finalised, and as such their assessment should be considered as preliminary only. Hence, should the final construction design differ substantively from this preliminary design then this biodiversity impact assessment would require revision to include these changes.

The Site is situated on the southern shore of Botany Bay within Woolooware Bay and is adjacent to a number of significant areas of biodiversity conservation including Coastal Wetlands, Towra Point Nature Reserve and Ramsar wetland, Towra Point Aquatic Reserve and associated values, Woolooware Bay and Botany Bay, Grey Mangrove forests, Coastal Saltmarsh and Seagrass communities, The Shorebird Community occurring on the relict tidal delta sands at Taren Point, and other Endangered Ecological Communities, populations and threatened species listed under the EPBC Act and BC Act.

The overwater structures are located within a Grey Mangrove (*Avicennia marina*) Forest community which extends to the north, east and west. The Grey Mangrove canopy is low and dense, and pneumatophores and seedlings are common. No other plant species were recorded within this forested area. No mangroves or seagrass were recorded growing on the muddy / silty substrate of the channel bordering the east of the Site or to the area adjacent to the Site.

Of the approximately 50 threatened species, either known or predicted to occur across the locality, only the Large Bent-winged Bat (*Miniopterus orianae oceanensis*), which is listed as Vulnerable under the BC Act, was recorded across the Site. Probable calls of this species were recorded infrequently and it was concluded that it is unlikely that this species is roosting on the Site but instead foraging across the Site intermittently. Calls of the Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as Vulnerable under the EPBC Act and BC Act, were also recorded 600 m east of the Site, suggesting that it too may forage across the Site intermittently. Whilst no threatened birds were recorded foraging across the Site, a Whimbrel (*Numenius phaeopus*), listed as Marine / Migratory under the EPBC Act, was observed 150 m west of the Site in 2017. In addition, a pair of Australian Pied Oystercatchers (*Haematopus longirostris)*, which is listed as Endangered under the BC Act, were recorded perched 100 m north-east of the Site.

There will be no removal and / or trimming of Grey Mangrove trees from within the Towra Point Nature Reserve. Allied Tree Consultancy (2021) determined that a total of 8 Grey Mangrove trees across the Site would need to be removed (6 during demolition and 2 for construction). A further 37 Grey Mangrove trees would need to be pruned and / or branches tied back during demolition and construction. The majority of impacts to Grey Mangrove trees are associated with works around the current wooden walkway connecting the landside to the most northerly building. Many of the trees trimmed in 2019 for the construction of the new seawall at the Oyster Farm Site now have epicormic growth on branches and / or trunks demonstrating that sympathetic pruning of these trees is a successful way to mitigate against larger tree loses. A permit under Part 7 of the FM Act is required to harm marine vegetation (i.e. Mangroves).

Currently there is 160.3 m^2 area of floating structures and 1,429 m^2 area of fixed structures across the Site. These will be removed and replaced with 125 m^2 area of floating structures and 1,920 m^2 area of fixed structures across the Site. Whilst the area of floating structures and gangways would be reduced by 35.3 m^2 the footprint of overwater fixed structures would by increased by 491.0 m^2. The largest changes are across the far north-eastern section of the Site where numerous smaller structures would be removed and replaced with a larger shed-style building and jetty which stretches out to the small island of Grey Mangroves just offshore. Inclusion of an additional 491.0 m^2 of overwater structure would change the estuarine habitat beneath this structure, as the area would be shaded and thereby limiting access to some fauna.

There are a number of potential risks to sensitive receptors during demolition of the existing structures and construction of the new facilities as the Site is located adjacent to a number of important and sensitive receptors (i.e. Proximity Area for Coastal Wetlands, Coastal Wetland, Grey Mangrove forests, Towra Point Nature Reserve Ramsar Wetland, Towra Point Aquatic Reserve, Woolooware Bay and Botany Bay) and it is these areas of high conservation significance which could potentially be at risk from this proposal. These risks in particular include impacts on water quality during demolition and construction as a consequence of mobilisation of sediments during civil works and run-off off contaminants. These, and other risks, were assessed as required under the EP&A Act and the EPBC Act.

The Tests of Significance (Part 7 of the BC Act) concluded that the risks to species, populations, communities and habitats within Woolooware Bay and the larger Botany Bay could be managed with commonly applied measures. Therefore, it is considered unlikely that this proposal would cause significant impacts, and hence the preparation of a Species Impact Statement is not required.

The EPBC Act assessments also concluded the risks to Towra Point Nature Reserve, and species and habitat within Woolooware Bay and locality could be managed and mitigated with commonly applied measures that have been documented within the Construction Environmental Management Plan and Erosion and Sediment Control Plan. Key to these mitigation measures will be the protection of the adjacent areas of conservation significance.

The earlier stages of the Oyster Farm Project (i.e. extensive soil remediation and seawall replacement) were undertaken successfully without perceivable significant impacts on adjacent and nearby sensitive receptors, demonstrating that with stringent measures and sympathetic management of the Site these areas of high biodiversity conservation could be protected and enhanced.

1 INTRODUCTION

1.1 Background

Alison Hunt & Associates Pty Ltd (AH Ecology) was commissioned by APP Corporation Pty Ltd (APP) on behalf of Transport for NSW (TfNSW) to undertake a biodiversity assessment of the impacts of the removal of the existing overwater structures and construction of new facilities (Lot 3 DP1165618) at the Oyster Farm, located along Captain Cook Drive, fronting Woolooware Bay, NSW (the 'Site') (Figure 1) (Plate1 & 2). This impact assessment has been prepared to accompany:

- An application to the Department of Primary Industries for a Part 7 *Fisheries Management Act 1994* permit to harm marine vegetation;
- An application for consent of the Minister to carry out activities in the Towra Point Aquatic Reserve as required to under the *Marine Estate Management Act 2014*; and
- A Review of Environmental Factors (REF) being prepared to satisfy TfNSW duties under s. 5.5 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The assessment incorporates the findings of reports that have previously been prepared for this project including:

- AH Ecology 2017 Road & Maritime Services. Remediation Project. Oyster Farm, Woolooware Bay. Biodiversity Impact Assessment. Alison Hunt & Associates Pty Ltd. Prepared for APP Corporation Pty Ltd. October 2017;
- AH Ecology 2019 Road & Maritime Services. Remediation Project. Oyster Farm, Woolooware Bay. Seawall Addendum Alison Hunt & Associates Pty Ltd. Prepared for APP Corporation Pty Ltd. September 2019; and
- AH Ecology 2020 Remediation Project. Sewall Demolition & Construction. Oyster Farm, Woolooware Bay. Seawall Demolition & Construction. Prepared for APP Corporation Pty Ltd, on behalf of Transport for NSW. September 2020.

Figure 1 Location of the Oyster Farm, Woolooware Bay

Source: SIX Maps

Plate 1 Aerial view of the extant overwater structures slated for removal

Plate 2 Aerial view showing Site and adjacent Towra Point Nature Reserve

1.2 Aims

The purpose of this study was to assess the potential direct and indirect impacts of the proposal on biodiversity, especially in relation to threatened species, populations and endangered ecological communities. Key ecological issues that required clarification included:

- The presence or potential for endangered ecological communities, endangered populations, threatened species and / or their habitat listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) to occur on the Site and within the locality (10 km radius of the Site);
- The presence or potential for endangered ecological communities, endangered populations, threatened species and / or their habitat listed under the NSW *Fisheries Management Act 1994* (FM Act) to occur on the Site and within the locality;
- The presence or potential presence of any matters of National Environmental Significance (NES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to occur on the Site and within the locality;
- The potential for impacts of the proposed works on biodiversity, especially in relation to the BC Act, FM Act, EPBC Act and the *Marine Estate Management Act 2014* (MEM Act); and
- Recommendations for the avoidance of impacts and management or mitigation options.

1.3 Site Location & General Description

The Oyster Farm (i.e. the Site) is located in the southern Sydney suburb of Woolooware within the Sutherland Shire local government area (LGA), approximately 20 km south of the Sydney central business district. Woolooware is situated on the southern shores of Woolooware Bay which forms part of Botany Bay (Figure 1).

The Site comprises a series of raised wooden walkways, and a number of large sheds and smaller buildings all constructed on piers, which support these above the intertidal and subtidal zones. Several wooden walkways, piers and small pontoons extend, from these buildings into Woolooware Bay. The overwater structures are currently being used for aquaculture and oyster processing. These are the structures that will be removed and replaced. A channel and loading dock area extends along the eastern boundary and provided access for barges and boats to Woolooware Bay.

These structures extend from an irregular shaped parcel of reclaimed land totalling approximately 0.84 ha. The land side has been remediated, including the installation of a seawall around the seaward perimeter. Access to the Site is via an unpaved driveway from Captain Cook Drive. The land is zoned *W1 Natural Waterways* under the *Sutherland Shire Local Environmental Plan 2015*. W1 is a zone for waterways below the mean high water mark where there are ecological and scenic values that require careful consideration and management.

The Site is bordered to the west and east by mangrove forest and to the south by Captain Cook Drive and Woolooware High School and the Woolooware and Cronulla Golf Clubs. Towra Point Nature Reserve is located directly to the east of the Site.

1.4 Proposal

New facilities would be constructed across the Site (Figures 3 & 4). These would be constructed to meet current design requirements and to facilitate the ongoing oyster farm operations. To achieve these outcomes the current overwater structures (Plates 1 & 2) would be demolished and removed off-site. These would be replaced with newly constructed facilities broadly covering the same footprint area. The proposal is for staged demolition and construction as some of the existing overwater structures are occupied by the existing operator.

The design of the new facility and the demolition and construction methodology are yet to be finalised. A Constructability Assessment prepared by Tonkin Consulting Pty Ltd (2021) provides constructability advice on the proposed replacement of all overwater and floating structures at the Site. The components of particular relevance to the ecology of the Site and locality are noted below.

1.4.1 Demolition

- The existing superstructure is proposed to be removed to the land manually or by using small trolleys, and then disposed of to a licenced facility;
- The floating structures would be disconnected and towed to a nearby boat ramp or slipway where they can be lifted out of the water by crane and disposed of off-site;
- The hinged gangways could be removed with them at the same time;
- The tide will need to be sufficiently high for the pontoons to be floating for this operation to avoid damage to on-ground biodiversity, including Grey Mangrove pneumatophores;
- There may be an opportunity to lift these materials onto landside and dispose of to a licenced facility;
- Existing piles would be removed where possible. Those unable to be removed would be cut off at the sea floor;
- There is no excavation or dredging proposed; and
- An Environmental Sediment Control Plan would be implemented to minimise opportunities for mobilised sediments to extend into Woolooware Bay and Botany Bay (refer Section 7.3.3).

1.4.2 Construction

The design of the structures is yet to be finalised but the construction of the water-based structures is likely to include:

- Installation of steel circular piles with HDPE sleeves for corrosion protection. Concrete is proposed to fill to the tops of the piles (down to bed level) to facilitate connection to the structure;
- Piles located close to land would be installed using land-based equipment. Piles locations unable to be reached from shore would be installed using a progressive overwater construction technique;
- Installation of fibre reinforced plastic (FRP) floor framing (bearers and joists) spanning between the piles, FRP mesh as external decking and FRP panels as internal flooring;
- Installation of timber wall framing with some structural steel elements and light weight cladding;
- Installation of timber roof framing with some structural steel elements with metal and polycarbonate roof sheeting;

- Installation of the wall and roof framing which may be supplied to Site as prefabricated wall panels and roof trusses similar to domestic-type construction;
- Installation of services to the overwater structures will be provided from land and will include water (including wet fire systems), power, communications and sewer;
- Installation of building services either under the floor / deck structure, or at high level through roof spaces;
- Overwater structures to be Disability Discrimination Act (DDA) compliant;
- Installation of proprietary type pontoons with HDPE floats, aluminium framing, and FRP mesh decking;
- Installation of steel circular restraint piles with HDPE sleeves for corrosion protection;
- Installation of aluminium framed hinged gangways with FRP mesh decking;
- The floating pontoons will include proprietary services bollards with light, water and power; and
- Supply services will be run on the underside of the gangway and within services ducts in the pontoons in the usual way for marinas.

The land-based activities and features are likely to include:

- Temporary parking for construction workers will be provided in a designated area;
- The landside with be spilt by fencing during construction to allow the existing operator access to the building in which they conduct business. The other side of the divide would be the construction compound, amenities and used as storage;

  The vacant paved area which can be utilised to assist demolition and construction of the new overwater and floating structures;
- Upgrade to the existing services of the Site and the construction of new lead in services; and

The proposal would be constructed over a duration of up to twelve months starting in early 2021.

Standard construction hours would be employed:

- 7.00 am to 6.00 pm Monday to Friday;
- 8.00 am to 1.00 pm Saturdays; and
- No work on Sundays or public holidays.

Workforce on-site at any one time is expected to be around 10 – 15 people.

1.4.3 Plant and Equipment

The plant and equipment likely to be used across the Site would include:

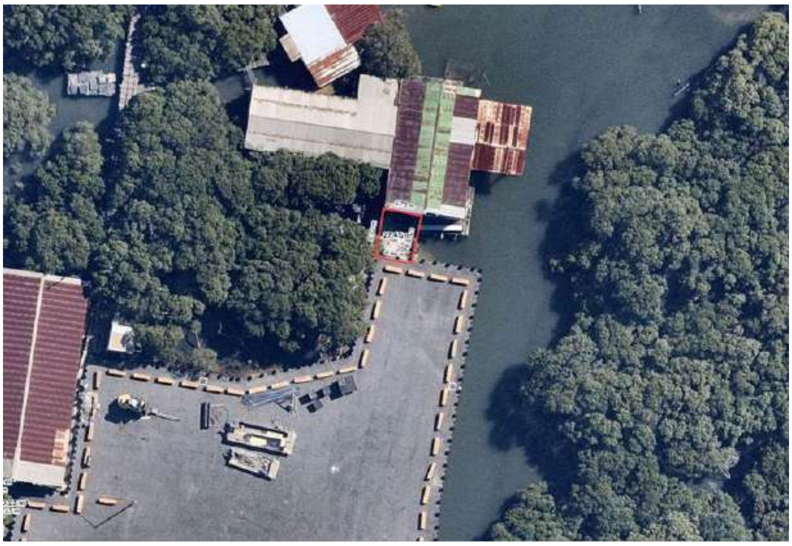
- 20 tonne excavators;
- Land mounted crane;
- Spider crane;
- Piling rig;
- Excavator;
- Concrete truck;
- Concrete pump;
- Floating boom;
- Hand tools;
- Generator;

- Oxyacetylene welder;
- Jack up barge or floating barges;
- Chainsaw; and
- Pneumatic drill / hammer.

1.4.4 Earthworks

There would be limited earthworks required. A small amount of sediment would be disturbed during the piling work, and demolition of the existing overwater structures. Earthworks during construction of the land-based elements would include demolition of existing pavements. Construction of the new ramps to tie in the landside to the overwater structures would require some minor earthworks. This would result in the removal and off-site disposal of an area of sediment (area outlined in red) shown in Figure 2. Construction of the capping beam pavement and kerbs may also involve limited earthworks.

Figure 2 Area of sediment removal (outlined in red)



1.4.5 Geotechnical Investigations

Geotechnical investigations would be undertaken post REF approval to determine rock depth to enable the construction of the driven steel CHS piles proposed for vertical and lateral support for the overwater / floating structures. Investigations would be focussed on the area of the main superstructure (Building 3) (Figure 3). These would comprise three bore holes drilled from a working barge setup on high tide as set out in JK Geotechnics (29 November 2021, Ref P54727SJRev2).

An Environmental Sediment Con troll Plan would be implemented to minimise opportunities for mobilised sediments to extend into Woolooware Bay and Botany Bay (refer Section 7.3.3).

1.4.6 Major Constraints

There is limited water depth in the immediate vicinity of the overwater structures and in Woolooware Bay. Over the footprint of the existing and new buildings and walkways, seabed levels generally vary from approximately +0.25 to -0.40 AHD. The tide heights vary from +0.925 to -1.175 AHD. The bed starts to become exposed above mid tide level and is completely exposed at most low tides. Over the footprint of the existing and proposed floating structures, bed levels generally vary from approximately 0.00 to -0.65 AHD and hence are designed to rest on the seabed at mid-tide level and below.

Figure 3 Proposed area of demolition and construction of new facilities

THIS DRAWING IS TO BE VIEWED IN COLOUR AS SOME FEATURES / SYMBOLS ARE DIFFERENTIATED BY COLOUR. DRAWING NOT TO BE RELIED ON IF PRINTED IN GREYSCALE.

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 200
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

SCALE 1 : 200
FLORA IMPACT PLAN

NOT FOR CONSTRUCTION

tonkin
tonkin.com.au

TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
FLORA IMPACT PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0400	0

© TONKIN CONSULTING
C:\Revit Local Files\2021\202079 Woolooware Bay R21_rhys.sanders.rvt 13/12/2021 2:05:51 PM

Image 1:
Existing birdseye view image of the existing Woolooware Bay Oyster Farm from the southern boundary that runs parralell to Captain Cook Drive. The image captures the view looking north to the city from the proposed site.

The site contains the newly constructed hardstand area that will be used as the site for the onland structures and connection to the overwater structures. The site also contains the existing oyster farm buildings proposed for removal.

Figure 4
3D view of existing structures & visualisation of proposed layout

Image 2:
A visualisation of the proposed layout for the new Woolooware Bay Oyster Farm.

The visualisation contains the proposed onland structures and overwater structures that will allow for commercial oyster farming within Woolooware Bay on a day to day basis.

DRAFT ONLY

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021			DWG NO LA-3	REV -	CLIENT Transport NSW
Rev	Description	Date	Tel. 02 9452 4911	admin@	ENGINEER Tonkin
A	For Information	21.09.2021	mob. 0419 501 681	pdsdesign.com.	

Paterson Design Studio PTY.LTD
Landscape Architects / Urban Designers
Registered Landscape Architect: Garth Paterson FAILA
Reg#716 BLA (CANB) MLAUD (HARV)
T + 61 2 9452 4911 admin@pdsdesign.com.au

2 LEGISLATIVE FRAMEWORK

2.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth EPBC Act requires assessment of proposed actions that are likely to cause significant impacts on Matters of National Environmental Significance (NES) listed under the EPBC Act. The EPBC Act identifies seven matters of NES, listed below.

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (Ramsar Wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

Those matters of NES relevant to this proposal includes wetlands of international importance, threatened species, populations, ecological communities and migratory species. The Site is located adjacent to a Ramsar Wetland (Figure 5).

2.2 NSW *Environmental Planning and Assessment Act 1979*

A Review of Environmental Factors (REF) is prepared to satisfy Transport for NSW (Transport) duties under s.5.5 of the EP&A Act to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity” and s.5.5 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for this proposal, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Part 7 of the BC Act and Part 7A of the FM Act require that the significance of the impact on threatened species and endangered ecological communities or their habitats is assessed using a five-part test at Section 7.3 of the BC Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head’s requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM).

2.3 NSW *Fisheries Management Act 1994*

The FM Act aims *to conserve, develop and share the fishery resources of the State for the benefit of present and future generations* and, in particular, to:

- Conserve fish stocks and key fish habitats;
- Conserve threatened species, populations and ecological communities of fish and marine vegetation;

- Promote ecologically sustainable development, including the conservation of biological diversity, and, consistently with those objectives;
- Promote viable commercial fishing and aquaculture industries;
- Promote quality recreational fishing opportunities;
- Appropriately share fisheries resources between the users of those resources; and
- Provide social and economic benefits for the wider community of New South Wales.

To meet these objectives, Part 7 of the FM Act outlines legislative provisions to protect fish habitat and Part 7A outlines provisions to conserve threatened species of fish and marine vegetation and their habitat.

Under the FM Act, fish means “marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead)” and includes oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes. The definition also includes any part of a fish, but does not include whales, other mammals, reptiles, birds, amphibians or other things excluded from the definition by the regulations.

2.4 NSW *Biodiversity Conservation Act 2016*

The purpose of this Act *is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.* BC Act applies to terrestrial and aquatic flora and fauna. Pursuant to the EP&A Act an assessment of the impacts of the proposed works in areas of critical habitat or that is likely to affect threatened species, populations or ecological communities, or their habitats listed under the BC Act, must be undertaken in the form of a Test of Significance (ToS) as defined under Part 7 of the BC Act for species listed under the BC Act. This involves assessing potential impacts of the proposal based on criteria that aid in assessing if the proposal is likely to have a significant impact on threatened species or their habitat or endangered ecological communities present at the Site or that have the potential to occur. If the ToS concludes that a significant impact is likely then a Development Application must be accompanied by a SIS.

2.5 NSW *Marine Estate Management Act 2014*

The *Marine Estate Management Act 2014* (MEM Act) provides the framework for the management of marine parks and aquatic reserves in NSW. Under Section 55(3) of the MEM Act (3) A determining authority (not being a Minister) must not carry out, or grant approval to carry out an activity (within the meaning of Part 5 of the E*nvironmental Planning and Assessment Act 1979*) unless the determining authority has:

(a) taken into consideration:
- (i) if there are management rules for the marine park or aquatic reserve, the purposes of the zone within the area concerned is situated as specified in those rules, and
- (ii) the permissible uses of the area concerned under the regulations or the management rules, and
- (iii) if a management plan for the marine park or aquatic reserve has been made, the objectives of the marine park or aquatic reserve, and
- (iv) any relevant marine park or aquatic reserve notifications

The Site is located adjacent to the Towra Point Aquatic Reserve (Figure 5), which is managed under the *Towra Point Aquatic Reserve Plan of Management 2001*. Under the MEM Act, if the determining authority considers that the proposal will have an effect on plants or animals within the aquatic reserve, then the determining authority must consult with the Minister for Environment and Minister for Primary Industry before determining the application.

2.6 *NSW Coastal Management Act 2016*

This Act aims to provide a strategic framework and objectives for managing coastal issues in NSW, and focusses on ecologically sustainable development. It defines the coastal zone as comprising four coastal management areas: Coastal Wetlands and Littoral Rainforests Areas, Coastal Vulnerability Areas, Coastal Environment Areas and Coastal Use Areas. The Act sets out specific management objectives for each of these zones.

2.7 *State Environmental Planning Policy (Coastal Management) 2018*

This SEPP gives effect to the objectives of the *Coastal Management Act 2016* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. *Clause 15* of the *Coastal Management SEPP* applies to all land within the coastal zone and requires that: development consent must not be granted to development on land within the coastal zone unless the consent authority is satisfied that the proposed development is not likely to cause increased risk of coastal hazards on that land or other land. The Site is located adjacent to an area mapped as Coastal Wetland (Figure 7).

2.8 *NSW Oyster Industry Sustainable Aquaculture Strategy 2016*

Priority Oyster Aquaculture Area areas have been designated as priority oyster aquaculture areas in line with the recommendations of the Healthy Rivers Commission in its Healthy Oysters, Healthy Rivers report (HRC 2003). Identifying priority oyster aquaculture areas recognises the importance of the industry to state and regional economies and the need to implement planning reforms that facilitate the environmental sustainability of the industry. The Site is mapped as a Priority Oyster Aquaculture Area (Figure 7)

3 ASSESSMENT METHODS

This assessment was undertaken to describe the biodiversity values of the Site and locality and assess the potential impacts of the proposal on biodiversity using the framework provided by Part 5A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act), NSW BC Act, FM Act and Commonwealth EPBC Act, and with reference to the *Threatened Species Test of Significance Guidelines* (OEH 2018) and *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DoE 2013).

3.1 Literature Reviewed

A review of available literature and databases was undertaken to assist with the identification of Site values, especially in relation to threatened species, populations and endangered ecological communities. A full list of reference materials is provided at Section 9 and those of particular relevance are listed below.

- Department of Planning, Industry & Environment (DPIE) – BioNet database [Atlas of NSW Wildlife] Threatened species database records (10 km radius of the Site) (accessed September 2021);
- NSW Department of Primary Industries (DPI) – Threatened Species Lists (accessed Au September 2021);
- Department of Agriculture, Water & Energy (DAWE) – Online protected matters search tool for MNES under the EPBC Act (10 km radius of the Site) (accessed September 2021);
- JBS&G 2016b DRAFT Remedial Action Plan. 'The Oyster Farm'. Captain Cook Drive, Woolooware NSW. Prepared for APP Corporation Pty Ltd. 23 November 2016, 51163 / 106148 (Rev A);
- AH Ecology 2017 Road & Maritime Services. Remediation Project. Oyster Farm, Woolooware Bay. Biodiversity Impact Assessment. Alison Hunt & Associates Pty Ltd. Prepared for APP Corporation Pty Ltd. October 2017;
- AH Ecology 2019 Road & Maritime Services. Remediation Project. Oyster Farm, Woolooware Bay. Seawall Addendum Alison Hunt & Associates Pty Ltd. Prepared for APP Corporation Pty Ltd. September 2019,
- AH Ecology 2020 Remediation Project. Sewall Demolition & Construction. Oyster Farm, Woolooware Bay. Seawall Demolition & Construction. Prepared for APP Corporation Pty Ltd, on behalf of Transport for NSW. September 2020;
- Tonkin Consulting Pty Ltd 2021 202079 Constructability Assessment. Woolooware Bay Oyster Lease Overwater and Floating Structures. Final. 12 November 2021. Prepared for Transport for NSW; and
- Allied Tree Consultancy 2021 Arboricultural Impact Assessment Report. Oyster Farm, (Lot 3 in DP1165618) Captain Cook Drive, Woolooware Bay, NSW. Prepared for Transport for NSW. Draft 3. November 2021.

3.2 Field Assessment

Numerous field assessments have been undertaken across the Site from September 2016 to September 2021, and these are detailed in Table 1.

Table 1 Field sampling effort in 2016, 2019, 2020 & 2021

Date	Time (hours)	Tide	Weather	Focus
7 September 2016	0900 – 1000	High tide 1.44 m @ 1154 hours	Overcast, calm, 14.1 to 21.7 °C. No rain.	Offshore seagrass, mangroves.
12 September 2016	1000 – 1300	Low tide 0.62 m @ 1009 hours	Mostly sunny, calm. 12.3 to 21.4 °C. No rain.	Terrestrial and intertidal biodiversity values.
1 – 6 November 2016	Dusk to dawn		Nocturnal surveys	Echolocation detector (Anabat Express™ GPS)
1 – 6 November 2016	Dawn		Clear skies, a slight breeze and the temperature was 22 °C	Migratory waders: a dusk survey was undertaken by walking the boundary of the Site and observing both within the Site and within the adjacent habitat with the purpose of visually identifying species.
1 – 6 November 2016	Dusk		Clear skies, a slight breeze and the temperature was 22 °C	Migratory waders: a nocturnal survey followed where any nocturnal calls were identified and roosting birds could be identified using spotlights.
4 September 2019	1000 - 1130	High tide 1.63 m @ 1207 hours	Warm (19°C), still and with clear skies.	Seawall and remediation progress.
13 August 2020	0800 – 1130	Low tide 0.65 m @ 0849 hours	Warm (20°C), still and with clear skies.	Seawall and remediation progress. Mangrove assessment. Stormwater outlets assessment. Removal of structures assessment.

Date	Time (hours)	Tide	Weather	Focus
23 August 2021	1400 – 1620	Low tide 0.39 m @ 1435 hours	Warm (24 ^{o}C), still and overcast.	Removal of structures assessment. Current condition of the Site estuarine and marine ecology.
26 August 2021	1530 - 1600		Dry, cool (14 ^{o}C), light breeze	Dedicated bird survey. Incidental fauna surveys.
26 August 2021	930 - 1015		Dry, cool (15 ^{o}C), cloudy, moderate breeze	Establish Anabat units. Dedicated bird survey. Incidental fauna surveys.
26 August – 10 September 2021	13 days in total			Anabat detectors.
10 September 2021	1000 - 1045		Dry, moderate (20 ^{o}C), still.	Collect Anabat units. Dedicated bird survey. Incidental fauna surveys.
Tide times: Roads & Maritime NSW Tides 2016 – 2017, 2019-2020, 2020-2021, 2021-2022				

Field investigations were undertaken to ascertain the Site condition and the presence, or likely presence, of threatened or protected species, populations and communities. The following tasks were undertaken:

- Random meander transects (as per Cropper 1993) across the Site noting plant species along with other factors including soil type and condition, the level of weed invasion and other signs of disturbance. Random meander transects also included searches for threatened plant species and habitat with the potential to occur across the Site;
- A general fauna habitat assessment including an assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna. In addition, indirect evidence of fauna (e.g. scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded;
- The direct observation of any fauna species present within, or adjacent to, the study area;
- Diurnal call identifications of fauna species with all calls being identified in the field;
- Marine areas across the Site including the channel were previously traversed by boat at high tide to search for the presence of seagrass and other marine vegetation. It was further searched at low tide for the presence of encrusting organisms and burrowing organisms and marine vegetation; and
- The likelihood of threatened terrestrial fauna and flora occurring on the Site was assessed through determining if suitable habitat was present. For plants and animals, this included several factors comprising the vegetation types present, drainage patterns, weed invasion and current land use activities.

Assessments identified the need for further surveys to target Yangochiroptera bats and some migratory wading birds as it was considered that a number of these species have the potential to occur on, or adjacent to the Site. The aims of these targeted surveys were to determine if:

- Cave-dependant Yangochiroptera bats were present within buildings and other structures across the Site; and
- Migratory waders were present across the Site or in adjacent vegetation.

Surveys designed to assess the above issues for both fauna groups were as follows:

- Bats were targeted through the use of two echolocation detectors (Anabat Express™ GPS Easting 329023; Northing 6232069 & Easting 329066; Northing 6232280) (Appendix A) placed on the Site. These detectors record the unique echolocation 'fingerprint' of each bat species and hence allow species identification. The detectors was deployed at the Site on 28 August 2021, for a total of 13 consecutive nights and were set to record from dusk to dawn during this time; and
- Migratory waders and other bird species were targeted using on ground survey. These surveys lasted for 20 minutes per investigation and were undertaken at both high and low tide intervals. During the surveys the researcher employed the point count method as detailed in DECC (2004) (i.e. all birds observed or heard calling were recorded. By the completion of this assessment a total of 60 minutes of dedicated bird surveys had been undertaken.

A detailed methodology for the fauna surveys is provided at Appendix A.

Personnel undertaking these assessments are detailed in Table 2 and *Curricula Vitae* are provided in Appendix B. Dr Alison Hunt and Mr Deryk Engel have been involved with the Oyster Farm Project since 2016.

Table 2 Personnel undertaking assessments

Personnel	Qualifications	Focus
Dr Alison Hunt	B.Sc. (Hons), PhD	Project director for the entire project. Marine assessments, terrestrial botanical assessments.
Mr Deryk Engel	B.Env.Sc. (Hons)	Fauna and targeted fauna surveys. Anabat analysis of calls. Likelihood of fauna occurring and being impacted.

3.3 Limitations

This assessment was aimed at providing an overall assessment of the ecological values of the Site and study area with particular emphasis on the likely presence of threatened species or ecological matters of interest through integration of data from a number of sources. This permitted an assessment of the likely impact of the proposal on these ecological values of the Site and locality. It was not designed to identify all species, whether resident or transitory to the Site, and it is likely that a number of species not mentioned in this report would also utilise the resources of the Site from time to time, especially given the adjacent location of the Towra Point Nature Reserve.

This assessment was based on the Constructability Assessment undertaken by Tonkin Consulting Pty Ltd (2021), which was based on a 70 % design package and therefore, should the final construction design differ substantively from this preliminary design then this biodiversity impact assessment would require revision to include these changes.

4 RESULTS

4.1 Site and Surrounding Environment

The Site is situated on the southern shore of Botany Bay within Woolooware Bay and is adjacent to a number of significant ecological features, which are discussed below.

4.1.1 Towra Point Nature Reserve

The Towra Point Nature Reserve is located to the east, adjacent to the Site (Figure 5). The Towra Point Nature Reserve is the largest and most diverse estuarine wetland complex in NSW and represents approximately 50% of the remaining mangrove area near Sydney and the majority of the saltmarsh communities remaining in this region. Towra Point Nature Reserve has been listed as an internationally important wetland under the Ramsar Convention. It is known to support threatened species, populations and ecological communities, populations of plants and animals important for maintaining biodiversity of a particular bioregion, species at a critical stage of their life cycle and it provides a food source, nursery habitat and migration paths for fish (OEH 2012).

4.1.2 Towra Point Aquatic Reserve

The Site is located within the Refuge Zone of the Towra Point Aquatic Reserve (Figure 5) (DPI 2022). This Aquatic Reserve covers an area of approximately 1,400 ha making it the largest in NSW and is managed under the *Towra Point Aquatic Reserve Plan of Management 2001*. It is known to be an important nursery area for fish and invertebrates, and to provide important habitat for migratory seabirds as well as being rich in marine biodiversity. The Reserve includes much of the remaining important seagrasses, mangroves and migratory wading bird habitats in Botany Bay. It represents major nursery habitat supporting commercial and recreational fish stocks in the coastal Sydney region. The objectives of this reserve are to conserve the biodiversity of fish and marine vegetation, protect fish habitat and to facilitate educational activities and scientific research (DPI 2022).

4.1.3 DPI Key Fish Habitat

DPI has mapped the entirety of Botany Bay, including Woolooware Bay, as Key Fish Habitat which is defined in this instance as *Oceanic, bay, inlet and estuarine habitats up to the level defined by High Water Solstice Spring tides (so called 'King tides' or Highest Astronomical Tide).* An objective of the FM Act is to ‘conserve key fish habitats’ (DPI undated) (DPI Fisheries NSW Spatial Data Portal accessed 2021).

4.1.4 Sutherland Shire Council Vegetation Mapping

The Sutherland Shire Council mapping of vegetation communities within the LGA shows *Mangrove* communities extending eastward and westward from the Site (Figure 6).

4.1.5 Estuarine Habitat Mapping

DPI (2008) mapping of the estuarine habitats of NSW shows extensive *Mangrove* communities surrounding the Site (Figure 6). Small patches of Saltmarsh are mapped approximately 130 m to the east of the Site, while the nearest mapped seagrass beds, comprised of *Zostera / Halophila*, are approximately 400 m to the north and north-east of the Site.

4.1.6 *SEPP (Coastal Management) 2018*

The majority of the Site is mapped as *Proximity Area for Coast Wetlands* and the areas adjacent to the Site are mapped as *Coastal Wetlands* (Figure 7). The walkway between the land based western building and the overwater structures to the north extend into the mapped areas of Coastal Wetlands.

Figure 5 Towra Point Nature Reserve & Towra Point Aquatic Reserve

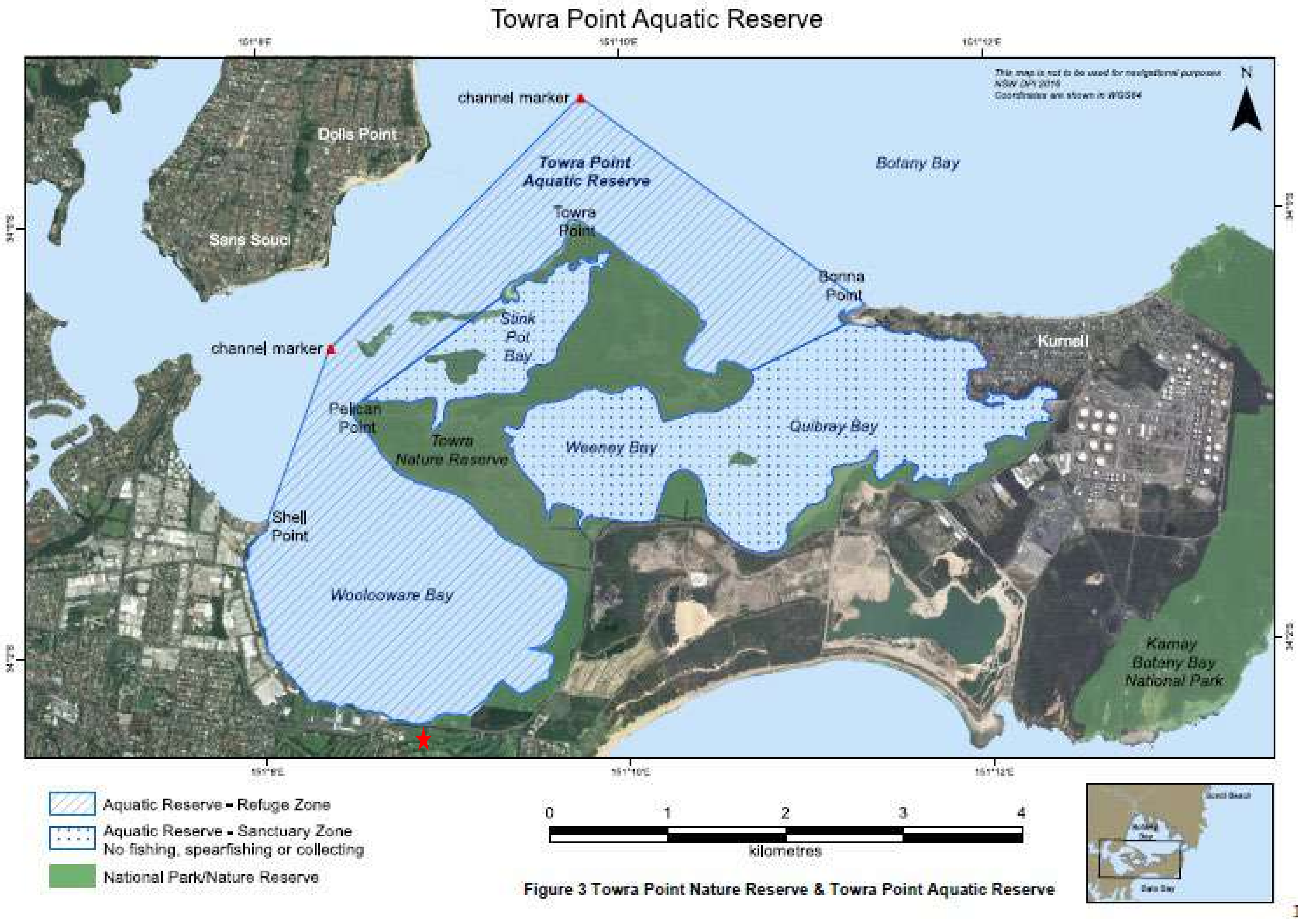


Figure 3 Towra Point Nature Reserve & Towra Point Aquatic Reserve

★ Site

Figure 6 Estuarine vegetation communities

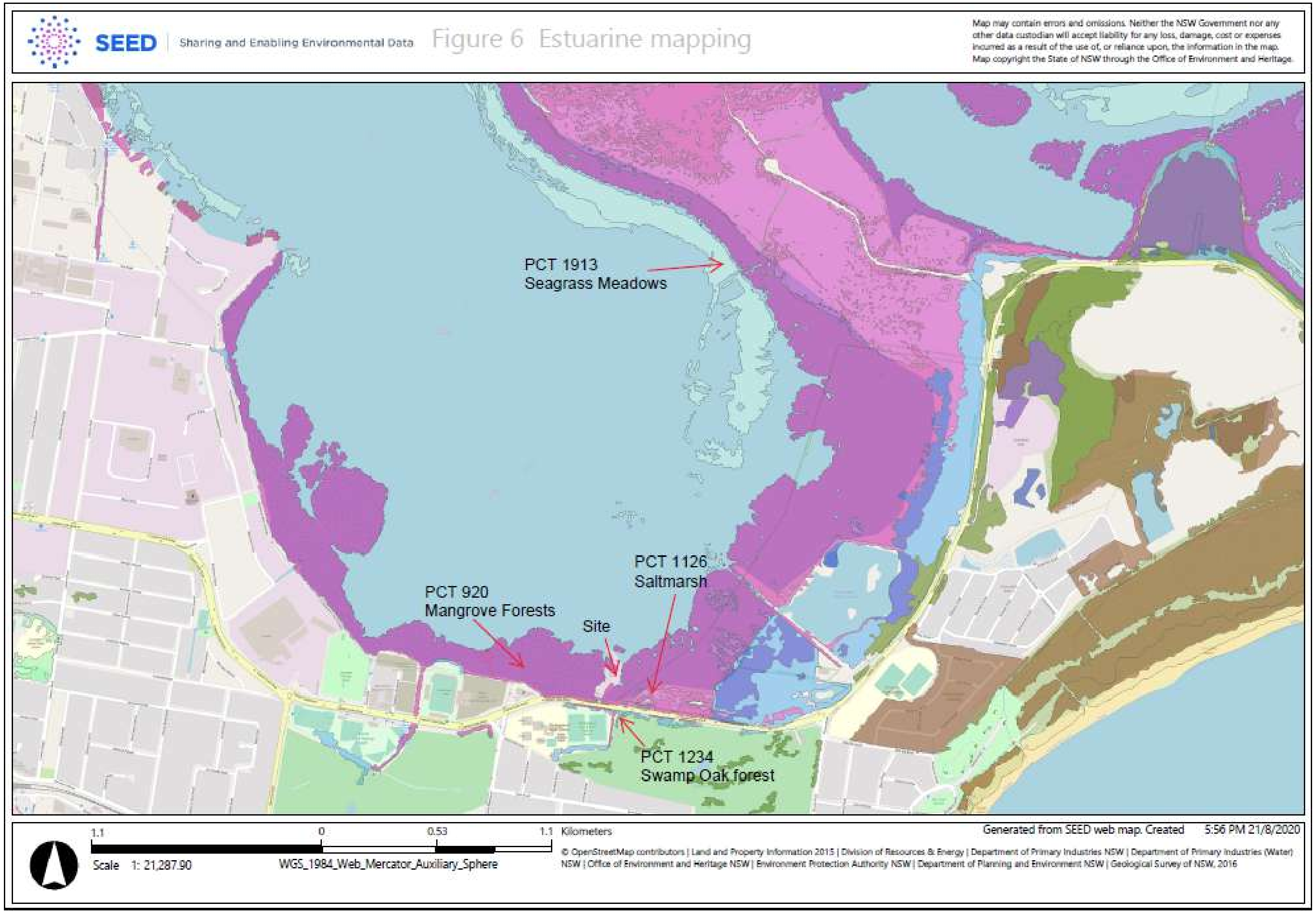
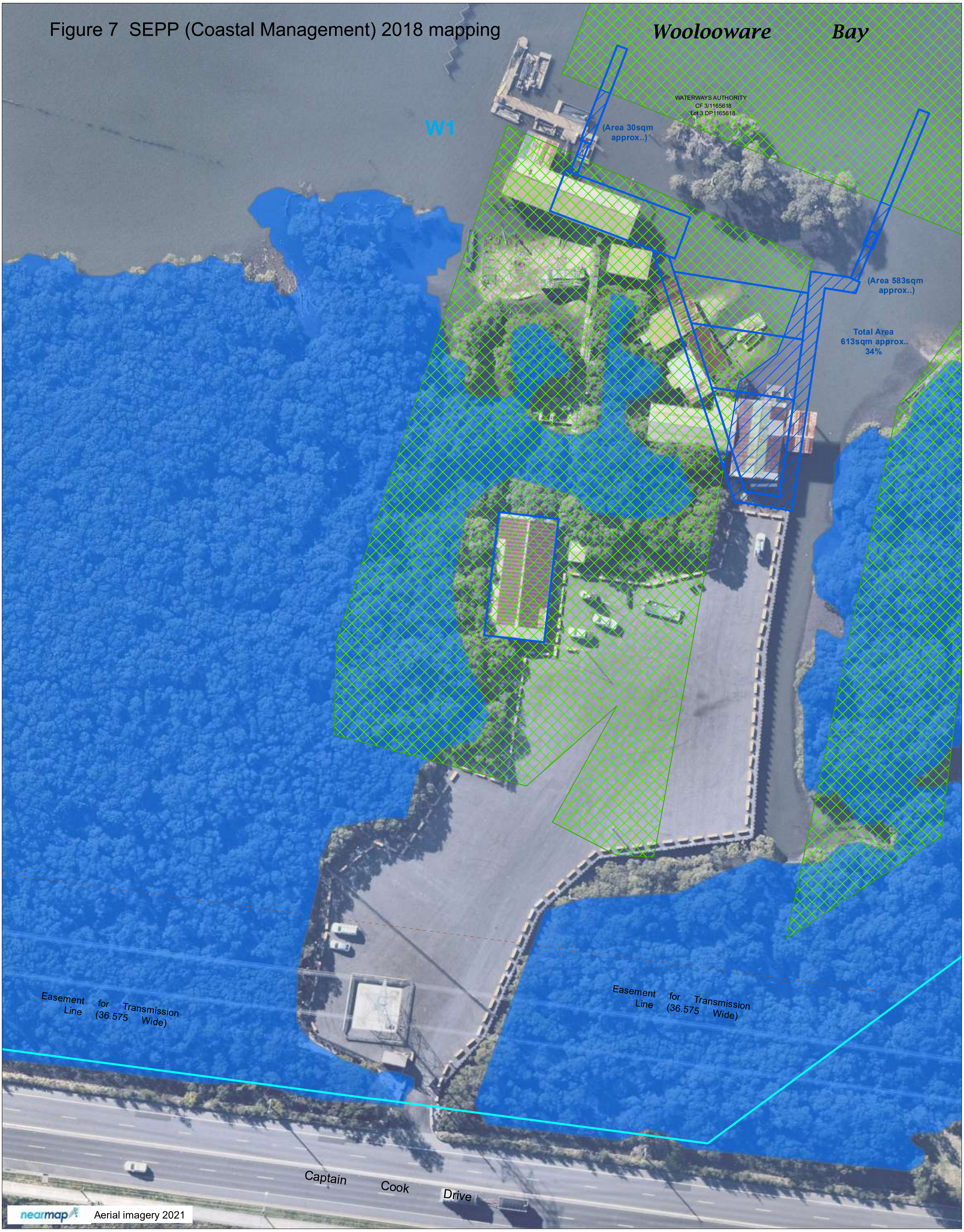


Figure 7 SEPP (Coastal Management) 2018 mapping



Easement
Transport (Maritime) title boundary
Coastal Wetland 2018 DPIE
Priority Oyster Aquaculture DPI - 2006-2015 (POA)
Tonkin Consulting - Project No:202079 SK2000 - Rev B - Date: 03/08/2021
Area outside POA area
W1 Natural Waterways LEP 2015

Plan compiled from information held in the Maritime Survey and Spatial Information Units.
Coordinate System: GDA 1994 MGA Zone 56

NSW GOVERNMENT | Transport for NSW

N W E S

Scale at A4 sheet 1:1,000

0 10 20 30 40 m

CUSTOM PLAN
LGA: SUTHERLAND
Locality: BOTANY BAY

Custom Plan of site
@ Captain Cook Drive
WOOLOOWARE

Date Produced: 16 August 2021

PLAN N^0: CP2021-275-F

N/A

4.2 Existing Site Description

The existing overwater structures consist of driven timber piles, timber floor framing, timber flooring, timber wall framing, corrugated metal and other light timber wall cladding, timber roof framing with some structural steel elements and corrugated metal roof cladding. The existing floating structures consist of proprietary type concrete pontoons, steel pontoons, timber restraint piles and various types of hinged access gangways. All existing structures are in poor condition. (Tonkin 202079 Final Constructability dated 12 November 2021).

These are situated within the intertidal area adjacent to the remediated and reconstructed hardstand area which is bordered by the newly installed seawall (Plates 3 – 7).

These structures are located within the Aquatic Refuge Zone of the Towra Point Aquatic Reserve and are adjacent to the Towra Point Nature Reserve, a Ramsar wetland.

Plate 3 North-eastern structures

Plate 4 North-western structures

Plate 5 Beneath the north-western structures

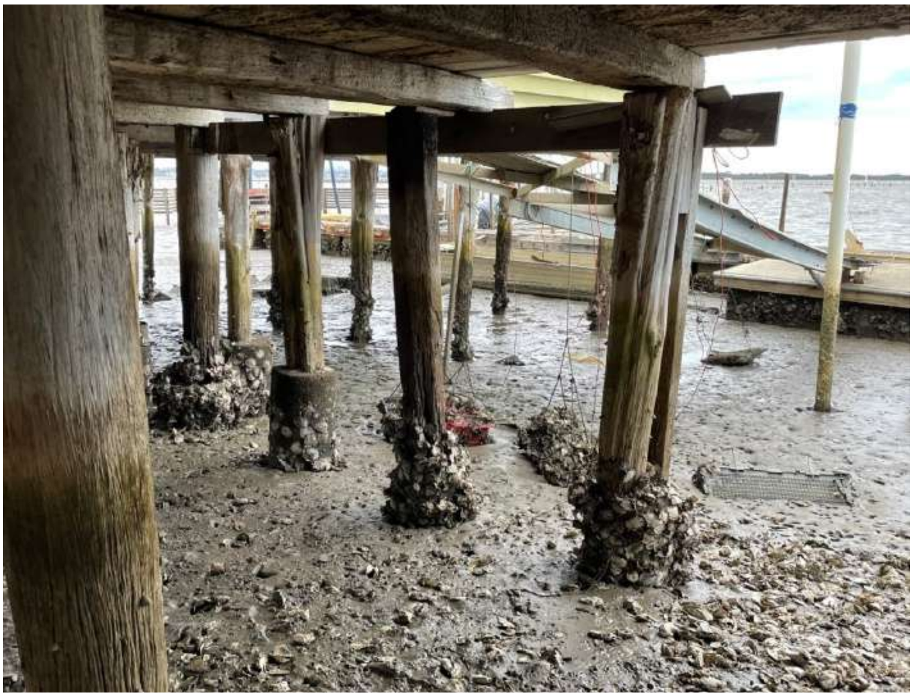


Plate 6 View of north-eastern structures

Plate 7 An example of the walkways used to access overwater structures

4.3 Site Biodiversity

4.3.1 Terrestrial Vegetation

The hardstand area is devoid of all vegetation.

4.3.2 Marine Vegetation

The overwater structures are located within a Grey Mangrove (*Avicennia marina*) Forest community which extends to the north, east and west (Plate 1 & 2). The Grey Mangrove canopy is low and dense, and pneumatophores and seedlings are common. Fruit was recorded on trees as were germinated seeds on the sandy / muddy substrate. No other plant species were recorded within this forested area. No mangroves or seagrass were recorded growing on the muddy / silty substrate of the channel bordering the east of the Site or to the area adjacent to the Site.

4.3.3 Fauna and Fauna Habitat

A list of fauna species recorded across, and / or adjacent to the Site is provided at Appendix A.

The Mangrove Forest community across the Site, including the areas accessed via the off-site boardwalks, is complex and healthy. Bioturbation of the muddy / silty substrate was common with numerous habitat holes and trails noted across the substrate, indicating that estuarine fauna are using this resource. The Mottled Shore Crab (*Paragrapus laevis)* and the periwinkle *Bembicium nanum* and the Sydney Rock Oyster *(Saccostrea glomerata)* were observed frequently across the muddy substrate of the forest floor and within the channel. The Common Toadfish (*Tetractenos hamiltoni*) was also abundant in deeper water adjacent to the Grey Mangrove Forest (e.g. the channel along the eastern boundary of the Site). Mangroves and mangrove forests provide important habitat and shelter for juveniles and adults of a wide range of fish species, including commercially and recreationally important species. They also produce large quantities of organic matter which are grazed by some marine fauna and further broken down by bacteria and fungi which are eaten by detritivores such as crabs. Sediments within the channel are likely to support benthic infauna.

The marine sediments adjacent to and beneath the overwater structures would support macrobenthic infauna. These assemblages are likely to be diverse within the Grey Mangrove Forests which appear to be healthy, functioning ecosystems. Anthropogenic disturbance though contamination and physical alteration of habitat, is known to effect macrobenthic infauna communities (Clark 1993, Warwick & Clark 1994), and hence the sediments of the more disturbed areas are likely to be more variable and less diverse (in both richness and abundance) than those in adjacent Grey Mangrove communities due to contamination and physical alteration of this area.

The relatively good condition of the Mangrove Forest Community and the proximity of the listed Towra Point Nature Reserve to the Site, provides potential for the presence of a range of avifauna across the Site. Twenty-one bird species were recorded during the field assessment. These included species common to urbanised areas (e.g. Pied Currawong (*Strepera graculina*), Australian White Ibis (*Threskiornis molucca*)), and those more commonly associated with estuarine habitats (e.g. Black-winged Stilt (*Himantopus himantopus)* and Australian Pied Oystercatcher (*Haematopus longirostris)*). There are mudflats across the Site, Oyster shell piles and an island approximately 30 m from the most northerly building. All of these are submerged at high tide. At low tide these would provide suitable habitat for the foraging requirements of a range of bird species, including migratory waders. Roosting opportunities also exist throughout the Mangrove Forest some of these birds.

It is unlikely that the Site would provide habitat for amphibian species (e.g. Green & Golden Bell Frog (*Litoria aurea*)) due to the absence of on-site water bodies and the saline nature of the adjacent habitat. Reptiles, namely snakes and lizards commonly found in urban environments, likely use the abundant debris across the Site as refuges and for shelter and foraging. The common Dark-flecked Garden Sun-skink (*Lampropholis delicata*) has previously been recorded foraging amongst debris on the Site (AH Ecology 2017).

No obvious hollow-bearing mangroves or other plants were observed, however several of the buildings are considered to provide suitable roosting habitat for Yangochiroptera bats. Targeted surveys for Yangochiroptera bats recorded six Yangochiroptera bats. Two of these species, Gould's Wattled Bat (*Chalinolobus gouldii*) and Chocolate Wattled Bat (*Chalinolobus morio*) were also recorded during surveys across the Site in 2016 (AH Ecology. 2017). The 2021 surveys also recorded a probable identification of the Large Bent-winged Bat (*Miniopterus orianae oceanensis*) after calls indicative of this species were recorded. This species is listed as Vulnerable under the NSW BC Act. Probable calls for the Large Bent-winged Bat were obtained on 3, 4 and 7 September at around 2311, 0030, and 1959, hours respectively. As the echolocation detectors were operated over the course of 13 evenings, and this species was only recorded on three occasions and the timing of one of their calls being at least 2.5 hours after sunset, it is not considered that this cave-occupying microbat is utilising or reliant upon the cave-substitute (roof cavities) habitat present. The lack of regular detection of calls indicative of this species at sunset would indicate it is not occupying those overwater structures present. Instead it is likely that this species would foraging above and over the subject site on occasion. In addition, the Vulnerable (EPBC Act and BC Act) Grey-headed Flying-fox (*Pteropus poliocephalus*) (a Yinpterochiropteran bat) was recorded calling approximately 600 m east of the Oyster Farm during 2016 (AH Ecology 2017). There was no evidence of a Grey-headed Flying-fox camp on or close to the Site.

The Common Brushtail Possum (*Trichosurus vulpecula*) scats were also recorded on the boardwalks. This common urban species had not been recorded previously.

5 CONSERVATION SIGNIFICANCE

A number of features of ecological significance occur, or have the potential to occur, within the locality (i.e. 10 km radius) and these are listed at Appendix C. A brief outline of the communities, species and populations known to occur (EPBC Act, FM Act and BC Act), or considered likely to occur (EPBC Act), within the locality are provided below, with relevant species being considered in more detail in Section 6: Impact Assessment.

5.1 Wetland of International Significance

The 603.7 ha Towra Point Nature Reserve is located directly to the east of the Site. This nature reserve is a Ramsar Site under the Ramsar Convention, indicating its international importance as a wetland site, and is therefore considered as a matter of NES under the EPBC Act. It is known to support threatened species and ecological communities, populations of plants and animals important for maintaining biodiversity of a particular bioregion, species at a critical stage of their life cycle and it provides a food source, nursery habitat and migration paths for fish.

Towra Point Nature Reserve supports approximately 40% of the mangrove communities and 60% of the saltmarsh communities remaining in the Sydney region. Along with the adjacent marine subtidal aquatic beds, the mangrove and saltmarsh communities provide habitat and food for 25 species of fish that are of economic significance. The Site also supports 34 species of migratory birds listed under international agreements, three threatened species listed under the Commonwealth EPBC Act, 23 threatened species and five endangered ecological communities listed under the NSW BC Act (OEH 2012).

5.2 Ecological Communities

There are twelve Threatened Ecological Communities (TEC) listed under the EPBC Act that are either known to occur, or are listed as being likely to occur, within the locality. Ten Endangered Ecological Communities (EEC) listed under the BC Act are also known to occur within the Sutherland Shire LGA. The Site and adjacent areas may have supported a number of these TEC / EEC in the past but significant alteration and clearing of the landscape over many years has resulted in a largely man-made landscape directly to the south and further west of the Site. However, there are four EEC which occur near to the Site and are therefore relevant to the proposal. These are:

- *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*. Sutherland Shire Council Vegetation Communities Mapping (Figure 6) shows small patches of this community at the entrance to the Site and to the south of Captain Cook Drive. Ground-verification of this mapping found that this EEC does not occur on-site. It is likely that this EEC would have occurred along the better drained and less saline margins shoreward of the Mangrove Forest before the Site was created through infilling. General threats to this community include clearing, drainage works, pollution, weed invasion and climate change (OEH 2016);
- *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*. Small patches of Coastal Saltmarsh are mapped approximately 130 m to the east of the Site (Figure 6). Saltmarsh communities are frequently found as a zone on the landward side of mangrove stands. This community was not identified on-site. Threats to Saltmarsh communities include: infilling for development, modification of tidal flows, alteration of salinity and increasing nutrient

levels, weed invasion, physical damage, dumping of rubbish, invasion by mangroves and inappropriate fire regimes (OEH 2016);

- *Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion.* This endangered ecological community listed under the EPBC Act and is represented by an assemblage of plants, animals and micro-organisms associated with seagrass meadows dominated by *Posidonia australis* which occur in warm temperate Manning Shelf and Hawkesbury Shelf bioregions The Site is located on the Hawkesbury Shelf. *Posidonia australis* is known from Botany Bay and Towra Point, although this species was not recorded directly adjacent to the Site and the closest mapped occurrence within Woolooware Bay is approximately 900 m to the north-east (Figure 6). This seagrass population has experienced decline from direct damage due to dredging, sand mining, reclamation, boat moorings, boat propellers, bait gathering, and from anthropogenic changes in water quality, particularly increased nutrients and reductions in water clarity; and
- *The Shorebird Community occurring on the relict tidal delta sands at Taren Point*. This EEC refers to a group of shorebirds which occupy the relict marginal shoal of the Georges River between Taren Point and Shell Point in Botany Bay, approximately 2 km north-west of the Site (refer Figure 5). It includes a characteristic assemblage of approximately 20 species, many of which are listed as migratory under the EPBC Act and threatened under the BC Act. Threats to this EEC include: loss of feeding and roosting habitat, fragmentation or isolation of sites, human disturbance and disturbance by dogs at roost and feeding sites and pollution (OEH 2016).

5.3 Fauna Species and Populations

Forty-eight species listed under the EPBC Act are either known to occur, or are listed as being likely to occur, within the locality, and 49 species and two endangered populations are listed under the BC Act and / or FM Act have been recorded within the locality of the Site. A brief summary of those species considered relevant is provided below.

- *Amphibians.* The Green & Golden Bell Frog (*Litoria aurea*) and Red-crowned Toadlet (*Pseudophryne australis*) have been recorded within the locality and are listed as Vulnerable and Endangered, respectively, under the BC Act and Vulnerable under the EPBC Act. These species are unlikely to find foraging, roosting, breeding or refuge on or adjacent to the Site due to its saline nature. Amphibians have not been recorded across the Site;
- *Terrestrial Mammals.* Four species of Yangochiroptera bats listed under the BC Act are known from the locality. Targeted surveys of this Site for bat species (Appendix A) did not record bats roosting in or under any of the buildings or other man-made infrastructure across the Site. However, surveys did record a probable identification of the Large Bent-winged Bat (*Miniopterus orianae oceanensis*) after calls indicative of this species were recorded (Appendix A). This species is listed as Vulnerable under the NSW BC Act. Probable calls for the Large Bent-winged Bat were obtained on 3, 4 and 7 September at around 2311, 0030, and 1959, hours respectively. As the echolocation detectors were operated over the course of 13 evenings, and this species was only recorded on three occasions, one of which being at least 2.5 hours after sunset, it is not considered that this cave-occupying microbat is utilising or reliant upon the cave-substitute (roof cavities) habitat present. The lack of regular detection of calls indicative of this species at sunset would indicate it is not occupying those overwater structures present. Instead it is likely that this species would foraging above and over the subject site on occasion. In fact, recordings of another four Yangochiroptera species recorded across the Site suggested that all are roosting in areas off-site and moving across the Site during foraging. One species of Yinpterochiropteran bat listed as

Vulnerable under the EPBC Act and BC Act, the Grey-headed Flying-fox, was recorded calling approximately 600 m east of the Oyster Farm. There was no evidence of a Grey-headed Flying-fox camp on or close to the Site although it is likely that this species overflies the Site and on occasion forages across the Site;

- *Avifauna.* The sandflats / mudflats associated with Woolooware Bay to the north of the Site and the broader Botany Bay are known to provide habitat for a wide range of shorebirds listed under the EPBC Act and BC Act. Seventeen waders and five woodland birds known from the locality are listed under the BC Act and nine waders and one woodland bird are listed under the EPBC Act. A further 15 bird species listed under the EPBC Act as solely Marine and / or Migratory birds are also known from the locality. On occasion some of these species may visit habitat on the Site and surrounding mangrove forests. A Whimbrel (*Numenius phaeopus*) was observed approximately 150 m west of the Site and this species is listed as Marine / Migratory under the EPBC Act (AH Ecology 2017). During the 2021 surveys two Australian Pied Oystercatchers (*Haematopus longirostris)*, listed as Endangered under the BC Act, were observed perched on a structure that is present about 100 m north-east of one of the overwater structures (Appendix A). During the course of the field investigations, no individuals of this species were observed within across the Site. This species is known to breed within Botany Bay, but no evidence of this occurring within the subject site was found. Given the fauna habitats present, combined with the land use history of this site, the Pied Oystercatcher is not considered to use the Site area for any of its life cycle requirements. No other observations of listed species were made during surveys of this Site; and
- *Marine Fish.* Botany Bay is known or predicted habitat for a number of fish species, reptiles, sharks, cetaceans and other marine mammals and is especially important as nursery habitat for many commercially important species due to the extant seagrass and mangrove communities throughout the area. Two marine mammals which are known from the locality are listed under the BC Act and one is listed under the EPBC Act (i.e. New Zealand Fur-seal (*Arctocephalus forsteri*) and Southern Right Whale (*Eubalaena australis*)). In addition, the Green Turtle (*Chelonia mydas*), Black Rockcod (*Epinephelus daemelii*), Grey Nurse Shark (*Carcharias taurus*) and Great White Shark (*Carcharadon carcharias*) are all listed under the FM Act, BC Act and / or the EPBC Act, all of which have been recorded within the locality.

5.4 Flora Species and Populations

- *Terrestrial flora.* It is unlikely that any of the five terrestrial plant species (i.e. Netted Bottle Brush (*Callistemon linearifolius),* Coast Groundsel (*Senecio spathulatus),* Villous Mint-bush (*Prostanthera densa),* Magenta Lilly Pilly (*Syzygium paniculatum)* Wallangarra White Gum (*Eucalyptus scoparia*)) listed under the EPBC Act and / or BC Act would occur on the Site or directly adjacent to the Site, due to the highly modified nature of all but the fringing mangrove vegetation along Woolooware Bay which extends into the Towra Point Nature Reserve; and
- *Marine flora.* The endangered seagrass population of *Posidonia australis* in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie, is listed under the FM Act. It is known from Botany Bay and Towra Point, although this species was not recorded directly adjacent to the Site and the closest mapped occurrence within Woolooware Bay is approximately 900 m to the north-east (Figure 6). This seagrass population has experienced decline from direct damage due to dredging, sand mining, reclamation, boat moorings, boat propellers, bait gathering, and from anthropogenic changes in water quality, particularly increased nutrients and reductions in water clarity.

All marine vegetation is protected under the FM Act, including seagrass, mangroves and seaweed due to their importance as species-rich habitats which provide shelter to numerous species of fish and invertebrates, especially as juveniles. This includes the Mangrove Forest Community across the Site and extending into Woolooware Bay and Towra Point Nature Reserve.

6 IMPACT ASSESSMENT

The Site is located within an area of high biodiversity and adjacent to habitat of conservation significance. The proposal would result in the removal of marine vegetation (i.e. Grey Mangroves), disturbance and removal of on-site habitats and there is the potential for off-site impacts on sensitive receptors as a consequence of demolition and construction activities.

6.1 Vegetation

6.1.1 Vegetation Removal

There will be no removal and / or trimming of Grey Mangrove trees from within the Towra Point Nature Reserve.

Allied Tree Consultancy (2021) determined that a total of 8 Grey Mangrove trees across the Site would need to be removed. This would include removal of 6 during demolition works (i.e. Tree numbers 67,69,78,92,95) and 2 during construction (i.e. Tree numbers 141,142). A further 37 Grey Mangrove trees would be subject to a major encroachment during demolition although these would be retained and instead pruned and / or branches tied back. Seventeen of the 37 trees identified for trimming during demolition would also require further trimming during the construction phase. The location of all Grey Mangrove trees and those to be trimmed and / or removed are showing in Figures 8-10). The majority of impacts to Grey Mangrove trees are associated with works around the current wooden walkway connecting the landside to the most northerly building (Figure 11).

Removal of the eight trees would reduce the number of Grey Mangroves across the Site and trimming of a further 37 trees would reduce the flowering and hence seed production from those limbs removed. Given that there are high densities of seedlings present throughout the Mangrove Forest it is likely that these trees would be replaced by seedlings already present. It is also likely that these seedlings would respond to the opening of habitat and this is already evident in areas that have lost trees, or parts of trees, through natural processes, supporting the highest densities of seedlings. It should also be noted that many of the trees trimmed for the construction of the new seawall now have epicormic growth on branches and / or trunks (Plate 8) This demonstrates that sympathetic pruning is a successful way to mitigate against larger tree loses.

Seagrass meadows were not recorded across, or adjacent to, the Site during any of the Site assessments undertaken since 2016. Access to the Site over water, is along a well-established channel between historic oyster leases. Regular use of this channel as access for this Site has largely precluded the establishment of seagrass beds along this route.

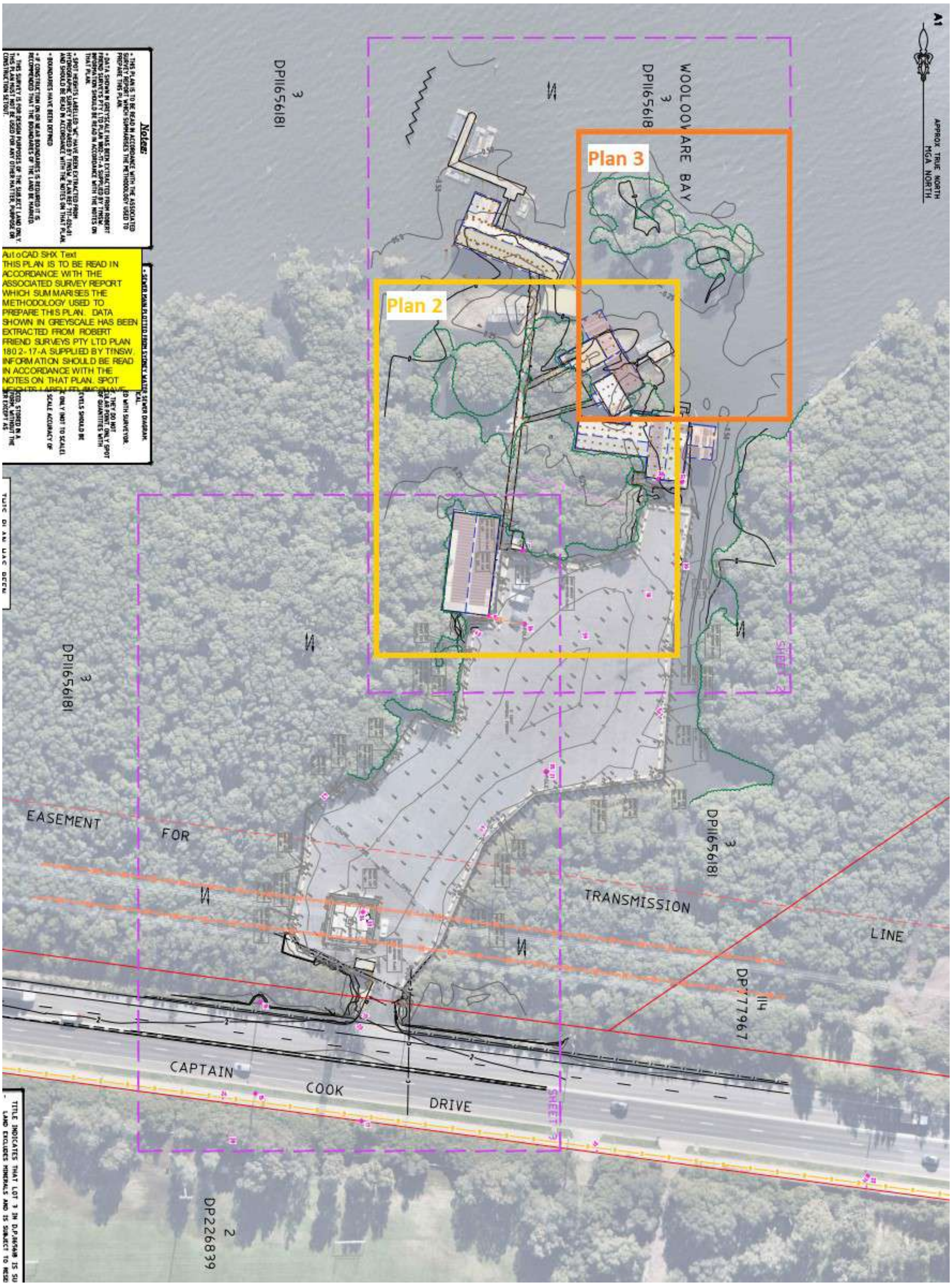
Therefore, it is unlikely that any other marine vegetation would be removed during demolition and or construction of the overwater structures.

6.1.2 Potential Indirect Impacts on Vegetation

Whilst a total of 8 Grey Mangroves would be removed and a further 37 tied back and / or trimmed there is also the potential that the remaining mangroves could be at risk of decline or death as disturbing or shading the tree could cause root death (pneumatophores) or damage, through such factors as physical damage during demolition and / or construction. Older trees tend to tolerate far less stress than younger trees as with age they become less responsive and find it very strenuous to respond to changes in their environment.

To mitigate against these risks, Allied Tree Consultancy (2021) has detailed Zones of Protection and the rationale behind establishment of these zones (refer Figure 1, page 27, Allied Tree Consultancy (2021)). These should be strictly adhered to during both demolition and construction in order to reduce the potential of long term decline in the Grey Mangrove Forest across the Site and in adjacent areas.

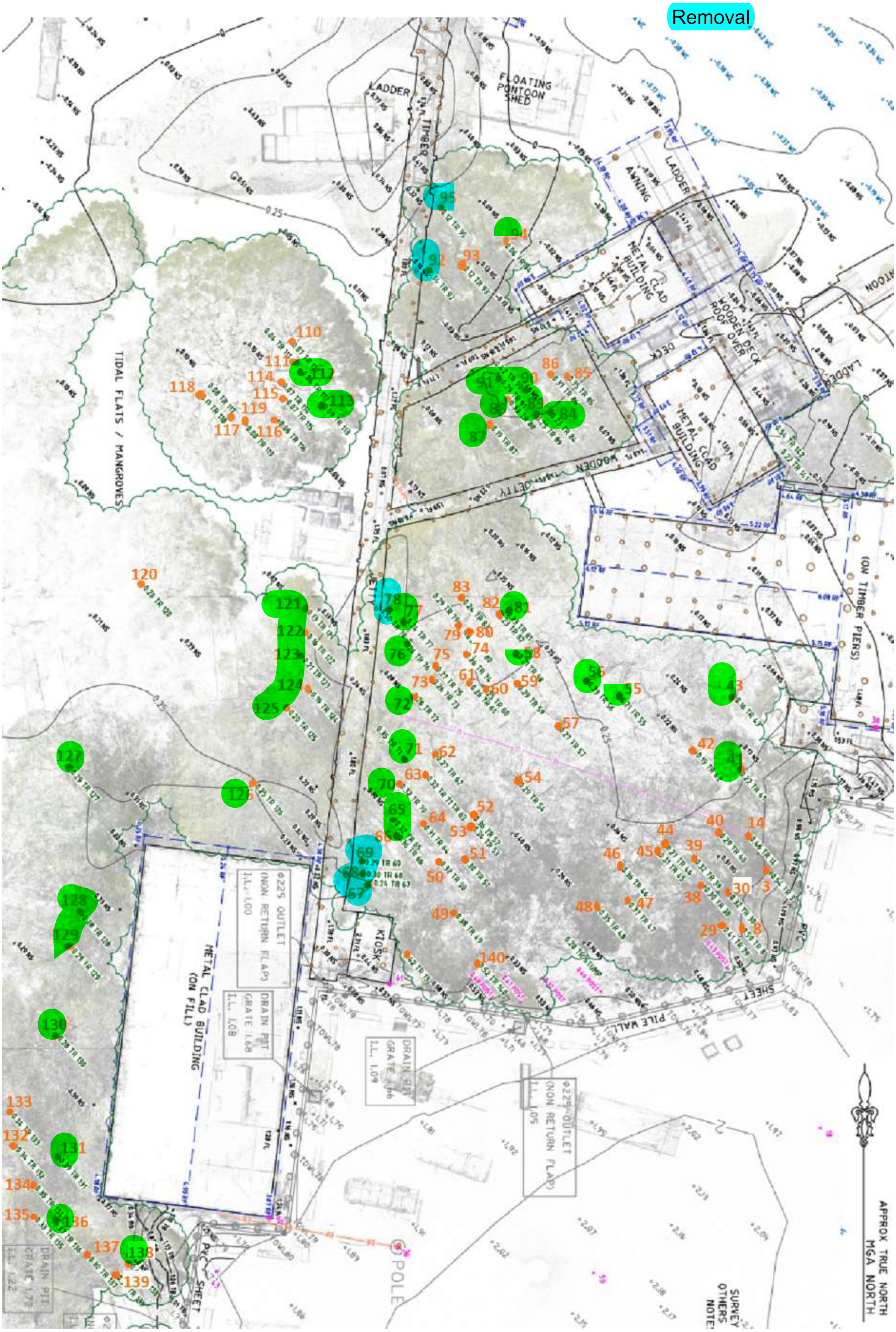
Figure 8 Area of Aboricultural Assessment, Oyster Farm



Source:
Allied Tree Consultancy 5.0 Plan 1; Area of assessment

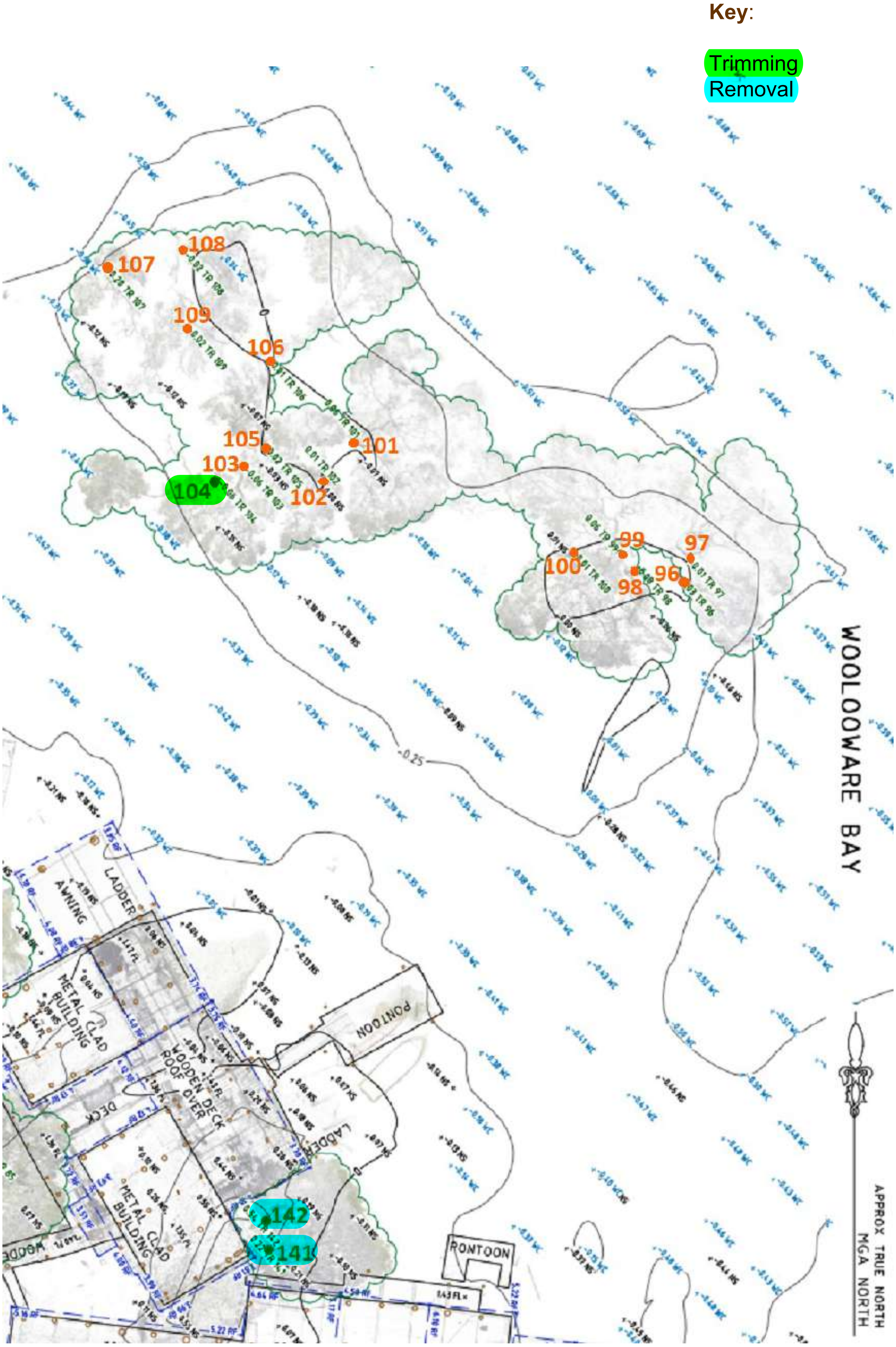
Figure 9 Location of Grey Mangroves across the Oyster Farm

Key:
Trimming
Removal



Source: Allied Tree Consultancy. 5.2 Plan3; Area of assessment illustrating tree location

Figure 10   Location of Grey Mangroves across the Oyster Farm



Source: ALLIED TREE CONSULTANCY   **5.2 Plan 3; Area of assessment illustrating tree location**

Figure 11 Area of Grey Mangrove Impact (source Tonkin 2021)

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	03.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 200
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

SCALE 1 : 200
FLORA IMPACT PLAN

NOT FOR CONSTRUCTION

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLORA IMPACT PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S0400	0

© TONKIN CONSULTING
C:\Revit Local Files\2021\202079 Woolooware Bay R21_rhys.sanders.rvt 13/12/2021 2:05:51 PM

Plate 8 Epicormic growth on trees trimmed during installation of seawall

6.2 Direct Disturbance & Removal of Estuarine Habitat

Currently there is 160.3 m^2 area of floating structures and 1,429 m^2 area of fixed structures across the Site. These will be removed and replaced with 125 m^2 area of floating structures and 1,920 m^2 area of fixed structures across the Site. Whilst the area of floating structures and gangways would be reduced by 35.3 m^2 the footprint of overwater fixed structures would by increased by 491.0 m^2 (Table 3). Figures 3 and 4 shows the overlay of new structures across the current footprint of the Oyster Farm. The largest changes are across the far north-eastern section of the Site where numerous smaller structures would be removed and replaced with a larger shed-style building and jetty which stretches out to the small island of Grey Mangroves just offshore.

These changes would introduce an additional 491 m^2 of permanent shading of substrate and habitat under these structures. Shading has been shown to affect both the structure and functioning of biological communities as a consequence of solar shading which disturbs the growth and biomass production in aquatic environments (Pardal-Souza *et al.* 2017). Biodiversity likely to be impacted includes: algae, estuarine infauna, mobile marine fauna and foraging by avifauna across these areas.

Table 3 Current and final footprint areas of structures across the Site

Description	Current (m^2)	Final (m^2)	Difference (m^2)
Floating structures & gangways	160.3	125.0	↓ 35.3
Overwater fixed structures	1,429.0	1,920.0	↑ 491.0
Source: Tonkin 202079 / S0320 / B			

6.3 Demolition & Construction

To mitigate against estuarine habitat impacts, the majority of activities would be undertaken from the landward side of the Site. Whilst these activities are likely to impact the Site through noise, vibration and light pollution (refer to Section 6.3.3) it is likely that in-water activities would also be required and these would disturb biodiversity and habitat during the process. These processes are discussed below.

6.3.1 In-water Activities

There is limited water depth in the immediate vicinity of the overwater structures. The seabed begins to be exposed above mid tide level and becomes completely exposed at most low tides. Consequently, the use of barges to assist with construction and / or demolition should be minimised and only undertaken at, or approaching, high tide to allow for free movement of these vessels in order to protect sediments, infauna, Grey Mangrove and their pneumatophores and foraging habitat. These should be removed from the shallow Site areas and moored within the deeper areas of the eastern channel for overnight / day storage or taken off-shore.

Activities which require water access include, but not limited to, the removal of existing piles which support the current structures. The removal of existing piles would be undertaken using land-based equipment where piles are close to land. Other piles would be progressively removed as part of the overwater construction of the new structures. Where existing piles are not in areas of existing structure locations, temporary piles would be installed from barges so that the equipment used can get sufficiently close to the piles. These temporary piles would then be removed. Where piles cannot be withdrawn, these would be cut off approximately 300 mm below bed level.

These in-water activities would disturb sediments during removal and installation of piles, remove existing encrusting habitat provided by the existing piles, and the vibration and noise associated with the removal and installation would cause disturbance to both marine and terrestrial fauna.

6.3.2 Installation of instream structures & alteration of flow regimes

The demolition of the current Site facilities and subsequent construction of the new facilities are unlikely to substantially alter flow regimes from their current state, as both the current facilities and new facilities are all positioned on piles above the high tide mark to facilitate movement of tidal flows (Cardno 2022).

The construction of the two new northern jetties either side of the small mangrove island, which would extend further into Woolooware Bay than the current footprint (i.e. proposed northern jetty - 33 m and southern jetty – 23 m from the edge of the northern most building), are also considered unlikely to affect current flows and movement of sediments (Cardno 2022).

The overall net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. The Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

6.3.3 Noise, vibration & light pollution

The Site is located in a peri-urban landscape. The immediate noise environment of the Site is dominated by traffic on Captain Cook Drive and the operations of the Oyster Farm. Surrounding land uses are primarily recreational (e.g. Cronulla Golf Course, Woolooware Golf Club, Shark Park) and conservation (i.e. Towra Point Nature Reserve). The nearest residential areas are approximately 320 m south in Locksey and Glandore Streets, across Captain Cook Drive and south approximately 250 m, and Woolooware High School approximately 250 m to the south west. Across Woolooware Bay is Towra Point Nature Reserve, which is uninhabited and is approximately 1.6 km from the Site. Air traffic from Sydney Airport also contributes to the noise and light environment as the Site is located approximately 2 km from the major north-south flight path of Sydney Airport. Heavy industry is also a part of the broader ongoing anthropogenic impacts including the 24 hour operation of Port Botany, fuel import terminals at Kurnell and the Sydney Desalination Plant also located at Kurnell.

Noise, vibration and light associated with demolition and construction have potential to disrupt terrestrial and estuarine fauna as disturbance of fauna can result in changes to the behaviour and patterns of usage of resources by some fauna species. A review of the impacts of anthropogenic noise impacts (Ambrose 2020) found there is strong evidence to support the notion that noise can impact the health, physiology and behaviour of fauna resulting in temporal changes in patterns of activity, altered spatial distribution or movements, reduced foraging and provisioning activities, changes in mate attraction and territorial defence. Similarly, artificial light can disturb orientation of terrestrial and marine fauna in their environment, disrupt their ability to find food, avoid predation and communication (Commonwealth of Australia 2020). Considering the adjacent location of the Towra Point Nature Reserve, a Ramsar listed wetland, this is especially important for the migratory shorebirds and seabirds that use this area.

Whilst TfNSW has incorporated design features including minimisation of windows which would reduce light spillage into surrounding areas and reduce the risk of bird death as a result of birds flying into the structure, and the use of low pedestal lighting along walkways, the final design of the new Oyster Farm facilities should be undertaken with strict regard to the Best Practice Lighting Design (Commonwealth of Australia 2020).

It is likely that potential noise, vibration and light impacts would be greatest during demolition and construction and therefore these would occur over a relatively short and fixed period of time. Site activities during construction, are likely to include construction workers, vehicles, large cranes, piling equipment, piling which is proposed to be steel driven to rock, concrete kibble buckets or concrete pumping line, 20 t tracked machine, demolition activities including cranes, hand demolition and the use of power tools.

Construction activities would be undertaken as follows:

- Monday to Friday 7 am to 6 pm; and
- Saturday 8 am to 1 pm (if required).

6.4 Operation

The upgraded Site and structures would service a similar patronage as that which has occurred historically on the site. As such, there is not expected to be any substantial change in amenity, noise or light pollution under the proposal.

6.5 Sensitive Receptors

There are genuine risks associated with potential indirect impacts on neighbouring areas of high conservation value during demolition and construction activities . Sensitive receptors potentially at risk from this proposal include:

- Coastal Wetlands;
- Towra Point Nature Reserve and Ramsar wetland;
- Towra Point Aquatic Reserve and associated values;
- Woolooware Bay and Botany Bay;
- Grey Mangrove forests;
- Coastal Saltmarsh and Seagrass communities;
- The Shorebird Community occurring on the relict tidal delta sands at Taren Point; and
- Other Endangered Ecological Communities, populations and threatened species listed under the EPBC Act and BC Act.

Any proposed activities across the Site that involve the disturbance of soils and sediments, especially with the use of earthmoving and piling equipment, could result in the mobilisation of sediments into the adjacent Mangrove Forest Community, Woolooware Bay and the wider Botany Bay area. Potential indirect impacts on these areas of high conservation value include:

- Smothering of vegetation and an increase in light attenuation which can decrease the productivity of vegetation and increase mortality;
- An increase in nutrients which can cause eutrophication;
- Infill of habitat refugia and smothering of spawning habitat;
- Decrease in growth rates and increased mortality due to obstruction of gills and feeding structures by suspended particles; and
- Changes to habitat for estuarine fauna including marine species and migratory waders.

6.6 Impacts on Species, Populations and Communities of Conservation Significance

Direct impacts on species, populations and communities of conservation significance are unlikely to occur as a consequence of this proposal. However, in the absence of mitigation measures there is the potential for indirect impacts to off-site biodiversity and these are discussed below.

6.6.1 Towra Point Nature Reserve

This Ramsar listed wetland has the potential to be indirectly impacted through poor water quality during demolition and construction as a consequence of:

- Mobilisation of sediments during civil works on-site causing:
  - Uncontrolled surface water runoff from the construction area; and
  - Movement of sediment during removal of current piles and the installation of new piles and boreholes.
- Run-off of contaminants:
  - Pollutants from machinery and construction equipment including lubricants, oils and fuels; and
  - Sewage and grey water spills.

In the absence of mitigation measures, the demolition and construction across the Oyster Farm could result in the mortality of aquatic plants and fauna, and changes to aquatic plant assemblages within the Towra Point Nature Reserve. However, measures would be implemented (i.e. Construction Environmental Management Plan (CEMP) and Erosion and Sediment Control Plan (ESCP) and stringent overall environmental controls) to mitigate against these potential risks. Mitigation measures implemented during the remediation phase, and removal and installation of the new seawall have demonstrated that such activities can be undertaken safely and without incident.

6.6.2 Commonwealth Statutory Assessments

The Towra Point Nature Reserve, a Ramsar wetland, and 30 species listed under the EPBC Act are considered to be potentially at risk from this proposal. Many of the species have the potential to forage across the Site and within the locality. However, it is unlikely that the Site would provide breeding habitat for the majority of these as many of the water-dependent bird species are migratory and breed in other locations, and the Site is highly modified and provides limited habitat. As a precautionary measure the potential impacts of this proposal have been assessed for these species using the Significant Impact Criteria detailed in the EPBC Act *Administrative Guidelines for Significance* (DoE 2013). The species assessed are listed in Table 4 and the full assessments are provided at Appendix D.

Table 4 EPBC Matters of National Environmental Significance relevant to the Oyster Farm

Scientific Name	Common Name	Conservation Ranking
Wetland of International Importance		
Towra Point Nature Reserve		Declared Ramsar Wetland
Critically Endangered		
Carcharias taurus	Grey Nurse Shark	CE
Calidris ferruginea	Curlew Sandpiper	CE,M,Mar
Calidris tenuirostris	Great Knot	CE,M,Mar
Numenius madagascariens	Eastern Curlew	CE,M,Mar
Endangered		
Calidris canutus	Red Knot	E,M,Mar
Rostratula australis	Australian Painted Snipe	E
Vulnerable		
Chelonia mydas	Green Turtle	V
Carcharadon carcharias	Great White Shark	V,M
Charadrius leschenaultii	Greater Sand-plover	V,M,Mar
Epinephelus daemelii	Black Rockcod	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Migratory		
Calidris alba	Sanderling	M,Mar
Limosa limosa	Black-tailed Godwit	M,Mar
Sternula albifrons	Little Tern	M,Mar
Xenus cinereus	Terek Sandpiper	M,Mar
Hirundapus caudacutus	White-throated Needletail	M,Mar
Tringa brevipes	Grey-tailed Tattler	M,Mar
Tringa nebularia	Common Greenshank	M,Mar
Plegadis falcinellus	Glossy Ibis	M,Mar
Pluvialis fulva	Pacific Golden Plover	M,Mar
Pluvialis squatarola	Grey Plover	M,Mar
Numenius phaeopus	Whimbrel	M,Mar
Haliaeetus lecuogaster	White-bellied Sea-eagle	M,Mar
Hydroprogne caspia	Caspian Tern	M,Mar
Limosa lapponica	Bar-tailed Godwit	M,Mar
Gallinago hardwickii	Latham's Snipe	M,Mar
Gelochelidon nilotica	Gull-billed Tern	M,Mar
Calidris ruficollis	Red-necked Stint	M,Mar
Actitis hypoleucos	Common Sandpiper	M,Mar
Calidris acuminata	Sharp-tailed Sandpiper	M,Mar

Note: EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*, V = Vulnerable, E = Endangered, M = Migratory, Mar = Marine. **Sources**: DAWE (2021), DPIE (2021)

The EPBC Act assessments concluded the risks to threatened species and habitat within Woolooware Bay and locality and could be managed and mitigated with stringently applied measures that would be documented within the CEMP and ESCP.

6.6.3 NSW Statutory Assessments

Pursuant to the EP&A Act, an assessment of the impacts of the proposed works in areas of critical habitat or that is likely to affect threatened species, populations or ecological communities, or their habitats listed under the BC Act and FM Act, must be undertaken in the form of a Test of Significance (ToS) under the BC Act and Assessments of Significance under the FM Act. These assessments for those species with the potential to be impacted by this proposal are provided at Appendix E and F, and listed in Table 5.

Table 5 Communities, populations and guilds of species listed under the BC Act and FM Act for which Assessments of Significance have been undertaken

Scientific Name	Common Name	Conservation Ranking & Relevant Act
Endangered Ecological Communities		
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions		EEC-BC
Swamp Oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions		EEC-BC
The Shorebird Community occurring on the relict tidal delta sands at Taren Point.		EEC-BC
Endangered Population		
Posidonia australis in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie		EP-FM
Marine Fishes		
Carcharias taurus	Grey Nurse Shark	CE-FM
Chelonia mydas	Green Turtle	V-BC
Epinephelus daemelii	Black Rockcod	V-FM
Carcharadon carcharias	Great White Shark	V-FM
Water-dependent Birds		
Esacus magnirostris	Beach Stone-curlew	CE-BC
Calidris ferruginea	Curlew Sandpiper	E-BC
Sternula albifrons	Little Tern	E-BC
Rostratula australis	Australian Painted Snipe	E-BC
Haematopus longirostris	Pied Oystercatcher	E-BC
Charadrius leschenaultii	Greater Sand-plover	V-BC
Calidris alba	Sanderling	V-BC

Scientific Name	Common Name	Conservation Ranking & Relevant Act
Calidris tenuirostris	Great Knot	V-BC
Epthianura albifrons	White-fronted Chat	V,EP-BC
Haematopus fuliginosus	Sooty Oystercatcher	V-BC
Limosa limosa	Black-tailed Godwit	V-BC
Onychoprion fuscata	Sooty Tern	V-BC
Pandion cristatus	Eastern Osprey	V-BC
Xenus cinereus	Terek Sandpiper	V-BC
Yinpterochiropteran Bat		
Pteropus poliocephalus	Grey-headed Flying-fox	E-BC
Yangochiropteran Bats		
Miniopterus australis	Little Bent-wing Bat	V-BC
Miniopterus orianae oceanensis	Large Bent-wing Bat	V-BC
Myotis macropus	Southern Myotis	V-BC
Scoteanax rueppellii	Greater Broad-nosed Bat	V-BC
Note: BC = NSW *Biodiversity Conservation Act 2016*, FM Act = NSW *Fisheries Management Act 1994*, EEC = Endangered Ecological Community, EP = Endangered Population, CE = Critically Endangered, E = Endangered, V = Vulnerable. **Source**: DPI Fisheries (2021), DPIE (2021), PlantNet (2021).		

The ToS concluded that the risks to threatened species, populations, communities and habitats within Woolooware Bay and the larger Botany Bay could be managed with stringently applied measures that would be documented within the CEMP and ESCP. Therefore, it is unlikely that this proposal would cause significant impacts and hence the preparation of a Species Impact Statement is not required.

All marine vegetation is protected under the FM Act. A worst-case scenario of the amount of Grey Mangrove trees to be removed is 8 with trimming of up to 37 Mangroves. No other direct impacts on marine vegetation are anticipated. Trimming of Grey Mangroves would include:

- Trimming as ‘pieces cut off in trimming, clipping, paring or pruning’;
- Pruning as ‘to cut or lop superfluous or undesired twigs, branches or roots from; to trim; to remove’;
- Undertaken using hand tools; and
- Is to comply with Australian Standards of pruning techniques—see *AS4373-1996 Pruning of Amenity Trees*.

.
A permit under Part 7 of the FM Act is required to harm marine vegetation (i.e. Mangroves).

6.7 Threatening Processes

Key threatening processes for threatened and protected matters relevant to this proposal include:

- *Degradation of native riparian vegetation along New South Wales water courses* (FM Act);
  In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would

be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved;

- *Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change* (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). This proposal is likely to result in temporary changes to flow regimes as demolition and construction is undertaken. However, it is unlikely to permanently changes flows across the Site; and
- *Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales*. (FM Act).
  This proposal could assist the spread of *Caulerpa taxifolia* via equipment used in the replacement of the seawall. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga* *Caulerpa taxifolia* (I&I NSW 2009).

6.8 Connectivity

The removal and trimming of the Grey Mangrove trees are unlikely to permanently disrupt the connectivity within the locality as any removal or trimming would occur in a relatively small area of the Site which is set amongst dense Grey Mangrove Forest.

The two new northern jetties would project 33 m and 23 m respectively into Woolooware Bay. These new structures would alter the connectivity of current habitat through shading of substrates, increasing encrusting habitats and by providing perching habitat for birds.

6.9 Cumulative Impacts

Cumulative impacts are those that add to the transformation of the ecological values of a Site or locality and generally occur when habitat is removed or altered and / or the natural hydrology of the area is altered through an accumulation and interaction of impacts from past, present and future proposals.

Each of the major stages of the Oyster Farm Project have contributed to cumulative impacts. The remediation of the Site and the installation of a new seawall altered habitats but these alterations ultimately provided benefits to the Site and locality.

The final stage of the Oyster Farm Project entails the demolition of unsafe and unstable structures and replacement with purpose built facilities across a footprint which includes the removal of 35.3 m^2 of floating structures but inclusion of an additional 491.0 $m^2$of fixed overwater structures which is likely to change the structure and functioning of biological communities as a consequence of solar shading which disturbs the growth and biomass production in aquatic environments.

Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site, and hence the Site is predicted to remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

7 MANAGEMENT & MITIGATION RECOMMENDATIONS

In the absence of mitigation measures, the proposal has the potential to indirectly impact on sensitive receptors within the locality, including a range of matters of conservation significance. Consequently, a number of management and mitigation measures have been incorporated into the management of this project. The goals of environmental management are outlined below along with specific considerations for this project.

7.1 Goals

Effective measures would be established with the aim of achieving the following goals:

- Minimisation of impacts on biodiversity values of the Site and locality of Woolooware Bay and Botany Bay;
- Protection of biodiversity values across the locality of Woolooware Bay and Botany Bay;
- Protection of the values of the adjacent Towra Point Nature Reserve Ramsar wetland; and
- Protection of the values of the neighbouring Towra Point Aquatic Reserve.

7.2 General Principles

The goals would be achieved through implementation of the following general principles:

- Avoidance of impacts;
- Minimisation of impacts where avoidance is not possible; and
- Mitigation measures.

These goals and principles should form the basis for environmental management across the Site. Considerations specific to this sensitive location are detailed in Table 6 and Section 7.3 below.

Table 6 Potential Impact and Proposed Mitigation Measures

Potential Impact	Mitigation Measures	Timing & Duration	Likely Efficacy of Mitigation	Residual Impacts Anticipated
Aquatic impacts on Towra Point Nature Reserve Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay and Botany Bay	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011), Section 3.3.2 *Standard precautions and mitigation measures* of the *Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013) and *NSW control Plan for the Noxious Marine Alga* *<u>Caulerpa taxifolia</u>* (I&I NSW 2009).	Prior to demolition and construction.	Effective	None
Edge effects on adjacent Towra Point Nature Reserve Ramsar wetland, Towra Point Aquatic Reserve, Woolooware Bay and Botany Bay	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to demolition and construction.	Effective	None
Native vegetation clearing:	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011). A permit under Part 7 of the FM Act is required in order to harm (remove / trim) marine vegetation (i.e. Mangroves). Removal and trimming should be undertaken under the supervision of a qualified arborist to mitigate any impacts on these trees.	Prior to demolition and construction.	Effective	None
Trimming of mangroves	A permit under Part 7 of the FM Act is required in order to harm (trim) marine vegetation (i.e. Mangroves). Trimming should be undertaken under the supervision of a qualified Level 5 arborist to mitigate any impacts on these trees.	Prior to demolition and construction.	Effective	None

Potential Impact	Mitigation Measures	Timing & Duration	Likely Efficacy of Mitigation	Residual Impacts Anticipated
Noise, vibration and light	Detailed design of the proposal should reduce the time taken for demolition and construction thereby reducing opportunities for impacts of noise, vibration light pollution.	Prior to demolition and construction.	Effective	None
	Confine works on Site to standard working hours (i.e. during daylight hours) and ensure that security lighting is shielded and minimised.	Prior to demolition and construction.	Effective	None

7.3 Specific Considerations

Specific consideration should be given to the following issues:

7.3.1 Grey Mangrove Community

All works within the Grey Mangrove community should be undertaken in accordance with:

> Allied Tree Consultancy 2021 Arboricultural Impact Assessment Report. Oyster Farm, (Lot 3 in DP1165618) Captain Cook Drive, Woolooware Bay, NSW. Prepared for Transport for NSW. Draft 2. November 2021.

7.3.2 Construction Activities

- Inspection of buildings and other structures for signs of fauna nesting or brooding by a fauna specialist prior to demolition;
- The removal and trimming of Grey Mangrove trees should be minimised and undertaken under the direction of a qualified Level 5 Arborist as per Allied Tree Consultancy (2021);
- The protection of the Mangrove Forest Community should be given the highest priority. Disturbance and / or decline of this community could substantially impact the adjacent areas of high conservation value;
- In-water activities should be avoided and then minimised. When in-water activities are required these should be scheduled to coincide with favourable hydrodynamic conditions to ensure that sediment re-suspension and dispersion is minimised, e.g. calm conditions and high tide;
- Barges or other vessels used to assist with demolition and construction should be towed into the deeper areas of the eastern channel for overnight / day storage to avoid smothering sediments and injuring Grey Mangroves through settling onto sediments and pneumatophores during low tide;
- Vessels accessing the Site over water should strictly adhere to the well-established channel between historic oyster leases to avoid any impacts on seagrass beds within Woolooware Bay; and
- Floating booms, silt curtains or screens should be used during the removal and installation of the piles and structures to minimise the mobilisation of sediments and the spread of suspended sediments.

7.3.3 Erosion and Sedimentation Controls

- Implementation of the ESCP to minimise opportunities for mobilised sediments to extend into Woolooware Bay and Botany Bay;
- Installation of sediment detention devices prior to construction to prevent untreated run-off and sediment entering waterways;
- Place any stockpiles away from stormwater drains and drainage lines;
- Any excavated materials should be removed off Site as soon as practicable to minimise the risk of run-off into adjacent areas;
- Rubbish and debris should be collected and removed off Site to prevent it entering the waterway and causing harm; and

- No chemicals, fuels and / or waste should be stored within or near any natural or stormwater drainage lines or on the foreshore. All such substances are to be contained in sealed vessels of appropriate volumes and, where necessary, stored within bunded areas.

8 CONCLUSION

The removal of the existing dilapidated structures across the Oyster Farm Site, and construction of new purpose built facilities would reduce the area of floating structures and gangways by 35.3 m^2 but increase the area of fixed overwater structures by 491.0 m^2, resulting in the alteration of this area as estuarine habitat. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate. To achieve this outcome, it is likely that 8 Grey Mangrove trees would be removed and 37 individuals would be tied back and / or trimmed. It should be noted that many of the trees trimmed in 2019 for the construction of the new seawall at the Oyster Farm Site now have epicormic growth on branches and / or trunks demonstrating that sympathetic pruning of these trees is a successful way to mitigate against larger tree loses. A permit under Part 7 of the FM Act is required to harm marine vegetation (i.e. Mangroves) and the removal and trimming should be undertaken under the supervision of a qualified arborist to mitigate any impacts on these trees.

There are a number of potential risks to sensitive receptors during demolition of the existing structures and construction of the new facilities as the Site is located adjacent to a number of important and sensitive receptors (i.e. Proximity Area for Coastal Wetlands, Coastal Wetland, Grey Mangrove forests, Towra Point Nature Reserve Ramsar Wetland, Towra Point Aquatic Reserve, Woolooware Bay and Botany Bay) and it is these areas of high conservation significance which are potentially at risk from this proposal. These risks were assessed as required under the EP&A Act and the EPBC Act.

The Tests of Significance (Part 7 of the BC Act) concluded that the risks to species, populations, communities and habitats within Woolooware Bay and the larger Botany Bay could be managed with commonly applied measures. Therefore, it is considered unlikely that this proposal would cause significant impacts, and hence the preparation of a Species Impact Statement is not required.

The EPBC Act assessments also concluded the risks to Towra Point Nature Reserve, and species and habitat within Woolooware Bay and locality could be managed and mitigated with commonly applied measures that have been documented within the Construction Environmental Management Plan (CEMP) and Erosion and Sediment Control Plan (ESCP). Key to these mitigation measures will be the protection of the adjacent areas of conservation significance.

The earlier stages of the Oyster Farm Project (i.e. extensive soil remediation and seawall replacement) were undertaken successfully without perceivable significant impacts on adjacent and nearby sensitive receptors, demonstrating that with stringent measures and sympathetic management of the Site these areas of high biodiversity conservation could be protected.

This assessment has been based on a design currently under development, and as such this assessment should be considered as preliminary only. Should the final construction design differ substantively from this preliminary design then our impact assessment would require revision to include these changes.

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APPENDIX A

Oyster Farm Overwater Structures

Detailed Fauna Methodology
&
Fauna Species List

FAUNA SURVEY METHODOLOGY
&
SPECIES RECORDED

Fauna investigations of the overwater structures and proximate habitats was undertaken by Deryk Engel (B.Env.Sc. (Hons.)) on the 26 and 28 August, and 10 September, 2021. Data collected during previous studies for the Oyster Farm Project, together with a recent initial Site assessment aimed at scoping the current condition of the Site, indicated that the following survey methodology would be adequate to determine the use and value of the Site to fauna. Tasks included:

- Dedicated bird surveys;
- Echolocation detection targeting insectivorous bats (i.e. Yangochiroptera [microbats]); and
- The identification of any indirect evidence such as tracks, scats and scratchings that would suggest the presence of a particular fauna species.

The survey times, weather and, methods employed during each investigation are provided in Table 1. The area investigated during the course of the field surveys included the recently created hardstand area and the overwater structures (i.e. the Site).

Table A1 Fauna survey details

Date (2021)	Duration 24-hour time	Cloud cover	Rain	Winds	Beaufort Scale	Temperature (°C)	Method(s) employed
26/08	15.30 – 16.00	0%	None	Light breeze	1	14	1 x Dedicated bird survey Incidental fauna survey
28/08	9.30 – 10.15	70%	None	Moderate breeze	3	15	Establish Anabat units 1 x Dedicated bird survey Incidental fauna survey
10/09	10.00 – 10.45	0%	None	None	0	20	Collection Anabat units Dedicated bird survey Incidental fauna survey
Note: 11 mm of rain was recorded on 5 & 6 September 2021.							

Dedicated Bird Surveys

Dedicated bird surveys were undertaken over 20 minutes per visit (i.e. 26 & 28 August, 10 September 2021) at high and low tide. All birds observed or heard calling were recorded (as per DECC 2004).

The locations of the dedicated bird surveys were undertaken are shown on Figure A, and the GPS are detailed below:

- Easting [E] 329042; Northing [N] 6232166;
- E328988; N6232187; and
- E329039; N6232070.

A total of 60 minutes of dedicated bird surveys were undertaken. Given the size of the site and scope of works proposed, this level of survey effort is considered adequate to determine the diversity of species that are present in the study area.

In addition to the dedicated bird surveys, whilst traversing the Site on foot or during the course of conducting other fauna work, any incidental bird observation or evidence to suggest the presence of a bird (e.g. white wash, nest site) were noted.

Microbat Surveys

The overwater structures were noted to support suitable sheltering opportunities for cave-dependent Yangochiroptera [microbats] (i.e. roof cavities); to target this group of animals Anabat Express™ echolocation detectors were employed. These units were placed within the subject site within proximity to two of the overwater structures that supported roof cavities that could be occupied by cave-utilising microbats (Figure A). The units were established on the 28 August, and collected 13 days later. GPS locations of the Anabats were:

- E329023; N6232166; and
- E329066; N6232280.

The units were set to record during the evening from sunset at 5.30 pm to sunrise at 6.30 am (total survey period 11 hours). Upon collection, each detector was noted to be operating. Any calls recorded were analysed in-house using Anabat 6.3 computer software.

Figure A1 Locations of specific fauna survey methods

Results

Table A2 lists fauna species recorded during the course of the surveys.

Table A2 Fauna species recorded during surveys during September & October 2021

FAMILY	SCIENTIFIC NAME	COMMON NAME	DETECTION
MAMMALS			
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	Scats
Vespertilioidae	*Chalinolobus gouldii*	Gould's Wattled Bat	Echolocation (C)
	Chalinolobus morio	Chocolate Wattled Bat	Echolocation (P)
	Nyctophilus sp.	Long-eared Bat	Echolocation (P)
	Vespadelus vulturnus	Little Forest Bat	Echolocation (C)
Miniopteridae	*Miniopterus orianae oceanensis*	**Large Bent-winged Bat ***	Echolocation (P)
Molossidae	*Austronomus australis*	White-striped Freetail Bat	Echolocation (C)
BIRDS			
Anatidae	*Anas superciliosa*	Pacific Black Duck	Observed
Anhingidae	*Anhinga novaehollandiae*	Darter	Observed
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant	Observed
	Phalacrocorax melanoleucos	Little Pied Cormorant	Observed
	Phalacrocorax sulcirostris	Little Black Cormorant	Observed
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	Observed
Threskiornidae	*Threskiornis molucca*	Australian White Ibis	Observed
Haematopodidae	*Haematopus longirostris*	**Australian Pied Oystercatcher ***	Observed
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	Observed
Laridae	*Chroicoephalus novaehollandiae*	Silver Gull	Observed
Cacatuidae	*Eolophus roseicapillus*	Galah	Observed
	Cacatua sanguinea	Little Corella	Observed
	Cacatua galerita	Sulphur-crested Cockatoo	Observed
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	Observed
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	Call
	Manorina melanocephala	Noisy Miner	Observed
Artamidae	*Strepera graculina*	Pied Currawong	Observed
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	Observed
Corvidae	*Corvus coronoides*	Australian Raven	Observed
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	Call
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	Observed
Notes: * = Species is listed under the NSW *Biodiversity Conservation Act 2016*; C - Confident Identification. Small possibility of confusion of calls with those of other bat species; P - Probable Identification. Some possibility of confusion of calls with those of other bat species.			

Figure A2 Shows the locations of threatened fauna recorded during September & October 2021 surveys during assessment of the overwater structures across the Site.

Figure A2 Threatened fauna recorded during September & October 2021

APPENDIX B

Curricula Vitae

ALISON HUNT & ASSOCIATES PTY LTD

Dr Alison Hunt

Dr Alison Hunt has 30 years of experience in providing environmental and ecological services in Australia and the USA. She has a Bachelor of Science (Honours) with a major in ecology and a PhD in conservation and population genetics. She is a committed environmental professional with a broad knowledge base of environmental and ecological planning issues. Alison was Senior Ecologist for ERM Pty Ltd and Principal and head of Ecology NSW for GHD Pty Ltd before starting her own consultancy in 2006. She is a Committee Member of the Ecological Consultants Association (NSW) and is a Department of Primary Industries NSW – Fisheries appointed scientific member of the Batemans Marine Park Advisory Committee. Alison has extensive experience working in the marine and estuarine ecosystems of Sydney Harbour and Botany Bay including most recently:

- **Marine benthic infauna assessments for the Kendall Bay Remediation Project, Jemena Ltd**. Involved detailed assessment of marine benthic communities at test and reference sites within and around Kendall Bay and working with CSIRO to develop a weight-of-evidence approach to remediation of Kendall Bay.
- **Oyster Farm Project, APP & Transport for NSW**. Ongoing project involving the remediation of an Oyster Farm, Woolooware Bay; including remediation of the Site, removal of existing seawall and installation of the new enhanced seawall and demolition of the existing structures and construction of new facilities.
- **Ecological advisor at the Australian Institute of Police Management site, North Head, Sydney, Australian Federal Police**. Aimed at advising on the protection of the Little Penguin and neighbouring marine environment during redevelopment.
- **Birkenhead Point Marina Pty Ltd – Birkenhead Point Marina, Sydney Harbour, Drummoyne.** Involved detailed assessment of the local marine ecology and assessment of the likely impacts of the redevelopment on matters of conservation significance.
- **Redevelopment of the UTS Rowing Club, Sydney Harbour, University of Technology, Sydney and Urbis.** Including surveying and mapping of the distribution of seagrass and other marine flora and fauna to determine the likely impacts of the proposed redevelopment.
- **Proposed rezoning of River Road West, Parramatta.** Including surveys of the mangroves and aquatic fauna habitat of the Parramatta River.
- **Construction of a boat skid, pontoon and jetty below the mean high tide line at Glades Bay, Gladesville**. Including mapping of seaweed, mangroves and encrusting fauna communities.

She has also worked in an international setting undertaking ecological research, environmental assessment and as a limited-term assistant professor in the USA where she lectured in Biology and Ecology. Alison has also lectured in Marine Biology at the University of Technology Sydney and tutored Genetics and Biology at the University of Sydney. Alison is a recognised expert in her field through publishing in international scientific journals (from 1987 – 2013) as well as peer reviewer for these journals.

Ariadne Australia Pty Ltd – Batemans Bay Marina, Batemans Bay
Ariadne Australia Pty Ltd – Pt Macquarie Marina, Port Macquarie
These projects have involved constraints and opportunities analyses of the proposed redevelopment of these two very different marinas. At both sites seagrass beds and mangrove forests dominate and important habitat for a range of threatened species are located within the locality. These projects involved mapping of species distribution and advising on innovative ways in which some development may proceed whilst still protecting biodiversity.

Birkenhead Point Marina Pty Ltd – Birkenhead Point Marina, Sydney Harbour, Drummoyne.
Assessment of the ecological impacts on the marine environment as a consequence of the redevelopment of Birkenhead Point Marina, Sydney Harbour, Drummoyne. Involved detailed assessment of the local marine ecology, including mapping of seagrass beds and existing jetty pylons and assessment of the likely impacts of the redevelopment on matters of conservation significance.

Eco Villages Australia Pty Ltd - Currawong Beach, Pittwater
The Currawong Beach Resort previously owned by the NSW Labour Council is undergoing redevelopment and whilst direct impacts on the marine environment are not anticipated important seagrass beds are located offshore. This project involved seagrass identification and mapping of their distribution and advising the development team of appropriate measures to protect these beds and other marine organisms within Pittwater.

Australian Federal Police – North Head
Dr Alison Hunt has undertaken ecological assessment and is ecological advisor for the protection of the Little Penguin during the proposed redevelopment of the Australian Institute of Police Management at their North Head, Sydney site. The Little Penguin which nests along the sandstone cliffs of the site is the only remaining mainland population of this species. Ensuring protection of this population and the neighbouring marine environment are key issues for the Commonwealth and the local community. Alison has prepared Ecological Assessment reports for this site, been involved in the development management plans, participated in a PWC Hearing and prepared a referral under the EPBC Act.

Australian Fisheries Management Authority – Torres Strait, Nhulunbuy, Darwin & Broome
This project focused on advising AFMA on the likely impacts of disposal of illegal fishing boats at Torres Strait, Nhulunbuy, Darwin and Broom and field surveys to identify the most suitable disposal sites with due consideration to protection of the marine environments. This challenging project also involved consultation with relevant stakeholders.

Eco Villages Australia Pty Ltd - Currawong Beach, Pittwater
The Currawong Beach Resort previously owned by the NSW Labour Council is undergoing redevelopment and whilst direct impacts on the marine environment are not anticipated important seagrass beds are located offshore. This project involved seagrass identification and mapping of their distribution and advising the development team of appropriate measures to protect these beds and other marine organisms within Pittwater.

Ariadne Australia Pty Ltd – Batemans Bay Marina & Pt Macquarie Marina
These projects have involved constraints and opportunities analyses of the proposed redevelopment of these two very different marinas. At both sites seagrass beds and mangrove forests dominate and

important habitat for a range of threatened species are located within the locality. These projects have involved mapping of species distribution and advising on innovative ways in which some development may proceed whilst still protecting these valuable resources.

Sydney Water Corporation – Kurnell, Botany Bay

Dr Alison Hunt, whilst Principal Ecologist with GHD Pty Ltd, investigated the ecological impacts of the proposed Sydney Water Desalination Plant at Kurnell. These studies included the mapping of remnant vegetation communities on site and an assessment of the likely impacts of the Desalination Plant on the site and the overall conservation values of the Kurnell Peninsula. She was also responsible for the assessment of the effects on marine population of the ocean inlet associated with this plant off the Kurnell Peninsula.

Sydney Harbour Foreshore Authority – Botany Bay

Dr Alison Hunt was project manager and lead scientist in the terrestrial and aquatic assessment of Spring Creek Wetland and Marsh Street Wetlands for the proposed Cooks Cove development site, Botany Bay, NSW. Surveys included fish, benthos and mapping of terrestrial and wetland vegetation communities across the proposed site.

Kogarah City Council – Botany Bay

Whilst Principal Ecologist with GHD Pty Ltd, designed and undertook a survey for Kogarah City Council which addressed the potential effects of leachate on marine benthos within Georges River, Botany Bay. This project included a modified BACI sampling design, remote collection of benthic samples, identification of benthos, and statistical analyses which allowed differences in benthos from several locations to be compared.

Qualification and Affiliations

- PhD, University of Wollongong, 1993
- BSc (Hons. I), University of Wollongong, 1987
- Royal Zoological Society of NSW, since 1983
- Australian Marine Sciences Association, since 1984
- Ecological Society of Australia, since 1984
- AUSRIVAS Certified
- Past Scientific Member of the Batemans Marine Park Advisory Committee
- BioBanking Accredited Assessor

Academic Awards

- Victorian Institute of Marine Sciences – Research Grant
- Genetics Society of Australia – Smith-White Award
- Ecological Society of Australia – Student Research Award
- Linnean Society of NSW – Joyce Vickery Research Support Grant.

Selection of Scientific Publications

- Sherman C, Hunt A & Ayre DJ 2008 Is Life-History a Barrier to Dispersal? Contrasting Patterns of Genetic Differentiation along an Oceanographically Complex Coast. Biological Journal of the Linnean Society, 2008, 95, 106–116.
- Hunt A, Karlson RH & McDonald JH (1997) Nuclear DNA sequence polymorphism analysis of population structure and geographic variation in a freshwater bryozoan with dimorphic dispersal capabilities. Ecological Society of America (USA);
- Hunt A, Karlson RH & McDonald JH (1996) Analysis of population structure and geographic variation in a freshwater bryozoan with dimorphic dispersal capabilities using DNA sequence polymorphisms. Society for the Study of Evolution (USA);
- Hunt A (1995) Genetic consequences of contrasting dispersal strategies for populations of two Australian species of intertidal starfish. Marine Benthic Ecology Meeting (USA);
- Hunt A (1993) Effects of contrasting patterns of larval dispersal on the genetic connectedness of local populations of two intertidal starfish, Patiriella calcar and P. exigua. Mar. Ecol. Prog. Ser. 92: 179-186;
- Hunt A (1992) Philopatry and the genetic structure of populations. Genetics Society of Australia;
- Hunt, A (1991) Restricted versus widespread dispersal of *Patiriella calcar* and *P. exigua.* Australian Marine Sciences Association;
- Hunt, A (1991) The consequence of broadcast spawning versus philopatry for the genetic structure of Australian starfish. Society for the Study of Evolution (USA);
- Hunt A & Ayre DJ (1989) Population structure in the sexually reproducing sea anemone, *Oulactis muscosa*. Mar. Biol. 102: 537-544;
- Hunt A (1989) Some preliminary data describing the structure of several populations in two co-occurring species of starfish. Ecological Society of Australia;
- Hunt A (1988) Geographic variation in the sea anemone *Oulactis muscosa.* Genetics Society of Australia; and
- Hunt A, Dickens HJ & Whelan RJ (1987) Movement of mammals through tunnels under railway lines. Aust. Zool. 24: 89-93.

DERYK CONRAD ENGEL

Senior Ecologist

Tertiary Qualifications:

1985 – 1988 – Bachelor of Environmental Science
University of Wollongong.
1989 – 1990 – Honours in Environmental Science
University of Wollongong.

Professional Affiliations:

Ecological Consultants Association of NSW
Ecological Society of Australia
Australian Mammal Society
Member Birdlife Australia
Royal Zoological Society

Licences and Certificates:

- Named under:
  - Scientific Research Licence under section 132C of the National Parks & Wildlife Act 1974 (#SL100484)
  - NSW Agriculture Animal Research Licence
  - Animal Care and Ethics Committee Research
  - Authority through the Director – General of the NSW Agriculture
- OH&S Induction Training for Construction Work – General Course
- Confined space
- Work safely at heights
- Asbestos awareness training
- Safely access the rail corridor
- Rail Industry Worker
- First aid
- Class MR Drivers Licence
- Boat Driver's Licence – NSW Maritime
- PADI – Advanced Open Water Diver certificate
- PaddleNSW – Kayak Guide certification
- ASI Academy of Surfing – Standup Paddle Board Instructor certification
- ASI Academy of Surfing – Water rescue safety award

Areas of Specialisation:

- Ecological survey and assessment.
- Project management and report preparation.
- Client liaison.
- Environmental management and implementation of best practice policies.
- Environmental assessment and habitat identification.
- Assessment of the value of habitat areas to species of conservation significance
- Clearing supervision
- Site monitoring post-development.

Vaccinations:

- Deryk maintains all of the necessary vaccinations required to handle microchiropterans (insectivorous bats) and release these animals from harp traps.
- Deryk is vaccinated against the bacterial infection caused by *Clostridium tetani* (Tetanus).

Publication Reviews:

Robertson, P. and Coventry, A.J. (2019) *Reptiles of Victoria: A guide to identification and ecology*. CSIRO Publishing, Victoria.

Publication reviewed at the request of the National Parks Association of NSW. Review published in the winter 2019 edition of Nature NSW.

Scientific Publications:

Engel, H. and Engel, D. (2012) Use of different bait types to determine which is the most effective at luring animals into the field of view of an infrared camera. *Consulting Ecology*. Vol 29, pp 11-19.

Engel, D. and Burcher, P. (2010) Infrared cameras, one alternative to trapping. *Consulting Ecology*. Vol 25, pp 19-22.

Engel, D., Bloomfield, S. and Edwards, J. (2010) A waterproofing option for Anabat detectors – protecting your tool. *Consulting Ecology*. Vol 24, pp 51-58.

Engel, D. (2004) Some observations on the Cumberland Plain Land Snail (*Meridolum corneovirens*). *Newsletter of the Ecological Consultants Association of NSW Inc*. Vol 7, pp 12-13.

Engel, D. (2004) Some observations on the Squirrel Glider (*Petaurus norfolcensis*), and the implications of these to the management of this threatened species. *Newsletter of the Ecological Consultants Association of NSW Inc*. Vol 7, pp 13-14.

Cameron, P, J. and Engel, D. (2001) Natural Resource Management: its role in eco-tourism enhancement and sustainability. *Proceedings of the ARAZPA/ASZK 2001 Conference: Zoos as Ecotourism Destinations.* Western Plains Zoo, Dubbo, pp 66-71.

Engel, D. and Rose, T. (1997) Diet of the Black-shouldered Kite (*Elanus axillaris*) in New South Wales. *The Australian Bird Watcher* Vol 17 (4) pp 211-213.

Quin, D., Goldingay, R., Churchill, S. and Engel, D. (1996) Feeding behaviour and food availability of the Yellow-bellied Glider (*Petaurus australis*) in North Queensland. *Wildlife Research* Vol 23 (6) pp 637-648.

Employment History:

1995 – current – Director – LesryK Environmental Pty Ltd
Conducting fauna investigations and preparing assessment reports for a range of developments proposed by a variety of federal, state and local government agencies, as well as private developers. Preparation of planning documents (Reviews of Environmental Factors) and rehabilitations plans (Bushland/Vegetation Plans of Management).

2019 – current – Senior Ecologist – OzArk Environment and Heritage Pty Ltd (Dubbo)
Conducting of fauna investigations and preparing assessment reports (including Biodiversity Development Assessment Reports) for a range of developments being considered within various western portions of NSW. Mentoring members of the ecological team. Preparation of quotes and determination of field work requirements.

2008 Research Assistant – University of Queensland.
Engaged to undertake fauna audits using set survey methods within defined sites in Brigalow Woodland. Work was centred around the northern New South Wales township of North Star, this being located approximately 1.5 hours north east of Moree and 1.5 hours south east of the Queensland township of Goondiwindi.

2002 Principal Ecologist – Hyder Consulting.
Responsibilities included the conducting of ecological surveys and the preparation of flora and fauna reports.

1996 Ranger – Royal National Park, South Metropolitan District.
Duties included the overseeing and assistance with track construction and maintenance, production of Review of Environmental Factors (REF), preparation of grant applications and general ranger duties.

1995 – 1996 & 1998 Environmental Officer – NSW Roads and Maritime Services, Sydney Region.
Duties included the overseeing of RTA projects, production of Review of Environmental Factors (REF) and Environmental Management Plans (EMP), preparation of community responses to the M5 East Motorway Environmental Impact Statement and other duties associated with the environmental responsibilities of the Roads and Traffic Authority.

1991 – current – Research assistant, field operative – various consultancy firms.
Undertaking field investigations targeting fauna species for a variety of ecological consultancy firms.

1990 – 1991 Research Officer – Environmental Science and Services, Brisbane.
Responsibilities included the assessment of habitat use, group size and foraging movements of Yellow-bellied Gliders, in the Tully-Millstream Area, Ravenshoe, Far Northern Queensland. This was a one-year monitoring project which involved capture, tagging, radiotracking and mapping of foraging movements.

Current Contracts:

- Conducting of targeted fauna surveys over the course of six months (commencing July 2020) on a large parcel of private land near Morgans Road, Belrose that has been identified for subdivision. Surveys undertaken to assist with the preparation of the Biodiversity Development Assessment Report (BDAR) being prepared. Client: Hayes Environmental Pty Ltd.

- Preparation of a Review of Environmental Factors, including preparation ecological working paper, Interim foreshore stabilisation works, Bonnie Vale, Royal National Park. Client: National Parks and Wildlife Service.

- Preparation of a Review of Environmental Factors, including preparation ecological working paper, for Fire trail Maintenance Works, Grosvenor-Gwydir fire trail complex. Client: Soil Conservation Service on behalf of Ku-ring-gai Council.

- Seagull Management, Snapper Island, Sydney Harbour. Objective, address seagull number and instigate humane treatment of population control. Client: Department of Finance, Broadspectrum Property/APP Corporation

- Fauna survey and assessment, median works, Hume Highway, Marulan Bypass, Marulan. Client: Transport for NSW.

- Australian White Ibis (*Threskiornis molucca*) monitoring study, Canterbury-Bankstown Local Government Area. Twelve-month study (at quarterly) currently being undertaken on behalf of Canterbury-Bankstown Council.

Select list of recent/applicable ecological consultancy projects:

- Biodiversity Development Assessment Report (BDAR), 45-49 Warriewood Road, Warriewood, NSW. Report prepared at the request of Creative Planning Solutions on behalf of the property owner during March 2020.

- Targeted Long-nosed Bandicoot (*Perameles nasuta*) investigation and general ecological consideration – proposed dwelling extension, 11-13 Hunter Street, Lewisham, NSW. Report prepared for Strata-Facility & Building Management during September 2019.

- Habitat assessment, Chiswick Stone Wharf removal project, Parramatta River. Investigation conducted at the request of NSW Roads and Maritime Services (now Transport for NSW) during August 2017.

- Flora and fauna assessment, removal of existing sandstone wall that extends into the Parramatta River, 5 Punch Street, Balmain. Investigation conducted at the request of NSW Roads and Maritime Services (now Transport for NSW) during June 2017.

- Targeted Long-nosed Bandicoot (*Perameles nasuta*) study, 97 Brighton Street, Petersham, NSW. Report prepared for Mr Robert Fung (property owner) during December 2017.

- Proposal for the relocation of a flying-fox colony from the Royal Botanic Gardens, Sydney. Report prepared for the Botanic Gardens Trust during October 2008.

- Ecological study, assessment of proposed perimeter fence, Watsons Bay, Sydney. Report prepared at request of ENSR Australia Pty Ltd on behalf of Defence Maintenance Management Pty Ltd during May 2008.

- Flora and fauna survey of Sydney Botanic Garden as part of the preparation of a Conservation Management Plan. Report prepared at the request of Conybeare Morrison and Partners, on behalf of the Botanic Gardens Trust during June 2002.

- Fauna audit, Mount Annan Botanic Gardens. Seasonal study [conducted over two seasons, winter and spring 2020] undertaken at the request of Australian Botanic Garden, Mount Annan. Report updating the fauna audit previously conducted at the request of the Gardens during the early part of 2006.

- Conservation area monitoring and biometric condition assessment, Southern Highlands Regional Shooting Complex (Hill Top Conservation Area). Yearly monitoring (2018/2019) undertaken at the request of the NSW Office of Sport.

- Regular monitoring of habitat boxes established as part of the conditions of approval provided by the Department of Planning for the residential subdivision of Lot 171 Highview Drive, Dolphin Point, NSW. Monitoring undertaken over a period of three years (2017-2019) at the request of Allen Price & Scarratts Pty Ltd.

- Fauna survey as part of a Stewardship site consideration (in accordance with the NSW *Biodiversity Conservation Ac 2016*), Greenwich Park, Marulan. Investigation undertaken at the request of Hayes Environmental Pty Ltd during 2019.

- Flora and fauna, survey and assessment, Interim Land Management Works, 'Nimmie-Caira' property, Maude and Balranald, NSW. Report prepared at the request of NSW Pubic Works Advisory during 2016.

APPENDIX C

Threatened communities, populations and species with potential to occur within locality (i.e. 10 km radius) of the Oyster Farm

Endangered ecological communities, populations and species recorded, and / or predicated to occur within the locality of the Oyster Farm

Vegetation Community	Conservation Status	Preferred Habitat	Likely Occurrence on Site
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	**BC-EEC EPBC-V**	**Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands.**	**Not recorded on or directly adjacent to the site but small patches have been mapped as occurring nearby.**
Swamp Oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions	**BC-EEC**	**Found on the coastal floodplains of NSW. Casuarina glauca (Swamp Oak) is the dominant species. On the fringes of coastal estuaries, the ground layer may include *Alexfloydia repens* (BC Act listed), *Baumea juncea, Juncus krausii, Phragmites australis, Selliera radicans* and other saltmarsh species.**	**Not recorded on site but small patches occur nearby.**
***The Shorebird Community occurring on the relict tidal delta sands at Taren Point*.**	**BC-EEC**	**A group of shorebirds which occupy a particular area of Botany Bay and includes a characteristic assemblage of approximately 20 species. :Occurs on the relict marginal shoal of the Georges River between Taren Point and Shell Point in Botany Bay**	**Occurs off-site on the sandflat / mudflat approximately 2 km to the west of the site.**
Posidonia australis in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie	**FM-EP**	**This seagrass population is found in the protected waters of coastal bays and estuaries and coastal lakes that are subject to frequent tidal flushing. Seagrass communities provide important feeding and refuge areas for a range of fish, molluscs and crustaceans, are drivers of fisheries productivity in coastal waters and are crucial to the maintenance of estuarine biodiversity. The population is located in Woolooware Bay and around Towra Point.**	**Not recorded on site or adjacent to the site although it is known from nearby locations.**

Note: BC = NSW Biodiversity *Conservation Act 2016,* FM Act = NSW *Fisheries Management Act 1994*, EPBC = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, EEC = Endangered Ecological Ecology, EP = Endangered Population, CE = Critically Endangered, E = Endangered, V = Vulnerable. **Bold** indicates those EEC recorded on site, with the potential to occur on site and / or with the potential to occur in the locality and to be affected by this proposal. **Sources**: BIONET (2021), PlantNet (2021),SPRAT(2021).

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
FLORA			
Callistemon linearifolius	Netted Bottle Brush	V-BC	This shrub species grows in dry sclerophyll forest on the coast and adjacent ranges. Unlikely. Suitable vegetation associations not present.
Senecio spathulatus	Coast Groundsel	E-BC	A low-growing smooth-stemmed daisy which grows on frontal dunes. Unlikely. Site is not representative of a frontal dune system.
Prostanthera densa	Villous Mint-bush	V-BC V-EPBC	Erect mint-smelling shrub which grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea. Unlikely. Site does not support suitable soils or geology.
Syzygium paniculatum	Magenta Lilly Pilly	E-BC V-EPBC	On the south coast it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. Unlikely. Suitable vegetation associations not present.
REPTILES			
Caretta caretta	Loggerhead Turtle	E-BC E-EPBC	This turtle is found in tropical and temperate waters off the Australian Coast. They have been recorded nesting on the NSW north coast and feeding around Sydney. Loggerhead Turtles have been recorded 3 km south of the site in Bate Bay, outside of Botany Bay. Unlikely. Records are outside of Botany Bay.
Chelonia mydas	**Green Turtle**	**V-BC** **V-EPBC**	**This turtle is known to occur in coastal waters of NSW and is opportunistically recorded feeding in estuaries particularly during warmer months of the year. It has been recorded at Taren Point.** **Likely to occasionally occur in Botany Bay.**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Eretmochelys imbricata	Hawksbill Turtle	V,M,Mar-EPBC	This turtle is pelagic for the first 5 – 10 years of life and then settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. They have also been found in association within seagrass habitats of coastal waters. This species has been recorded 3 km south of the site in Bate Bay, outside of Botany Bay. Unlikely. Records are outside of Botany Bay.
Varanus rosenbergi	Rosenberg's Goana	V-BC	Found in heath, open forest and woodland, associated with termite mounds which are a critical habitat component. Unlikely to occur. Record is from the Royal National Park. Habitat not present.
AMPHIBIAN			
Litoria aurea	Green & Golden Bell Frog	E-BC V-EPBC	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). It has been recorded in terrestrial environments approximately 4 km east of the site. Unlikely to occur. All water resources on site are estuarine.
Pseudophryne australis	Red-crowned Toadlet	V-BC	Occurs in open forests and periodically inhabits wet drainage lines below sandstone ridges that often have shale lenses or cappings. Unlikely to occur. Records within Royal National Park. Habitat not available.
FISHES			
Black Cod	***Epinephelus daemelii***	**V-FM** **V-BC**	**Generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m. Recently settled juvenile black cod (i.e. individuals that have recently completed the pelagic, drifting larval stage) are often found in coastal rock pools while slightly older juvenile black cod are often found in estuary systems.** **Juveniles may be found in Woolooware Bay.**
Grey Nurse Shark	***Carcharias taurus***	**E-FM** **CE-EPBC**	**Breeding sites generally have sandy-bottomed gutters or rocky caves and are in the vicinity of inshore rocky reefs or islands. The closest breeding site is at**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
			Maroubra approximately 16 km to the north-east. Feeds on a large range of bony fishes, sharks, rays, squid and crustaceans. **Likely to occasionally occur in Botany Bay.**
Great White Shark	***Carcharadon carcharias***	**V-FM** **V,M-EPBC**	**Typically found from close inshore habitats (e.g. rocky reefs and shallow coastal bays) to the outer continental shelf and slope areas.** **Likely to occasionally occur in Botany Bay.**
AVES			
Water--dependent Species			
Botaurus poiciloptilus	Australasian Bittern	E-BC E-EPBC	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Recorded at Towra Point Nature Reserve. Unlikely to occur. No habitat on site.
Calidris alba	**Sanderling**	**V-BC** **M,Mar-EPBC**	**A summer migrant which is recorded along the NSW coast on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons.** **Potential to occasionally occur. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.**
Calidris canutus	**Red Knot**	**E,M,Mar-EPBC**	**This species mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast.** **Potential to occasionally occur. This species has been recorded from numerous locations in Botany Bay.**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Calidris ferruginea	**Curlew Sandpiper**	**E-BC CE,M,Mar -EPBC**	**Occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts.** **Potential to occasionally occur. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.**
Calidris tenuirostris	**Great Knot**	**V-BC CE,M,Mar -EPBC,**	**Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms.** **Potential to occasionally occur. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.**
Charadrius leschenaultii	**Greater Sand-plover**	**V-BC V,M,Mar-EPBC**	**Restricted to coastal areas where it roosts during high tide on sandy beach and rocky shores. Forages on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.** **Potential to occasionally occur. This species has been recorded from numerous locations in Botany Bay.**
Charadrius mongolus	**Lesser Sand-plover**	**V-BC E,M,Mar-EPBC**	**Non-breeding summer migrant. During the non-breeding season, the species is almost strictly coastal, preferring sandy beaches, mudflats of coastal bays and estuaries, sand-flats and dunes near the coast and occasionally frequenting mangrove mudflats in Australia.** **Potential to occasionally occur. This species has been recorded from Botany Bay.**
Diomedea exulans	Wandering Albatross	E-BC E,M,Mar-EPBC	This species is marine, pelagic and aerial and feed in pelagic, offshore and inshore waters. Unlikely to occur at the Site. Recorded off the Royal National Park.

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Epthianura albifrons	White-fronted Chat	V,EP-BC	Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals. Unlikely to occur across the Site although recorded at Towra Point Nature Reserve.
Esacus magnirostris	Beach Stone-curlew	CE-BC Mar-EPBC	This species forages in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Potential to occasionally occur. Has been recorded within Woolooware Bay.
Haematopus fuliginosus	Sooty Oystercatcher	V-BC	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Recorded at numerous locations in Botany Bay.
Haematopus longirostris	Pied Oystercatcher	E-BC	Favours intertidal flats of inlets and bays, open beaches and sandbanks. A pair recorded perching 100 m NE of the Site. Recorded at numerous locations in Botany Bay.
Limosa limosa	Black-tailed Godwit	V-BC M,Mar-EPBC	Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Potential to occasionally occur. Recorded at Towra Point Nature Reserve.
Numenius madagascariensis	Eastern Curlew	CE,M,Mar-EPBC	This curlew is Australia's largest shorebird. It arrives back in Australia in August and feeds on intertidal mudflats. Potential to occasionally occur. This species has been recorded within Woolooware Bay and within the wider Botany Bay.

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Onychoprion fuscata	**Sooty Tern**	**V-BC**	**The Sooty Tern breeds and generally forages offshore tropical waters.** **Potential to occasionally occur. Recorded at Towra Point Nature Reserve.**
Pandion cristatus	**Eastern Osprey**	**V-BC**	**Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feeds on fish over clear, open water.** **Potential to occasionally overfly the Site. Recorded at Towra Point Nature Reserve.**
Rostratula australis	**Australian Painted Snipe**	**E-BC** **E-EPBC**	**Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.** **Unlikely to find suitable habitat at the Site. Recorded at Taren Point.**
Sternula albifrons	**Little Tern**	**E-BC** **M,Mar-EPBC**	**Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).** **Potential to occasionally occur. Recorded at numerous locations in Botany Bay.**
Thalassarche melanophris	Black-browed Albatross	V-BC V,M,Mar-EPBC	Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Spends most of its time at sea, breeding on small isolated islands. Unlikely to occur. Recorded off the Royal National Park.
Xenus cinereus	**Terek Sandpiper**	**V-BC** **M,Mar-EPBC**	**Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.** **Potential to occasionally occur. Found at numerous locations in Botany Bay.**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Woodland Birds			
Callocephalon fimbriatum	Gang-gang Cockatoo	V-BC	In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Unlikely to occur. Habitat not suitable.
Daphoenositta chrysoptera	Varied Sittella	V-BC	A small songbird with a sharp, slightly upturned bill, short tail, barred undertail and yellow eyes and feet. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Recorded in the Royal National Park. Unlikely. No suitable habitat.
Tyto novaehollandiae	Masked Owl	V-BC	Lives in dry eucalypt forests and woodlands. Pairs home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Unlikely to occur. Recorded at Towra Point Nature Reserve.
Ninox strenua	Powerful Owl	V-BC	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Unlikely to occur. Recorded to the south nearer to Royal National Park.
Lathamus discolor	Swift Parrot	E-BC CE-EPBC	Migrates to the Australian SE mainland between March and October to areas on the mainland where eucalypts are flowering profusely or where there are abundant lerp infestations. Unlikely to occur. Recorded to the west near Sylvania Waters.

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Glossopsitta pusilla	Little Lorikeet	V-BC	A small bright green parrot which forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Unlikely. No suitable habitat.
Solely Migratory and / or Marine Birds			
Hirundapus caudacutus	**White-throated Needletail**	**V,M,Mar-EPBC**	**The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts.** **Potential. Could overfly the study area and is known from Botany Bay.**
Tringa brevipes	**Grey-tailed Tattler**	**M,Mar-EPBC**	**Often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide.** **Potential to occasionally occur. Found at numerous locations in Botany Bay.**
Tringa nebularia	**Common Greenshank**	**M,Mar-EPBC**	**It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass.** **Potential to occasionally occur. Recorded at Towra Point Nature Reserve.**
Plegadis falcinellus	**Glossy Ibis**	**M,Mar-EPBC**	**Preferred habitat for foraging and breeding are fresh water marshes but occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons.** **This species has been recorded within Woolooware Bay.**
Pluvialis fulva	**Pacific Golden Plover**	**M,Mar-EPBC**	**Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
			Sarcocornia, **or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.** **Potential to occasionally occur. Recorded at Taren Point.**
Pluvialis squatarola	**Grey Plover**	**M,Mar-EPBC**	**Grey Plovers usually forage on large areas of exposed mudflats and beaches of sheltered coastal shores such as inlets, estuaries and lagoons.** **Potential to occasionally occur. Recorded at Towra Point Nature Reserve.**
Numenius phaeopus	**Whimbrel**	**M,Mar-EPBC**	**This species is a regular migrant to Australia and NZ and can be found on intertidal mudflats of sheltered coasts and lagoons and estuaries often with mangroves. This species was recorded foraging 150 m west of the site.** **Recorded 150 m NW of the Site. It is likely that this species would occur on the site and is known to occur within the environs of Botany Bay.**
Haliaeetus lecuogaster	**White-bellied Sea-eagle**	**V-BC** **Mar-EPBC**	**Found in coastal areas, on islands, estuaries, inlets, large rivers, inland lakes and reservoirs where they forage over water. Builds huge nests of sticks.** **Likely to overfly the Site. Widely recorded across the Towra Point Nature Reserve.**
Hydroprogne caspia	**Caspian Tern**	**M,Mar-EPBC**	**Usually forages in open wetlands, including lakes and rivers. They often prefer sheltered shallow water near the margins, but can also be found in open coastal waters. In coastal inlets they may prefer to forage in tidal channels, or over submerged mudbanks.** **Potential to occasionally occur. Recorded in numerous locations in Botany Bay.**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Limosa lapponica	Bar-tailed Godwit	M,Mar-EPBC	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Potential to occasionally occur. Recorded in numerous locations in Botany Bay.
Gallinago hardwickii	Latham's Snipe	M,Mar-EPBC	Summer migrant to coastal Australia where it feeds on soft wet ground or shallow water with tussocks and woodland, saltmarshes and mangrove fringes. Potential to occasionally occur. Recorded at Towra Point Nature Reserve.
Gelochelidon nilotica	Gull-billed Tern	M,Mar-EPBC	These Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. Potential to occasionally occur. Recorded at Towra Point Nature Reserve.
Calidris ruficollis	*Red-necked Stint*	*M,Mar-EPBC*	*Recorded in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.* *Potential to occasionally occur. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.*
Actitis hypoleucos	Common Sandpiper	M,Mar-EPBC	Found along all coastlines of Australia although the population when in Australia is concentrated in northern and western Australia. It is mostly found around muddy margins or rocky shores and rarely on mudflats. Potential to occasionally occur. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.
Calidris acuminata	Sharp-tailed Sandpiper	M,Mar-EPBC	This species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
			This species has been recorded within Towra Point Nature Reserve.
Thinornis cucullatus cucullatus	Eastern Hooded Dotterel	CE-BC V-EPBC	Prefers sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, beachast seaweed and sparsely vegetated sand-dunes for shelter and nesting. Occasionally found on tidal bays and estuaries. This species recorded at Cape Solander, Bate Bay in 2013. Unlikely to be find suitable habitat across the Site.
MAMMALS			
Marine Mammals			
Arctocephalus forsteri	New Zealand Fur-seal	V-BC	Prefers rocky parts of islands with jumbled terrain and boulders. Recorded at Bates Bay south of Botany Bay.
Eubalaena australis	Southern Right Whale	E-BC E-EPBC	Migrate between summer feeding grounds in Antarctica and winter breeding grounds around the coasts of southern Australia, New Zealand, South Africa and South America. They move inshore in winter for calving. Recorded at Bates Bay south of Botany Bay.
Yangochiropteran Bats			
Miniopterus australis	**Little Bent-wing Bat**	**V-BC**	**Found in well-timbered areas including rainforest, wet and dry sclerophyll forests, *Melalecua* swamps and coastal forests. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.** **Recorded in a timbered area 2 km east of the site.**
Miniopterus orianae oceanensis	**Large Bent-wing Bat**	**V-BC**	**Roosts in caves, derelict mines, stormwater tunnels, buildings. Forages in forested areas.** **Recorded at numerous locations at Towra Point Nature Reserve and Sutherland LGA. Recorded moving / foraging across the Site.**

Scientific Name	Common Name	Status	Habitat Requirements / Records & Likely Occurrence
Myotis macropus	**Southern Myotis**	**V-BC**	**Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges. Forages over streams and pools catching insects and small fish by raking their feet across the water surface.** **Recorded 6 km north of the site. Not recorded on the site.**
Scoteanax rueppellii	**Greater Broad-nosed Bat**	**V-BC**	**Occurs in woodland, moist and dry eucalypt forest and rainforest but prefers tall wet forest. Roosts in tree hollows but also buildings.** **Recorded at Towra Point Nature Reserve. Not recorded on the site.**
Yinpterochiropteran Bats			
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V-BC** **V-EPBC**	**Subtropical and temperate rainforests, tall sclerophylla forests and woodlands, heaths and swamps.** **Recorded at numerous locations at Towra Point Nature Reserve and Sutherland LGA. Recorded at the Site.**
Note: BC Act = *Biodiversity Conservation Act 2016*; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*, V = Vulnerable, E = Endangered, EP = Endangered Population, M = Migratory, Mar = Marine. **Bold** indicates those species recorded on site, with the potential to occur on site and / or with the potential to occur in the locality and to be affected by this proposal. **Sources**: BIONET (2021), PlantNet (2021),SPRAT(2021)			

APPENDIX D

Statutory Assessment under the EPBC Act

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

A range of matters of NES listed under the EPBC Act are listed as occurring, or having the potential to occur within the locality and these are listed below. The criteria detailed in the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DoE 2013) were used to assess the significance of likely impacts on these MNES as a consequence of the proposal and this assessment is detailed below.

Matters of NES listed under the EPBC Act addressed in this assessment

Scientific Name	Common Name	Category
Wetland of International Importance		
Towra Point Nature Reserve		Declared Ramsar Wetland
Critically Endangered		
Carcharias taurus	Grey Nurse Shark	CE
Calidris ferruginea	Curlew Sandpiper	CE,M,Mar
Calidris tenuirostris	Great Knot	CE,M,Mar
Numenius madagascariens	Eastern Curlew	CE,M,Mar
Endangered		
Calidris canutus	Red Knot	E,M,Mar
Rostratula australis	Australian Painted Snipe	E
Vulnerable		
Chelonia mydas	Green Turtle	V
Carcharadon carcharias	Great White Shark	V,M
Charadrius leschenaultii	Greater Sand-plover	V,M,Mar
Epinephelus daemelii	Black Rockcod	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Migratory		
Calidris alba	Sanderling	M,Mar
Limosa limosa	Black-tailed Godwit	M,Mar
Sternula albifrons	Little Tern	M,Mar
Xenus cinereus	Terek Sandpiper	M,Mar
Hirundapus caudacutus	White-throated Needletail	M,Mar
Tringa brevipes	Grey-tailed Tattler	M,Mar
Tringa nebularia	Common Greenshank	M,Mar
Plegadis falcinellus	Glossy Ibis	M,Mar
Pluvialis fulva	Pacific Golden Plover	M,Mar
Pluvialis squatarola	Grey Plover	M,Mar
Numenius phaeopus	Whimbrel	M,Mar

Scientific Name	Common Name	Category
Haliaeetus lecuogaster	White-bellied Sea-eagle	M,Mar
Hydroprogne caspia	Caspian Tern	M,Mar
Limosa lapponica	Bar-tailed Godwit	M,Mar
Gallinago hardwickii	Latham's Snipe	M,Mar
Gelochelidon nilotica	Gull-billed Tern	M,Mar
Calidris ruficollis	Red-necked Stint	M,Mar
Actitis hypoleucos	Common Sandpiper	M,Mar
Calidris acuminata	Sharp-tailed Sandpiper	M,Mar
Note: EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*, V = Vulnerable, E = Endangered, M = Migratory, Mar = Marine. **Sources**: DEE (2021), DPIE (2021)		

Wetland of International Significance

An action is likely to have a significant impact on the ecological character of a Ramsar wetland if there is a real chance or possibility that it will result in:

- Areas of the wetland being destroyed or substantially modified;

  Towra Point Nature Reserve will not be directly impacted as a consequence of this proposal. However, in the absence of mitigation measures there is the potential that the wetland could be impacted through changes in water quality and sedimentation. It is considered that the changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay would be minimal and these could be adequately managed with the implementation of the CEMP and ESCP.

- A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland;

  The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes in the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. The eastern channel adjacent to Towra Point Nature Reserve would not be directly impacted. Hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

- The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;

  It is unlikely that the demolition and construction of the facility would directly impact the habitat or life cycle of a native species to such an extent that it would be seriously affected. Whilst this proposal would result in the alteration of 491.0 m^2 of estuarine habitat, this alteration is considered unlikely to significantly impact the resources available for native species to such an extent that they would be seriously impacted. The removal of the decaying structures and replacement with purpose built facilities (including new services for water, sewer, drainage) is likely to overall benefit species within the locality. Nonetheless, in the absence of mitigation measures, there is the potential that species dependent upon the wetland could be impacted as they are vulnerable to changes in water quality and sedimentation that could potentially occur during construction of this project. However, it is considered that the changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay would be minimal and manageable with a stringently applied CEMP and ESCP.

- A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health; or

  In the absence of mitigation measures there is the potential that changes to water quality could occur as a consequence of this proposal. However, it is considered that the changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay would be minimal with the implementation of the CEMP and ESCP, which include measures to reduce sediment re-suspension and dispersion and the minimisation and the spread of suspended sediments.

- An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

  This proposal could assist the spread of the marine alga, *Caulerpa taxifolia,* via equipment used during the demolition and construction process. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga* *Caulerpa taxifolia* (I&I NSW 2009).

Critically Endangered and Endangered Species

Critically Endangered and Endangered species assessed include:

- Grey Nurse Shark;
- Curlew Sandpiper;
- Great Knot;
- Eastern Curlew;
- Red Knot; and
- Australian Painted Snipe.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population;

  In the absence of mitigation measures there is the potential that bird species could be impacted as they are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. However, it is considered that the changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay would be minimal with the implementation of the CEMP and ESCP and therefore unlikely to impact these birds. Current threats to the Grey Nurse Shark primarily include commercial and recreational fishing (DoE 2014). This proposal would not impact this species or its habitat directly.

- Reduce the area of occupancy of the species;

  None of these species are known to occur across the Site. This proposal does not include works that would reduce the area of occupancy for any of these species. The works may disrupt fauna activities across the Site but these would be temporary as post-construction the Site would be re-instated to its current landuse. The proposal does not include plans to remove areas of vegetation or substantially change drainage patterns or water flows in the long-term. Therefore, this proposal is unlikely to change the area of potential habitat for these bird species or the Grey Nurse Shark.

- Fragment an existing population into two or more populations;

  The proposal does not include plans to remove areas of vegetation or substantially change drainage patterns or water flows and hence is unlikely to fragment existing populations.

- Adversely affect habitat critical to the survival of a species;

  Habitat has not been identified as critical habitat within the recovery plan for these bird species or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEWHA 2009). The Recovery Plan for the Grey Nurse Shark (DoE 2014) lists aggregation sites as habitat critical to the survival of this species. This document specifies 13 key aggregation sites in NSW, none of which fall within the locality of the Site.

- Disrupt the breeding cycle of a population;

  None of these bird species rely on this Site for breeding purposes. Indirect impacts on sensitive adjacent habitat will be minimised by the implementation of a CEMP and ESCP. The key aggregation sites (believed important for this species reproduction) listed for the Grey Nurse Shark fall outside of the locality and suitable aggregation habitat is not present in the immediate vicinity of the Site.

- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

  The proposal does not include plans to remove areas of vegetation or substantially change drainage patterns or water flows. Mitigation measures will include a CEMP and ESCP that will minimise the likelihood of impacts on the quality of adjacent habitat for these species.

- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;

This proposal could assist the spread of the marine alga, *Caulerpa taxifolia*, via equipment used in the channel during the construction process. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga* <u>*Caulerpa taxifolia*</u> (I&I NSW 2009).

- Introduce disease that may cause the species to decline;

  Disease has not been identified as a threat to these critically endangered and endangered species. This proposal is unlikely to introduce or spread disease and the CEMP will provide for general activities to avoid the introduction and or spread of diseases.

- Interfere with the recovery of the species.

  Changes to habitat for any of these species is unlikely as all works are relatively minor and post-construction the Site would be re-instated to its current landuse. Key aggregation sites for the Grey Nurse Shark have been identified as critical for the recovery of this species. However, these sites are not present within the locality.

Vulnerable Species

Vulnerable species assessed include:

- Grey-headed Flying-fox;
- Green Turtle;
- Black Rockcod;
- Great White Shark; and
- Greater Sand-plover.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species;

  An important population of the Grey-headed Flying-fox is unlikely to be impacted by this proposal as a camp site does not occur on the Site or nearby and this proposal does not include the removal of feed trees for this species.

  The Green Turtle and Black Rockcod suffers from many threats, however most relevant to this proposal are marine debris and pollution and habitat damage (DAWE 2020).

  The main threat to the Great White Shark is accidental or illegal capture (DAWE 2020), the demolition and construction activities proposed would not contribute to this threat.

  As with many migratory shorebirds, the Greater Sand-plover suffers from a number of threats, but relevant to this proposal is the loss and modification of habitat (DAWE 2020).

  In the absence of mitigation measures there is the potential that the Green Turtle, Great White Shark and Greater Sand-plover could be impacted as these species are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. However, it is considered that the changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay would be minimal with the stringent implementation of the CEMP and ESCP.

- Reduce the area of occupancy of an important population;

  Important populations of these species are not known to occur on the Site. In addition, this proposal is unlikely to change the areas of available potential habitat for any of these species as post-construction the Site would be returned to its current landuse. Indirect impacts on sensitive adjacent habitat will be minimised through the stringent implementation of a CEMP and ESCP. There will be no direct impacts on the marine habitat of the Great White Shark, Black Rockcod or Green Turtle and the construction will not remove Grey-headed Flying-fox habitat.

- Fragment an existing important population into two or more populations;

  The proposal does not include plans to remove areas of vegetation or substantially change drainage patterns or water flows and hence is unlikely to fragment existing populations in the locality.

- Adversely affect habitat critical to the survival of a species;

  The Draft National Recovery Plan for the Grey-headed Flying Fox (DECCW 2009) describes foraging and roosting habitat as habitat critical to this species survival. There is no such habitat present on Site and this proposal would not impact any such habitat present within the locality. Habitat has not been identified as critical habitat in NSW for the Black Rockcod, Green Turtle, Great White Shark and Greater Sand-plover or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEWHA 2009).

- Disrupt the breeding cycle of an important population;

  None of these species rely on this Site for breeding habitat and hence this proposal is unlikely to directly impact breeding in these species. Furthermore, impacts on sensitive adjacent habitat will be minimised through the stringent implementation of a CEMP and ESCP.

- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

  There will be no direct impacts on the marine habitat of the Great White Shark, Black Rockcod or Green Turtle and the current proposal will not remove Grey-headed Flying-fox habitat. Mitigation measures will be put in place via a stringently implemented CEMP and ESCP and this will minimise the likelihood of impacts on the quality of adjacent habitat for these species.

- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

  This proposal could assist the spread of the marine alga, *Caulerpa taxifolia*, via equipment used during the construction process. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga* *Caulerpa taxifolia* (I&I NSW 2009).

- Introduce disease that may cause the species to decline; or

  This proposal is unlikely to introduce or spread disease and the CEMP will provide for general activities to avoid the introduction and or spread of diseases.

- Interfere substantially with the recovery of the species.

  Long-term changes to habitat for any of these species is unlikely, and post-construction the Site would be re-instated to its current landuse. There will be no direct impacts on the marine habitat of the Great White Shark or Green Turtle and the replacement of the seawall will not remove Grey-headed Flying-fox habitat.

Migratory Species

An action is likely to have a significant impact on the 19 migratory species listed above if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

  The main threat to migratory shorebirds is direct and indirect habitat loss (DAWE 2021). There will be no direct impacts on habitat as the Site itself does not constitute important habitat for these species. However, indirect impacts on sensitive adjacent habitat may occur as these species are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. It is considered that the stringent implementation of the CEMP and ESCP will impose mitigation measures sufficient to minimise any such indirect impacts.

- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

  This proposal could assist the spread of the marine alga, *Caulerpa taxifolia*, via equipment used during the construction process. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga* <u>*Caulerpa taxifolia*</u> (I&I NSW 2009).

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

  There are unlikely to be any direct impacts on breeding habitat. However indirect impacts on sensitive adjacent habitat may occur as these species are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. It is considered that the stringent implementation of the CEMP and ESCP will assist with minimising the risk of sedimentation and changes to water quality which could affect breeding, feeding and resting behaviour of these species.

CONCLUSION

There are unlikely to be any direct impacts on matters of NES as a consequence of this proposal. There is the potential for indirect impacts on the adjacent Ramsar wetland and Towra Point Nature Reserve. However, the demolition and construction proposed is unlikely to have a significant impact on this sensitive adjacent habitat or any of the relevant listed species as it is considered that:

- Shorebird foraging habitat and estuarine and terrestrial fauna habitat and connectivity would not be substantially altered; and
- Risks to water quality and sedimentation of sandflats and mudflats around Woolooware Bay and the broader environs would be minimal with the stringent implementation of commonly applied environmental management techniques which are detailed in the CEMP and ESCP.

APPENDIX E

NSW *Biodiversity Conservation Act 2016*

Tests of Significance

Tests of Significance

Background

Assessments of Significance were undertaken to determine the significance of the likely impacts of the proposal on threatened species and endangered ecological communities listed on the Schedules of the BC Act, for which potential habitat occurs or for those species considered to be of particular relevance to the estuarine environment of Woolooware Bay, Botany Bay and surrounds.

Guilds of species, populations and communities listed under the BC Act for which Tests of Significance have been undertaken.

Scientific Name	Common Name	Conservation Ranking
Endangered Ecological Communities		
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions		EEC
Swamp Oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions		EEC
The Shorebird Community occurring on the relict tidal delta sands at Taren Point.		EEC
Marine Species		
Chelonia mydas	Green Turtle	V
Water Dependent Birds		
Esacus magnirostris	Beach Stone-curlew	CE
Calidris ferruginea	Curlew Sandpiper	E
Sternula albifrons	Little Tern	E
Rostratula australis	Australian Painted Snipe	E
Haematopus longirostris	Australian Pied Oystercatcher	E
Charadrius leschenaultii	Greater Sand-plover	V
Calidris alba	Sanderling	V
Calidris tenuirostris	Great Knot	V
Epthianura albifrons	White-fronted Chat	V,EP
Haematopus fuliginosus	Sooty Oystercatcher	V
Limosa limosa	Black-tailed Godwit	V
Onychoprion fuscata	Sooty Tern	V
Pandion cristatus	Eastern Osprey	V
Xenus cinereus	Terek Sandpiper	V
Yangochiropteran Bat		
Pteropus poliocephalus	Grey-headed Flying-fox	V

Scientific Name	Common Name	Conservation Ranking
Yangochiroptera Bats		
Miniopterus australis	Little Bent-wing Bat	V
Miniopterus orianae oceanensis	Large Bent-wing Bat	V
Myotis macropus	Southern Myotis	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V
Note: BC = *NSW Biodiversity Conservation Act 2016*, EEC = Endangered Ecological Ecology, EP = Endangered Population, CE = Critically Endangered, E = Endangered, V = Vulnerable. **Source**: DPIE (2021), PlantNet (2021).		

Endangered Ecological Communities

Swamp Oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions is listed as an EEC under the BC Act. This community generally occurs on the coastal floodplains of NSW. *Casuarina glauca* (Swamp Oak) is the dominant species. This community has not been recorded on, or directly adjacent to, the Site but small patches have been mapped as occurring nearby.

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is listed as an EEC under the BC Act. This community generally occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. This community has not been recorded on, or directly adjacent, to the Site but small patches have been mapped as occurring nearby.

The Shorebird Community occurring on the relict tidal delta sands at Taren Point is listed as an EEC under the BC Act. It is comprised of a group of shorebirds which occupy a relict marginal shoal of the Georges River between Taren Point and Shell Point in Botany Bay and includes a characteristic assemblage of approximately 20 species. This community occurs along the sandflats / mudflats of Woolooware Bay.

a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

These are not threatened species.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

There will be no direct impact on these communities. However, these EEC are vulnerable to changes in water quality brought about by increased nutrient levels, sedimentation and pollution. It is considered that risks to these communities would be appropriately managed through stringent implementation of commonly applied measures which would be detailed in the CEMP and ESCP.

c) In relation to the habitat of a threatened species or ecological community:

I. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

II. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

This proposal does not include removal or modification of these EEC. All occur off-site and the stringent implementation of the CEMP and ESCP would assist with the protection of these communities.

d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not listed as a declared area of outstanding biodiversity value under Part 3 of the NSW *Biodiversity Conservation Regulation 2017*. No declared areas of outstanding biodiversity value would be directly or indirectly affected by this proposal.

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community across and adjacent to the site and within the locality. A CEMP and ESCP would be prepared and should be stringently applied to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. Minor earthworks would be required but substantial changes to drainage patterns and the eastern channel are not predicted to occur and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales. (FM Act). This proposal could assist the spread of *Caulerpa taxifolia* via equipment used in the construction process. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species and change ecosystems. To reduce the risk, equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*.

It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW Control Plan for the Noxious Marine Alga Caulerpa taxifolia* (I&I NSW 2009).

Marine Species

Green Turtle is listed as Vulnerable under the BC Act. This turtle is known to occur in coastal waters of NSW and is opportunistically recorded feeding in estuaries particularly during warmer months of the year. This species has been recorded at Taren Point.

a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

There will be no direct impact on the marine habitat of this species. However, in the absence of mitigation measures there is the potential that the Green Turtle could be impacted as they are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. It is considered that the stringent implementation of the CEMP and ESCP will impose mitigation measures sufficient to minimise any such indirect impacts.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

This species is not an endangered ecological community.

c) In relation to the habitat of a threatened species or ecological community:

I. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

II. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

III. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

There are unlikely to be direct impacts on this species. However, the Green Turtle is vulnerable to changes in water quality brought about by increased nutrient levels, sedimentation and pollution. It is considered that risks could be appropriately managed through implementation of commonly applied measures which would be detailed in the CEMP and ESCP.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not listed as a declared area of outstanding biodiversity value under Part 3 of the NSW *Biodiversity Conservation Regulation 2017*. No declared areas of outstanding biodiversity value would be directly or indirectly affected by this proposal.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community across and adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. Minor earthworks would be required but substantial changes to drainage patterns and the eastern channel are not predicted to occur and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales. (FM Act). This proposal could assist the spread of *Caulerpa taxifolia* via equipment used during construction. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga Caulerpa taxifolia* (I&I NSW 2009).

Water-dependent Birds

Beach Stone-curlew is listed as Critically Endangered under the BC Act. This species forages in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. This species has been recorded within Woolooware Bay.

Curlew Sandpiper is listed as Endangered under the BC Act. It occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.

Little Tern is listed as Endangered under the BC Act. This species is almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). The Little Tern has been recorded at numerous locations in Botany Bay.

Australian Painted Snipe is listed as Endangered under the BC Act. It prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. This species has been recorded at Taren Point.

Pied Oystercatcher is listed as Endangered under the BC Act. It favours intertidal flats of inlets and bays, open beaches and sandbanks. It has been recorded at numerous locations in Botany Bay and it was recorded during this study perched on a structure about 100 m north-east of the Site.

Greater Sand-plover is listed as Vulnerable under the BC Act. This species is restricted to coastal areas where it roosts during high tide on sandy beach and rocky shores. It forages on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks and has been recorded within Botany Bay at numerous locations.

Sanderling is listed as Vulnerable under the BC Act. It is a summer migrant which has been recorded along the NSW coast on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.

Great Knot is listed as Vulnerable under the BC Act. It occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. It is often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. This species has been recorded from numerous locations in Woolooware Bay and Botany Bay.

White-fronted Chat is listed as Vulnerable and as an Endangered Population under the BC Act. It is a gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. It is regularly observed in the saltmarsh and on the sandy shoreline of a small island off Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals.

Sooty Oystercatcher is listed as Vulnerable under the BC Act. It favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries and has been recorded at numerous locations in Botany Bay.

Black-tailed Godwit is listed as Vulnerable under the BC Act. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. This Godwit has been recorded at Towra Point Nature Reserve.

Sooty Tern is listed as Vulnerable under the BC Act. The Sooty Tern breeds and generally forages in offshore tropical waters. It has been recorded at Towra Point Nature Reserve.

Eastern Osprey is listed as Vulnerable under the BC Act. It favours coastal areas, especially the mouths of large rivers, lagoons and lakes where it feeds on fish over clear, open water. It has been recorded at Towra Point Nature Reserve.

Terek Sandpiper is listed as Vulnerable under the BC Act. This Sandpiper favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools. This species has been recorded at numerous locations in Botany Bay.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

None of these species has been recorded across the Site although some are known from the adjacent Towra Point Nature Reserve. It is possible that some of these species could on occasion overfly the Site or forage across nearby areas but it is considered that the overall risk to these species from direct impacts is low. However, indirect impacts on sensitive adjacent habitat may occur as these species are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. It is considered that the stringent implementation of the CEMP and ESCP will impose mitigation measures sufficient to minimise any such indirect impacts.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

These species are not endangered ecological communities.

c) In relation to the habitat of a threatened species or ecological community:

I. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

II. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

III. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

None of these species has been recorded across the Site although some are known from the adjacent Towra Point Nature Reserve. It is possible that some of these species could on occasion overfly the Site or forage across nearby areas but it is considered that the overall risk to these species from direct impacts is low. However, these species are vulnerable to changes in water quality brought about by increased nutrient levels, sedimentation and pollution. It is considered that risks could be appropriately managed through implementation of commonly applied measures which would be detailed in the CEMP and ESCP.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not listed as a declared area of outstanding biodiversity value under Part 3 of the NSW *Biodiversity Conservation Regulation 2017*. No declared areas of outstanding biodiversity value would be directly or indirectly affected by this proposal.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. Minor earthworks would be required but substantial changes to drainage patterns and the eastern channel are not predicted to occur and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales. (FM Act). This proposal could assist the spread of *Caulerpa taxifolia* via equipment used in the channel during construction. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga Caulerpa taxifolia* (I&I NSW 2009).

Yangochiropteran Bats

Little Bent-wing Bat is listed as Vulnerable under the BC Act. It is found in well-timbered areas including rainforest and wet and dry sclerophyll forests, *Melaleuca* swamps and coastal forests. This bat is known to roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day. It has been recorded in a timbered area 2 km east of the Site.
Large Bent-wing Bat is listed as Vulnerable under the BC Act. This bat roosts in caves, derelict mines, stormwater tunnels, buildings and forages in forested areas. It has been recorded at numerous locations at Towra Point Nature Reserve and Sutherland LGA. Probable calls of this species were recorded on 3 out of 13 nights across the Site in September 2021. This indicates that this species appears to be foraging across the Site on occasion but is unlikely to be roosting in any of the overwater structures.
Southern Myotis is listed as Vulnerable under the BC Act. It generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, and under bridges. This bat forages over streams and pools catching insects and small fish by raking their feet across the water surface. It has been recorded 6 km north of the Site but it has not been recorded on the Site.
Greater Broad-nosed Bat is listed as Vulnerable under the BC Act. It is known to forage in woodland, moist and dry eucalypt forest and rainforest but prefers tall wet forest and roosts in tree hollows but also buildings. It has been recorded at Towra Point Nature Reserve but it has not been recorded on the Site.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

It is unlikely that any of these species are using this Site for roosting or breeding as none have been identified during inspection of the overwater structures during surveys dating from 2016 to 2021. However, to provide certainty pre-demolition inspections should be undertaken prior to demolition as specified in the CEMP. There is the potential that some of the species may forage across the Site on occasion (e.g. Large Bent-wing Bat). It is considered that the proposal may temporarily disrupt this foraging habitat during construction activities but it is likely that once the demolition and construction activities cease, the new facilities would result in habitat that is reflective of the current habitat available across the Site. Therefore it is unlikely that this proposal would disrupt the life-cycle of the species to such an extent that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

These are not endangered ecological communities.

c) In relation to the habitat of a threatened species or ecological community:

I. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

II. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

III. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

It is considered that the proposal may temporarily disrupt any foraging habitat during construction activities but it is likely that once the demolition and construction activities cease, the new facilities would result in habitat that is reflective of the current habitat available across the Site. Therefore it is unlikely that this proposal would remove, modify, fragment or isolate habitat to such an extent that the long-term survival of these species is placed at risk.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not listed as a declared area of outstanding biodiversity value under Part 3 of the NSW *Biodiversity Conservation Regulation 2017*. No declared areas of outstanding biodiversity value would be directly or indirectly affected by this proposal.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Yangochiropteran Bat

Grey-headed Flying-fox is listed as Vulnerable under the BC Act and EPBC Act. It roosts in camps generally located within 20 km of a regular food source and are commonly found in gullies, close to water and in vegetation with a dense canopy. This species feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. It has been recorded overflying and calling near the Site although a camp-site is not present across, or adjacent to the Site.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species may overfly, or forage, across the Site on occasion. However, a camp-site is not known from the Site. It is considered that the proposal may temporarily disrupt any foraging activity across the Site during demolition and construction activities but it is likely that once the demolition and construction activities cease the new facilities would result in habitat that is reflective of the current habitat available across the Site. Therefore it is unlikely that this proposal would disrupt the life-cycle of the species to such an extent that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

I. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

This species is not an endangered ecological community.

c) In relation to the habitat of a threatened species or ecological community:

I. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

II. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

III. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

Foraging habitat and habitat fragmentation are unlikely to be altered as a consequence of this proposal as the new facilities would result in habitat that is reflective of the current habitat available across the Site.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The subject site is not listed as a declared area of outstanding biodiversity value under Part 3 of the NSW *Biodiversity Conservation Regulation 2017*. No declared areas of outstanding biodiversity value would be directly or indirectly affected by this proposal.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

CONCLUSION

This proposal is unlikely to have a significant impact on any of these EEC or species listed under the BC Act. There is the potential for indirect impacts on the adjacent Ramsar wetland and Towra Point Nature Reserve as these sensitive receptors are susceptible to changes in water quality and sedimentation of sandflats and mudflats around Woolooware Bay and the broader environs. However, it is considered that the demolition and construction proposed could be managed in such a way by using commonly applied techniques as to make significant impacts unlikely as it is considered that:

- Shorebird foraging habitat and estuarine and terrestrial fauna habitat and connectivity would not be substantially altered; and
- Risks to water quality and sedimentation of sandflats and mudflats around Woolooware Bay and the broader environs would be minimal with the stringent implementation of commonly applied environmental management techniques which are detailed in the CEMP and ESCP.

APPENDIX F

NSW *Fisheries Management Act 1994*

Assessments of Significance

Assessment of Significance

Background

Assessments of Significance were undertaken to determine the significance of impacts of the proposal on threatened species and endangered ecological communities listed on Schedules of the FM Act, for which potential habitat occurs, or for those species considered to be of particular relevance to the estuarine environment of Woolooware Bay, Botany Bay and surrounds.

Guilds of species, populations and communities listed under the FM Act for which Assessments of Significance have been undertaken.

Scientific Name	Common Name	Conservation Ranking and Relevant Act
Endangered Population		
Posidonia australis in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie		EP-FM
Marine Species		
Carcharias taurus	Grey Nurse Shark	CE-FM
Epinephelus daemelii	Black Rockcod	V-FM
Carcharadon carcharias	Great White Shark	V-FM
Note: FM Act = *NSW Fisheries Management Act 1994*, EP = Endangered Population, CE = Critically Endangered, V = Vulnerable. **Source**: DPI (2021)		

Endangered Population

***Posidonia australis* in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie** is listed as an endangered population under the FM Act. This seagrass population is found in the protected waters of coastal bays and estuaries and coastal lakes that are subject to frequent tidal flushing. Seagrass communities provide important feeding and refuge areas for a range of fish, molluscs and crustaceans, are drivers of fisheries productivity in coastal waters and are crucial to the maintenance of estuarine biodiversity (Pronk & Holder 2012). The population is located in Woolooware Bay and around Towra Point but is not present across the Site.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This is not a threatened species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

This endangered population is vulnerable to changes in water quality brought about by increased nutrient levels, sedimentation and pollution. This population was not identified in the direct vicinity of the Site, however it is known from nearby. It is considered that risks to this population would be appropriately managed through implementation of commonly applied measures which would be detailed in a CEMP and ESCP.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

This is not an endangered ecological community.

d) In relation to the habitat of a threatened species, population or ecological community:

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

This proposal does not include removal or modification of this population. This population occurs off-site and implementation of a CEMP and ESCP would assist with its protection.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat has not been listed in the Register of Critical Habitat kept by the Director General of the Office of the Environment or the Register of Critical Habitat kept by the Director General of Department of Primary Industries.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Conservation and recovery actions stated in the population's factsheet (NSW DP1 2012) and the Priorities Action Statement (NSW DPI 2016) would not be compromised. The demolition of the extant structures and the construction of new structures with a very similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland and Woolooware Bay. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current hydrological regime across the Site, and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate. Indirect impacts will be minimised and threats mitigated through the implementation of the CEMP and ESCP.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. Minor earthworks would be required but substantial changes to drainage patterns and the eastern channel are not predicted to occur and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales. (FM Act). This proposal could assist the spread of *Caulerpa taxifolia* via equipment used during construction. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW Control Plan for the Noxious Marine Alga Caulerpa taxifolia* (I&I NSW 2009).

Marine Species

Grey Nurse Shark is listed as Critically Endangered under the FM Act. Breeding sites generally have sandy-bottomed gutters or rocky caves and are in the vicinity of inshore rocky reefs or islands. The closest breeding site is at Maroubra approximately 16 km to the north-east of Woolooware. This shark feeds on a large range of bony fishes, sharks, rays, squid and crustaceans. Likely to occasionally occur in Botany Bay.

Black Rockcod is listed as Vulnerable under the FM Act. Generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m. Recently settled juvenile Black Rockcod (i.e. individuals that have recently completed the pelagic, drifting larval stage) are often found in coastal rock pools while slightly older juvenile Black Rockcod are often found in estuary systems. Juveniles may on occasion be found in Woolooware Bay.

Great White Shark is listed as Vulnerable under the FM Act. Typically found from close inshore habitats (e.g. rocky reefs and shallow coastal bays) to the outer continental shelf and slope areas. May occasionally occur in Botany Bay.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

There will be no direct impact on the marine habitat of these species. However, in the absence of mitigation measures there is the potential that these species could be impacted as they are vulnerable to changes in water quality and sedimentation that could potentially occur as a consequence of this proposal. It is considered that the implementation of the CEMP and ESCP will impose mitigation measures sufficient to minimise any such indirect impacts.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

These are not endangered populations.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

These are not endangered ecological communities.

d) In relation to the habitat of a threatened species, population or ecological community:

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

There is unlikely to be direct impacts on these species. However, these species are vulnerable to changes in water quality brought about by increased nutrient levels, sedimentation and pollution. It is considered that risks would be appropriately managed through implementation of commonly applied measures which would be detailed in the CEMP and ESCP.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

The Recovery Plan for the Grey Nurse Shark (DoE 2014) lists aggregation sites as habitat critical to the survival of this species. This document specifies 13 key aggregation sites in NSW, none of which fall within the locality of the Site.

Critical habitat in NSW has not been listed in the Register of Critical Habitat kept by the Director General of the Office of the Environment or the Register of Critical Habitat kept by the Director General of Department of Primary Industries for the Green Turtle, Great White Shark and Black Rockcod.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Recovery Plans exist for the Great White Shark (DoE 2013), the Black Rockcod (2012), and the Grey Nurse Shark (DoE 2014) and the Green Turtle is considered in the national marine turtle recovery plan (Environment Australia 2003). The proposed project does not contravene the management objectives for these species. Any indirect impacts on habitat quality and potential threats will be mediated by mitigation measures stated in the CEMP and ESCP.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Degradation of native riparian vegetation along New South Wales water courses (FM Act). In the absence of mitigation measures this proposal could result in the degradation of the native Mangrove Forest Community adjacent to the site and within the locality. A CEMP and ESCP would be prepared to ensure that the potential for impacts is minimised and that these communities are protected and conserved.

Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands – Habitat loss / change (BC Act); *Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams* (FM Act). *Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands* (EPBC Act). The demolition of the extant structures and the construction of new structures with a similar footprint is unlikely to cause substantial changes to the hydrological regime of the wetland. Overall the net effect of the demolition and construction of new facilities would result in habitat that is reflective of the current habitat available across the Site. Minor earthworks would be required but substantial changes to drainage patterns and the eastern channel are not predicted to occur and hence the Site would remain a shallow intertidal area vegetated with Grey Mangroves that occur across a muddy / sandy substrate.

Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales. (FM Act). This proposal could assist the spread of *Caulerpa taxifolia* via equipment used during construction. This species is listed as a marine pest and is easily spread to areas where it can smother marine habitats and displace naturally occurring species. To reduce the risk equipment should be thoroughly cleaned if moved from areas that are infested with *C. taxifolia*. It is recommended that management of *C. taxifolia* be addressed in the CEMP and ESCP so as to minimise the risk of invasive species establishment and that these measures be in line with the *NSW control Plan for the Noxious Marine Alga Caulerpa taxifolia* (I&I NSW 2009).

CONCLUSION

This proposal is unlikely to have a significant impact on any of these populations or species listed under the FM Act as it is considered that:

- Estuarine fauna habitat, and general fauna habitat and connectivity are unlikely to be impacted to such an extent that any of these species would be at risk as a consequence of this proposal; and
- Risks to water quality and sedimentation of sandflats and mudflats around Woolooware Bay and the broader environs would be minimal with the implementation of commonly applied environmental management techniques which are detailed in the CEMP and ESCP.

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Appendix E

Arboricultural Assessment

ALLIED TREE
CONSULTANCY
Level 5 and 8 Arboriculturist

Arboricultural Impact Assessment Report

For the site address
Oyster Farm, (Lot 3 in DP1165618)
Captain Cook Drive,
WOOLOOWARE BAY, NSW

Prepared for
Transport for NSW

AUTHOR
Warwick Varley and Geoff Beisler

STATUS

Draft	August 2021
Draft 2	November 2021
Draft 3	November 2021
Final	November 2021

REFERENCE D4620

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1.0 Introduction

1.1 *Allied Tree Consultancy* (ATC) has been commissioned by *Transport for NSW* to prepare an Arboricultural Assessment Report for the development in progress at an oyster farm lease, being Lot 3, Captain Cook Drive, Woolooware Bay. This proposal includes the demolition and construction of infrastructure for the Oyster lease. The aim provides for the protection of the surrounding vegetation community, although limited to the Mangroves only. This report has included one-hundred and ten (110) trees located adjacent to the proposed works.

1.2 This report will address for these trees the:

- species' identification, location, dimensions, and condition;
- SULE (Safe Useful Life Expectancy) and STARS (Significance of a Tree Assessment Rating System) rating;
- discussion and impact of the proposed works on each tree;
- tree protection zones and protection specifications for trees recommended for retention.

2.0 Standards

2.1 Allied Tree Consultancy provides an ethical and unbiased approach to all assignments, possessing no association with private utility arboriculture or organisations that may reflect a conflict of interest.

2.2 This report must be made available to all contractors during the tendering process so that any cost associated with the required works for the protection of trees can be accommodated.

2.3 It is the responsibility of the project manager to provide the requirements outlined in this report relative to the Protection Zones, Measures (Section 7.0), and Specifications (Section 8.0) to all contractors associated with the project before the initiation of work.

2.4 All tree-related work outlined in this report is recommended to be conducted in accordance with the:

- Australian Standard – AS4373; Pruning of Amenity Trees.
- Guide to Managing Risks of Tree Trimming and Removal Work[1].
- All tree works must be carried out at a tertiary level (minimum Certificate-level 3) qualified and experienced (minimum five years) arboriculturist.

[1] Safe Work Australia; July 2016; Guide to Managing Risks of Tree Trimming and Removal Work, Australia

- For any works in the vicinity of electrical lines, the arboriculturist must possess the ISSC26 endorsement (Interim guide for operating cranes and plant in proximity to overhead powerlines).

2.5 As a minimum requirement, all trees recommended for retention in this report must have removed all dead, diseased, and crossing limbs and branch stubs to be pruned to the branch collar. This work must comply with the local government tree policy (Sutherland Shire Council) and Section 2.4.

3.0 Disclosure Statement

Trees are living organisms and, for this reason, possess natural variability. This cannot be controlled. However, risks associated with trees can be managed. An arborist cannot guarantee that a tree will be safe under all circumstances nor predict the time when a tree will fail. To live or work near a tree involves some degree of risk, and this evaluation does not preclude all the possibilities of failure.

4.0 Methodology

4.1 The following tree assessment was undertaken using criteria based on the guidelines issued by the International Society of Arboriculture.

4.2 The format of the report is summarised below;

4.2.1 **Plan 1-3;** Tree Location Relative to Site: These are unscaled plans reproduced from the Survey Plan as referenced in Section 4.4.1, depicting the area of assessment and numbered tree location.

4.2.2 **Table 1;** This table compiles the tree species, dimensions**,** brief assessment (history, structure, pest, disease or any other variables subject to the tree), significance, allocation of the zones of protection (i.e., Tree Protection Zone[2] ;TPZ and Structural Root Zone; SRZ) for each tree illustrated in Plan 1, Section 5.0. All measurements are in metres.

4.2.3 Discussion relating to the site assessment and proposed works regarding the trees.

4.2.4 **Protection Specification**; Section 8.0 details the requirements for that area designated as the Tree Protection Zone (TPZ), for those trees recommended for retention.

[2] Australian Standard, 4970; 2009 – Protection of Trees on Development Sites, Australia

4.3 The opinions expressed in this report, and the material, upon which they are based were obtained from the following process and data supplied:

4.3.1 Site assessment on the 4th and 17th August 2021 using the method of the Visual Tree Assessment[3]. This has included a Level 2 risk assessment, being a *Basic Assessment*[4]. The assessment has been conducted by Warwick Varley[5] and Geoff Beisler[6] on behalf of ATC.

4.3.2 ATC has identified the trees for inclusion based on an initial site assessment on the 4th of August 2021. This included the onsite discussion with Jake Cashman (*APP Corporation*). The following points determine trees included in this assessment.

- The trees included in this report are those that reside up to 10m from any existing structure and based on the location of the dripline to be within 3m of any structure.
- This included any tree, irrespective of height, that provided for a stem diameter of greater than 50mm.
- Based on the scope of this report, the Grey Mangrove is the only tree species that occurs in the area of assessment.
- Assessed trees are not necessarily impacted by the proposed works, and have been included before a proposed design has been determined.

4.3.3 Tagging of trees with round embossed aluminium tags wired to the trees at waist level and facing the area of entry where trees reside. The numbering is sequential and consistent with the Plan set contained in Section 5.0. These tags are considered temporary, and the removal of these tags/wire from site after completion of the assessment process is mandatory.

4.3.4 All measurements, unless specified otherwise, are taken from the tree centre.

4.3.5 This report includes one hundred and ten (110) trees located adjacent to the area of work. The numbering is sequential and tree locations are attempted to be ordered geographically other than those trees that have been included from the initial assessment[7].

---

[3] Mattheck, C. Breloer, H.,1994, The Body Language of Trees – A handbook for failure analysis The Stationary Office, London
[4] Dunster J.A., 2013, Tree Risk Assessment Manual, International Society of Arboriculture, 2013, USA
[5] Consulting Arborist, (level 5 and 8)
[6] Consulting Arborist, (level 5)
[7] Allied Tree Consultancy, November 2020, Arboricultural Assessment Report, Reference D4317

The numbering has carried on from the tree numbering assigned within the initial Arborist Report[7].

4.3.6 A photographic inventory exists for all trees. This has been taken at the time of the assessments (see Section 4.3.1). Although do not necessarily provide independent photos for all numbered trees. These are available on request.

4.3.7 Raw data from the preliminary assessment, including the specimen's dimensions, was compiled by the use of a diameter tape, height clinometer, angle finder, compass, steel probes, Teflon hammer, binoculars, and recording instruments.

4.3.8 The vicinity of the dripline to existing structures when within 3m has been included in the assessment section of Table 1 for each tree. This will include the distance of the dripline and identification of the structure from where it is measured. The structures are defined based on the assigned labels (in italics) illustrated in the survey drawings (Section 4.4.1).

4.4 Documentation provided

The following documentation has been provided to Allied Tree Consultancy and utilised within the report.

4.4.1 Surveyor

Drawn by *CMS Surveyors P/L*
Date: 5 August 2021
Reference: 2057detail
Drawing No: Sheet 1-3, Issue 3

4.4.2 Design

Drawn by *Transport for NSW, Hydrographic Survey*
Date: 11 November 2021
Reference: 202079
Drawing No: S0100(B), S0200(B), S0310(B), S0320(B), S0350(A), S0400(B), S1000(B), S1010(B), S1020(B), S1030(B), S1031(A), S1110(B), S1120(B), S1130(B), S1210(B), S1220(A), S1230(B), S1310(B).

4.4.3 Document

<u>Constructability Assessment</u>
Author *Tonkin*
Date: 12 November 2021

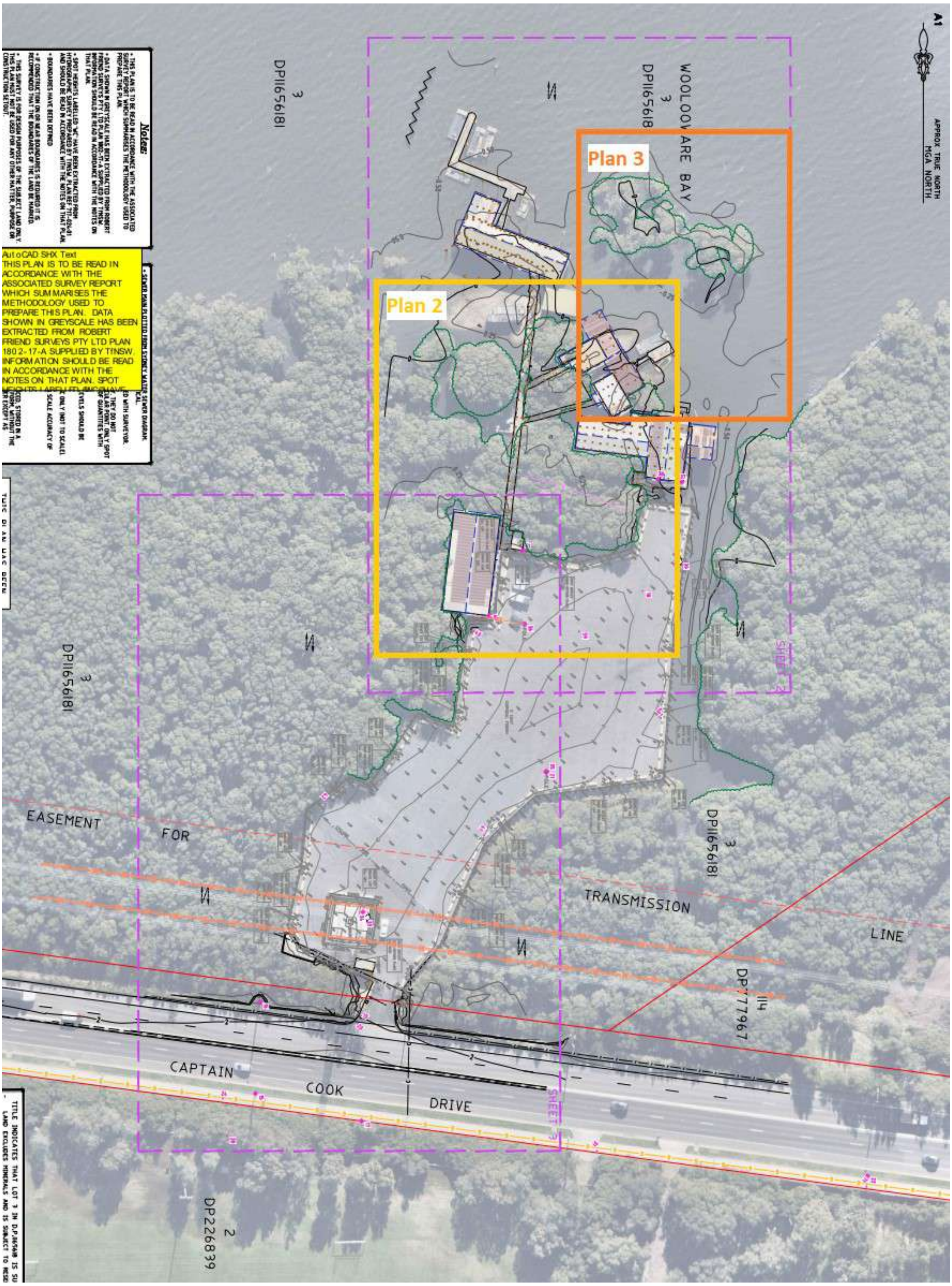
4.5 Limitations of the assessment/discussion process

4.5.1 The assessment has considered only the visually apparent tree symptoms during the time of assessment.

4.5.2 Any tree, regardless of apparent defects, would fail if the forces applied to exceed the strength of the tree or its parts, for example, extreme storm conditions.

4.5.3 The assessment has been limited to that part of the tree which is visible, existing from the ground level to the crown. Root decay can exist and, in some circumstances provide no symptoms of the presence. This assessment responds to all the symptoms provided by a tree, however, cannot provide a conclusive recommendation regarding any tree that may have extensive root decay that leads to windthrow without the appropriate symptoms.

5.0 Plan 1; Area of assessment



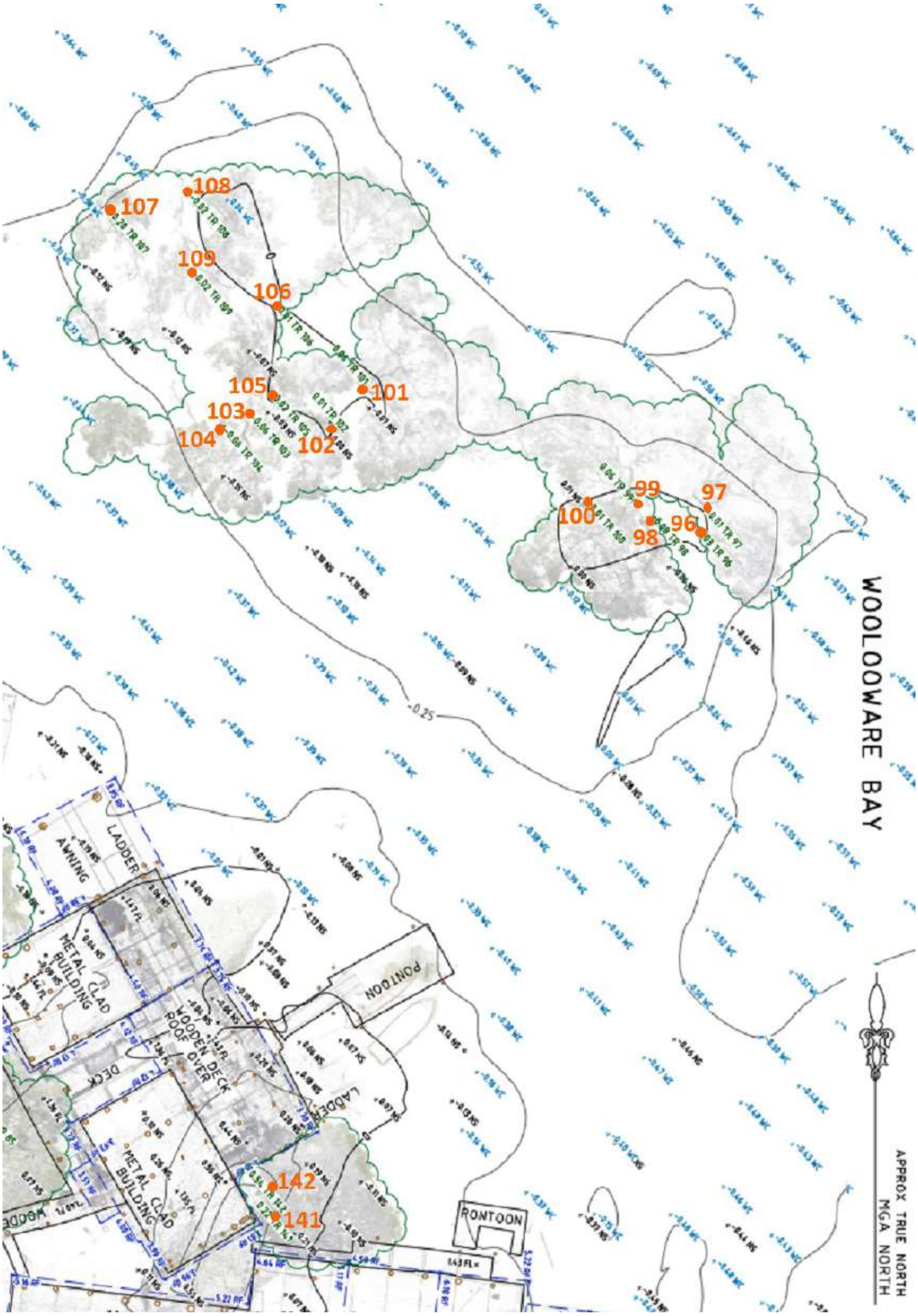
Not to scale
Source: Adapted from *CMS Surveyors P/L,* Sheet 1, see Section 4.4.1

5.1 Plan 2; Area of assessment illustrating tree location

Not to scale

Source: Adapted from *CMS Surveyors P/L,* Sheet 2, see Section 4.4.1

5.2 Plan 3; Area of assessment illustrating tree location



Not to scale

<u>Source</u>: Adapted from *CMS Surveyors P/L,* Sheet 2, see Section 4.4.1

6.0 Table 1 – Tree Species Data

Terminology/references provided in Appendix A.

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
3	*Avicennia marina* Grey Mangrove	3	0.17	0 x 0	M	_	_	_	**4A**	**Low**	-	-
Assessment This tree is dead.											**Development Impact** No Impact	
8	*Avicennia marina* Grey Mangrove	3	0.11	1 x 1	M	I	S	A	**2A**	**High**	**2.00**	**1.31**
Assessment The southern side of the crown contains stub cut branches and fractured branch sockets, this appears to be in association with the adjacent car park.											**Development Impact** No Impact	
14	*Avicennia marina* Grey Mangrove	5	0.19 0.17	6 x 6	M	C	E	A	**1B**	**High**	**3.06**	**1.86**
Assessment A small, narrow longitudinal wound on the stem at 1.1m, upper side (tension side) is occluding; the opening is too narrow for probing. The eastern crown is adjacent/ on the periphery of the existing deck to the east.											**Development Impact** No Impact	
29	*Avicennia marina* Grey Mangrove	3	0.28 [C]	1 x 1	M	I	W	C	**3D**	**High**	**3.36** [C]	**1.94** [C]
Assessment This tree is growing horizontal, therefore the DBH is estimated. A large, open fracture wound in present in the lower stem, and the distal end has been severely lopped- only small epicormic growths remain.											**Development Impact** No Impact	

<table>
<tr><th>Tree No.</th><th>Botanical Name[1]
Common Name</th><th>Height (m)</th><th>DBH (m)</th><th>Crown Spread (m)</th><th>Age</th><th>Crown Class</th><th>Crown Aspect</th><th>Vitality Rating</th><th>SULE Rating</th><th>STARS[2] Rating</th><th>TPZ[3]</th><th>SRZ</th></tr>
<tr><td>30</td><td>Avicennia marina
Grey Mangrove</td><td>6</td><td>0.33</td><td>5 x 6</td><td>M</td><td>C</td><td>Sym.</td><td>A</td><td>1B</td><td>High</td><td>3.96</td><td>2.08</td></tr>
<tr><td colspan="11">Assessment
This tree presents as typical for the species.</td><td colspan="2">Development Impact
No Impact</td></tr>
<tr><td>38</td><td>Avicennia marina
Grey Mangrove</td><td>6</td><td>0.26</td><td>6 x 7</td><td>M</td><td>C</td><td>Sym.</td><td>A</td><td>1A</td><td>High</td><td>3.12</td><td>1.88</td></tr>
<tr><td colspan="11">Assessment
This tree presents as typical for the species.</td><td colspan="2">Development Impact
No Impact</td></tr>
<tr><td>39</td><td>Avicennia marina
Grey Mangrove</td><td>4</td><td>0.23[C]</td><td>3 x 4</td><td>M</td><td>I</td><td>W</td><td>A</td><td>2A</td><td>High</td><td>2.76</td><td>1.79</td></tr>
<tr><td colspan="11">Assessment
This tree is growing horizontal, therefore the DBH is estimated.</td><td colspan="2">Development Impact
No Impact</td></tr>
<tr><td>40</td><td>Avicennia marina
Grey Mangrove</td><td>6</td><td>0.21</td><td>5 x 5</td><td>M</td><td>S</td><td>Sym.</td><td>A</td><td>1A</td><td>High</td><td>2.52</td><td>1.72</td></tr>
<tr><td colspan="11">Assessment
This tree presents as typical for the species.</td><td colspan="2">Development Impact
No Impact</td></tr>
<tr><td>41</td><td>Avicennia marina
Grey Mangrove</td><td>4</td><td>0.23</td><td>4 x 4</td><td>M</td><td>I</td><td>E</td><td>A, B</td><td>3D</td><td>High</td><td>2.76</td><td>1.79</td></tr>
<tr><td colspan="11">Assessment
A large, open wound is present for the entirety of the stem below 2.2m. Evidence of old wounding/ fractured roots at the basal flare. Further open wounds are located in the mid crown. Some twiggy decline is present, lower crown. The eastern crown is adjacent/ on the periphery of the existing deck to the east.</td><td colspan="2">Development Impact
Major Encroachment</td></tr>
<tr><td>42</td><td>Avicennia marina
Grey Mangrove</td><td>4</td><td>0.14</td><td>2 x 3</td><td>M</td><td>I</td><td>Sym.</td><td>A</td><td>2A</td><td>High</td><td>2.00</td><td>1.45</td></tr>
<tr><td colspan="11">Assessment
Previously composed of 2 stems, the northern stem has failed at 1m. Minor conflict with insulated service line above the tree is evident.</td><td colspan="2">Development Impact
No Impact</td></tr>
</table>

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
43	*Avicennia marina* Grey Mangrove	7	0.33	7 x 7	M	D	Sym.	A	**1B**	**High**	**3.96**	**2.08**
Assessment The eastern crown is conflicting with the adjacent shed to the east and north. The dripline is tangential to the *Metal Clad Building (on Timber Piers)*											**Development Impact** Major Encroachment	
44	*Avicennia marina* Grey Mangrove	3	0.16[C]	2 x 2	M	S	Sym.	C	**3A**	**High**	**2.00**	**1.53**
Assessment This tree presents significant decline. Growing horizontally, extensive wounding and/ or pipe cavity constitutes the entirety of the stem. The crown is composed of 2 separate portions of approximately 1x1m, located at each end.											**Development Impact** No Impact	
45	*Avicennia marina* Grey Mangrove	4	0.23	4 x 3	M	C	E	A, B	**2A**	**High**	**2.76**	**1.79**
Assessment This tree presents some twiggy decline, lower crown. Growing horizontally.											**Development Impact** No Impact	
46	*Avicennia marina* Grey Mangrove	5	0.15 0.13 0.09	3 x 3	M	C	E	A	**1B**	**High**	**2.62**	**1.75**
Assessment This tree presents a basal wound from previous stem failure.											**Development Impact** No Impact	
47	*Avicennia marina* Grey Mangrove	5	0.26	5 x 4	M	C	Sym.	A	**2A**	**High**	**3.12**	**1.88**
Assessment Basal wounding and a pipe cavity are evident in the lower stem, western side. These appear to be generated by previous failure at the base. The pipe cavity appears to extend to an open wound at 2m, northern side.											**Development Impact** No Impact	
48	*Avicennia marina* Grey Mangrove	4	0.20	3 x 4	M	I	W	A	**1B**	**High**	**2.40**	**1.68**
Assessment This tree presents a small, apparent cavity at base, western side. An open wound from a dead wood stub is present											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
at 2.4m, northern side.												
49	*Avicennia marina* Grey Mangrove	6	0.25	6 x 6	M	D	W	A	**2A**	**High**	**3.00**	**1.85**
Assessment Provides the habit typical for the species. The dripline extends over the *kiosk.*											**Development Impact** No Impact	
50	*Avicennia marina* Grey Mangrove	6	0.15	2 x 4	M	C	W	A	**2A**	**High**	**2.00**	**1.49**
Assessment A basal wound, northern side is occluding. The western side of crown is on the tangent of the adjacent structure.											**Development Impact** No Impact	
51	*Avicennia marina* Grey Mangrove	5	0.19	3 x 4	M	I	S	A	**1A**	**High**	**2.28**	**1.65**
Assessment Provides the habit typical for the species.											**Development Impact** No Impact	
52	*Avicennia marina* Grey Mangrove	5	0.16	2 x 2	M	C	NE	A, B	**2A**	**High**	**2.00**	**1.53**
Assessment This tree presents some twiggy decline, eastern crown.											**Development Impact** No Impact	
53	*Avicennia marina* Grey Mangrove	5	0.25	5 x 4	M	C	E	A	**1B**	**High**	**3.00**	**1.85**
Assessment Minor conflict with insulated service line located above is evident.											**Development Impact** No Impact	
54	*Avicennia marina* Grey Mangrove	6	0.25	6 x 4	M	C	Sym.	A	**1B**	**High**	**3.00**	**1.85**
Assessment Minor conflict with insulated service line located above is evident. Several lower order branches have failed.											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
55	*Avicennia marina* Grey Mangrove	5	0.26 0.18	7 x 10	M	C	Sym.	A	**2A**	**High**	**3.79**	**2.04**
Assessment An aged basal wound reveals a pipe cavity in the lower portion of the larger stem. The smaller stem (eastern crown), is tangential with the *Metal Clad Building (on Timber Piers).*											**Development Impact** Major Encroachment	
56	*Avicennia marina* Grey Mangrove	6	0.26	6 x 7	M	C	Sym.	A	**1B**	**High**	**3.12**	**1.88**
Assessment The eastern crown is tangential with the *Metal Clad Building (on Timber Piers).*											**Development Impact** Major Encroachment	
57	*Avicennia marina* Grey Mangrove	5	0.29	5 x 6	M	C	S	A	**2A**	**High**	**3.48**	**1.97**
Assessment An aged failure at 1.1m, western side, has allowed the formation of a pipe cavity in the lower stem.											**Development Impact** No Impact	
58	*Avicennia marina* Grey Mangrove	4	0.17	2 x 5	M	S	E	A	**2D**	**High**	**2.04**	**1.57**
Assessment Heavily suppressed, this tree is growing horizontally to the northeast, and all foliage bar a small sprout on the basal flare is dripline is tangential to the *Metal Clad Building (on Timber Piers)*											**Development Impact** Major Encroachment	
59	*Avicennia marina* Grey Mangrove	5	0.23	4 x 5	M	C	S	A	**1A**	**High**	**2.76**	**1.79**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
60	*Avicennia marina* Grey Mangrove	5	0.12	1 x 1	M	I	S	A	**2A**	**High**	**2.00**	**1.36**
Assessment Several wounds are present on lower stem, including a small pipe cavity.											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
61	*Avicennia marina* Grey Mangrove	5	0.15	2 x 3	M	C	Sym.	A	**1A**	**High**	**2.00**	**1.49**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
62	*Avicennia marina* Grey Mangrove	5	0.22 0.16	5 x 4	M	C	N	A	**1A**	**High**	**3.26**	**1.92**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
63	*Avicennia marina* Grey Mangrove	5	0.17	5 x 3	M	I	N	A	**2D**	**High**	**2.04**	**1.57**
Assessment This tree presents wounds in the lower stem that reveal a pipe cavity. The dripline extends over the *Timber Jetty,* by 1.2m.											**Development Impact** No Impact	
64	*Avicennia marina* Grey Mangrove	4	0.22	2 x 3	M	S	Sym.	A	**2D/3D**	**High**	**2.64**	**1.75**
Assessment The main stem of this tree has completely failed at 3m.											**Development Impact** No Impact	
65	*Avicennia marina* Grey Mangrove	5	0.16	1 x 1	M	S	E	B	**2D/3D**	**High**	**2.00**	**1.53**
Assessment This tree presents crown decline. Conflicting with the service line located above.											**Development Impact** Major Encroachment	
66	*Avicennia marina* Grey Mangrove	6	0.31	7 x 6	M	C	Sym.	A	**1B**	**High**	**3.72**	**2.02**
Assessment This tree is conflicting with the service line above. The dripline extends over the *Timber Jetty,* by 2m.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
67	*Avicennia marina* Grey Mangrove	6	0.19	4 x 4	M	C	W	A	**1B**	**High**	**2.28**	**1.65**
Provides the habit typical for the species. The dripline extends over the *Kiosk.*											**Development Impact** Remove	
68	*Avicennia marina* Grey Mangrove	5	0.18	4 x 3	M	I	N	A	**1B**	**High**	**2.16**	**1.61**
Assessment The entirety of the crown is located over the adjacent *Timber Jetty*.											**Development Impact** Remove	
69	*Avicennia marina* Grey Mangrove	4	0.18	1 x 2	M	S	N	B	**3A**	**High**	**2.16**	**1.61**
Assessment The stem has failed at 3.5m, some crown decline is evident. The dripline extends over the *Timber Jetty,* by 400mm.											**Development Impact** Remove	
70	*Avicennia marina* Grey Mangrove	4	0.17	2 x 2	M	I	N	A	**2A**	**High**	**2.04**	**1.57**
Assessment The upper crown, over the adjacent jetty, appears to have been loped long ago. Approximately half the foliar mass extends over the *Timber Jetty*											**Development Impact** Major Encroachment	
71	*Avicennia marina* Grey Mangrove	3	0.09	1 x 1	Y	S	NE	A	**2A**	**High**	**2.00**	**1.20**
Assessment This tree is growing horizontally to the northeast. The entirety of the crown is located over the *Timber Jetty.*											**Development Impact** Major Encroachment	
72	*Avicennia marina* Grey Mangrove	4	0.18	5 x 2	M	C	N	A	**2D**	**High**	**2.16**	**1.61**
Assessment This tree presents open wounds that reveal a pipe cavity in lower stem. The entirety of the crown is located over the *Timber Jetty.*											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
73	*Avicennia marina* Grey Mangrove	7	0.28	6 x 6	M	C	Sym.	A	**1A**	**High**	**3.36**	**1.94**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
74	*Avicennia marina* Grey Mangrove	7	0.25	4 x 4	M	C	Sym.	A	**1A**	**High**	**3.00**	**1.85**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
75	*Avicennia marina* Grey Mangrove	6	0.23	3 x 5	M	C	E	A	**1A**	**High**	**2.76**	**1.79**
Assessment This tree presents as typical for the species.											**Development Impact** No Impact	
76	*Avicennia marina* Grey Mangrove	6	0.27	6 x 4	M	C	Sym.	A	**1B**	**High**	**3.24**	**1.91**
Assessment The lowest 1st order branch, northern side, is experiencing minor conflict with the adjacent jetty. The upper crown, northern side had significant foliar mass located over the *Timber Jetty*.											**Development Impact** Major Encroachment	
77	*Avicennia marina* Grey Mangrove	6	0.22	5 x 5	M	C	NE	A	**1A**	**High**	**2.64**	**1.75**
Assessment The northern Crown is located over the footprint of the *Timber Jetty*.											**Development Impact** Major Encroachment	
78	*Avicennia marina* Grey Mangrove	5	0.28[B]	4 x 7	M	I	E	A	**1B**	**High**	**3.36**	**1.94**
Assessment This tree presents multiple open wounds on the lower stems. Foliar mass is located over the footprints of the *Timber Jetty's* to the north and west.											**Development Impact** Remove	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
79	*Avicennia marina* Grey Mangrove	4	0.10	1 x 2	M	S	E	A	**3D/4C**	**Medium**	**2.00**	**1.26**
Assessment This tree is a single sprout emerged from a degraded stump, partial separation of the union is evident.											**Development Impact** No Impact	
80	*Avicennia marina* Grey Mangrove	5	0.13	1 x 1	M	S	E	A	**2A**	**High**	**2.00**	**1.40**
Assessment Wounds on the lower stem, northern side, reveal a small basal cavity.											**Development Impact** No Impact	
81	*Avicennia marina* Grey Mangrove	5	0.20	2 x 3	M	C	E	A	**1A**	**High**	**2.40**	**1.68**
Assessment This tree presents as typical for the species.											**Development Impact** Major Encroachment	
82	*Avicennia marina* Grey Mangrove	5	0.19	3 x 5	M	I	E	A, B	**2A/2D**	**High**	**2.28**	**1.65**
Assessment This tree presents some crown decline.											**Development Impact** No Impact	
83	*Avicennia marina* Grey Mangrove	4	0.18 0.06 0.10	4 x 3	M	I	E	A	**2A**	**High**	**2.57**	**1.73**
Assessment A basal wound reveals pipe cavity. The western crown is located over the adjacent *Timber Jetty*.											**Development Impact** No Impact	
84	*Avicennia marina* Grey Mangrove	4	0.22	6 x 5	M	C	SW	A	**2A**	**High**	**2.64**	**1.75**
Assessment The southern and eastern portions of the crown are located over the adjacent *Timber Jetty's*.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
85	*Avicennia marina* Grey Mangrove	4	0.12	2 x 1	M	S	S	A	**2D**	**High**	**2.00**	**1.36**
Assessment This tree presents significant conflict with the jetty and structure to the east. All foliage is located over the footprint of the adjacent *Timber Jetty*.											**Development Impact** No Impact	
86	*Avicennia marina* Grey Mangrove	4	0.14	2 x 2	M	C	SE	A	**2D**	**High**	**2.00**	**1.45**
Assessment A basal wound, eastern side, reveals a cavity. The dripline is conflicting with the *Metal Clad Building* to the north east.											**Development Impact** No Impact	
87	*Avicennia marina* Grey Mangrove	4	0.25 0.23[C]	8 x 6	M	C	N	A	**1B**	**High**	**4.08**	**2.10**
Assessment This tree appears to have possibly failed in the past- multiple stems are growing horizontally. The drip line, western and northern sides, is located over the footprint of the adjacent *Timber Jetty's*.											**Development Impact** Major Encroachment	
88	*Avicennia marina* Grey Mangrove	3	0.25 0.23[B,C]	8 x 8	M	I	N	A	**1B**	**High**	**4.08**	**2.10**
Assessment This tree appears to have possibly failed in the past- multiple stems are growing horizontally. The drip line is located over the adjacent Timber Jetty to the east, as is a large 1st order branch.											**Development Impact** Major Encroachment	
89	*Avicennia marina* Grey Mangrove	3	0.25	8 x 4	M	S	N	A	**1B**	**High**	**3.00**	**1.85**
Assessment This tree presents as typical for the species.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
90	*Avicennia marina* Grey Mangrove	4	0.22 0.16	6 x 6	M	C	Sym.	A	**1B**	**High**	**3.26**	**1.92**
Assessment This tree has foliar mass, northern side, located over the adjacent *Timber Jetty*, including a large 1st order branch-this branch has a pipe cavity present.											**Development Impact** Major Encroachment	
91	*Avicennia marina* Grey Mangrove	4	0.28	7 x 4	M	C	N	A	**2A**	**High**	**3.36**	**1.94**
Assessment A wound at 1.3m, southern side, reveals a cavity. All foliar mass is located over the adjacent *Timber Jetty.*											**Development Impact** Major Encroachment	
92	*Avicennia marina* Grey Mangrove	5	0.23	5 x 5	M	I	N	A	**1B**	**High**	**2.76**	**1.79**
Assessment The northern drip line is located over the *Timber Jetty* to the west.											**Development Impact** Remove	
93	*Avicennia marina* Grey Mangrove	6	0.25	6 x 6	M	C	Sym.	A	**1A**	**High**	**3.00**	**1.85**
Assessment The distal portion of the northern drip line is located over the adjacent *Timber Jetty*.											**Development Impact** No Impact	
94	*Avicennia marina* Grey Mangrove	5	0.29 0.22	7 x 7	M	C	S	A	**1A**	**High**	**4.37**	**2.16**
Assessment The south eastern distal portion of the crown is conflicting with the adjacent *Metal Clad Building*.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
95	*Avicennia marina* Grey Mangrove	3	0.20 0.10 0.10[B,C]	5 x 4	M	I	SE	A	**2A**	**High**	**2.94**	**1.83**
Assessment This tree provides the habit typical for the species. The dripline is tangential to the *Timber Jetty.*											**Development Impact** Remove	
96	*Avicennia marina* Grey Mangrove	6	0.23	4 x 4	M	C	S	A	**1A**	**High**	**2.76**	**1.79**
Assessment This tree provides the habit typical for the species, and the habit is typical for a forest class, although biased.											**Development Impact** No Impact	
97	*Avicennia marina* Grey Mangrove	6	0.32	6 x 5	M	C	SW	A	**1A**	**High**	**3.84**	**2.05**
Assessment This tree provides the habit typical for the species, a dead stub extends from the bole, remains of an old leader.											**Development Impact** No Impact	
98	*Avicennia marina* Grey Mangrove	6	0.26	5 x 5	M	C	NE	A	**1A**	**High**	**3.12**	**1.88**
Assessment This tree provides the habit typical for the species. Substantial epicormic growth extends over the stem.											**Development Impact** No Impact	
99	*Avicennia marina* Grey Mangrove	6	0.21 0.21 0.26	7 x 9	M	I	N	A	**1A**	**High**	**4.74**	**2.24**
Assessment Composed of three leaders that initiate from a common bole, the habit is otherwise typical for the species.											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
100	*Avicennia marina* Grey Mangrove	2	0.30	1 x 1	M	S	Sym.	B	**3A**	**Medium**	**3.60**	**2.00**
	Assessment This tree has completely failed, where the remains consist of a stump, and all active growth is epicormic. The tree provides poor form although could regenerate into a new tree pending the strength of the attachment points for the epicormic growth.										**Development Impact** No Impact	
101	*Avicennia marina* Grey Mangrove	6	0.29 0.21	5 x 11	M	I	Sym.	A	**1A**	**High**	**4.30**	**2.15**
	Assessment Composed of two leaders that initiate from a 1.0m high stem, and offers a typical habit.										**Development Impact** No Impact	
102	*Avicennia marina* Grey Mangrove	6	0.20 0.18	5 x 7	M	D	Sym.	A	**1A**	**High**	**3.23**	**1.91**
	Assessment Composed of two leaders that initiate from a 1.0m high stem, and offers a typical habit.										**Development Impact** No Impact	
103	*Avicennia marina* Grey Mangrove	5	0.22	5 x 3	M	C	E	A	**1A**	**High**	**2.64**	**1.75**
	Assessment Two leaders initiating from a common bole, one stem is dead, the remaining stem provides typical form, however contains numerous epicormic shoots.										**Development Impact** No Impact	
104	*Avicennia marina* Grey Mangrove	4	0.18	3 x 3	M	C	NW	A	**2A**	**High**	**2.16**	**1.61**
	Assessment This tree appears to have succumbed to partial windthrow, where the predominate stem lays near horizontal to the ground, before the upper leader elevates above grade. This has resulted with the dripline to be approximately 6m from the base of the tree. The root system is exposed on the eastern side, and provides the potential for complete windthrow.										**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
105	*Avicennia marina* Grey Mangrove	6	0.22	3 x 3	M	I	N	A	**1A**	**High**	**2.64**	**1.75**
Assessment Two leaders initiating from a common bole, one leader is dead (stub), the remaining stem provides typical form, however contains numerous epicormic shoots.											**Development Impact** No Impact	
106	*Avicennia marina* Grey Mangrove	4	0.25	4 x 4	M	C	NE	A	**3A**	**Medium**	**3.00**	**1.85**
Assessment This tree appears to have succumbed to windthrow, where the predominate stem lays on the ground. The root system is exposed on the western side, and provides the potential for complete windthrow.											**Development Impact** No Impact	
107	*Avicennia marina* Grey Mangrove	2	0.25 0.25	3 x 3	O	C	S	C	**4A**	**Medium**	**4.24**	**2.14**
Assessment This is two separate stems growing near flush with one another, the soil around the root system has been eroded away to expose an extensive graft between the root systems (within the SRZ). Therefore, has been considered as a single tree. Both have succumbed to windthrow and are predominately laying on the ground, where they have continued to grow. The western stem, has only 2 out of the 5 branches active, that is, 60% dead, and the eastern stem is entirely dead, but for some active epicormic shoots initiating from the root crown.											**Development Impact** No Impact	
108	*Avicennia marina* Grey Mangrove	6	0.22	2 x 5	M	I	S	A	**1A**	**High**	**2.64**	**1.75**
Assessment The stem initiates vertically before entirely bowing south, a codominant growth response. Substantial epicormic growth exists.											**Development Impact** No Impact	
109	*Avicennia marina* Grey Mangrove	6	0.22	2 x 1	M	I	S	A	**2A**	**High**	**2.64**	**1.75**
Assessment Initially composed of two leaders, one has died and formed a decayed stub, the remaining leader initiates vertically											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
before entirely bowing south, a codominant growth response.												
110	*Avicennia marina* Grey Mangrove	5	0.12	6 x 3	M	C	NE	A	**1A**	**High**	**3.60**	**1.60**
Assessment This is five independent trees, growing from an area of 1m $^{2.}$ The Dbh range between 50mm to 112mm, and a mean of 90mm. Their habits are similar yet, bow towards the northeast at varying angles. The crown class for each range from suppressed, intermediate to co-dominant. The closest dripline is 3m from the *Timber Jetty*.											**Development Impact** No Impact	
111	*Avicennia marina* Grey Mangrove	5	0.11 0.09	4 x 2	M	C	NE	A	**1A**	**High**	**2.00**	**1.46**
Assessment This tree divides into two leaders from a 0.5m high stem; each leader bows near-horizontal north east. The closest dripline is 1.4m from the *Timber Jetty*.											**Development Impact** No Impact	
112	*Avicennia marina* Grey Mangrove	4	0.07 0.07 0.05	2 x 3	Y	S	NE	A	**1A**	**Medium**	**2.50**	**1.50**
Assessment This is three independent trees, growing from an area of 0.5m ^{2}. Each leader bows near-horizontal northeast. The driplines are tangential with the *Timber Jetty*.											**Development Impact** Major Encroachment	
113	*Avicennia marina* Grey Mangrove	5	0.13	3 x 3	M	C	NE	A	**1A**	**High**	**2.00**	**1.40**
Assessment This tree divides into two leaders from a 1.2m high stem, the crown mass is biased. The closest dripline is 1.5m from the *Timber Jetty*.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
114	*Avicennia marina* Grey Mangrove	3	0.07	2 x 3	Y	C	E	A	**1A**	**Medium**	**2.00**	**1.08**
Assessment This tree offers typical form, other than the crown bias. The closest dripline is 2.0m from the derelict barge and 2.5m from the *Timber Jetty*.											**Development Impact** No Impact	
115	*Avicennia marina* Grey Mangrove	5	0.11	3 x 2	M	I	E	A	**1A**	**High**	**2.00**	**1.31**
Assessment This tree provide an upright habit, near forest class. The dripline is well removed from any structure.											**Development Impact** No Impact	
116	*Avicennia marina* Grey Mangrove	1	0.06	4 x 1	Y	S	E	A	**2A**	**High**	**2.00**	**1.02**
Assessment The stem initiates vertically before the entire crown structure bows near entirely horizontal. The closest dripline is 2.0m from the derelict barge and 5m from the *Timber Jetty*.											**Development Impact** No Impact	
117	*Avicennia marina* Grey Mangrove	3	0.11	5 x 3	M	S	E	A	**1A**	**High**	**2.00**	**1.31**
Assessment The stem initiates vertically before the entire crown structure bows near entirely horizontal. The closest dripline is tangential to the derelict barge and 5m from the *Timber Jetty*.											**Development Impact** No Impact	
118	*Avicennia marina* Grey Mangrove	4	0.10	3 x 3	M	C	E	A	**1A**	**Medium**	**2.00**	**1.26**
Assessment The stem initiates vertically before the entire crown structure bows near entirely horizontal. The closest dripline is 2.0m from the derelict barge and 5m from the *Timber Jetty*.											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
119	*Avicennia marina* Grey Mangrove	1	0.08	3 x 2	Y	S	S	A	**2A**	**High**	**2.00**	**1.15**
Assessment The stem initiates vertically before the entire crown structure bows near entirely horizontal. The closest dripline is tangential to the derelict barge and 5m from the *Timber Jetty*.											**Development Impact** No Impact	
120	*Avicennia marina* Grey Mangrove	5	0.15	11 x 8	M	D	Sym.	A	**1A**	**High**	**8.00**	**2.49**
Assessment This tree presents a habit composed of approximately five leaders that initiate from a common root crown. The crown structure is sprawling. The closest dripline is tangential to the derelict barge and 8m from the *Timber Jetty*.											**Development Impact** No Impact	
121	*Avicennia marina* Grey Mangrove	3	0.10 0.10	4 x 3	M	C	Sym.	A	**1A**	**High**	**2.50**	**1.46**
Assessment A stunted atypical habit composed of 1st order/leaders that are difficult to assign . The closest dripline is 1m to the derelict barge and 1.5m from the *Timber Jetty*.											**Development Impact** Major Encroachment	
122	*Avicennia marina* Grey Mangrove	5	0.12	3 x 3	Y	I, C, F	Sym.	A	**1A**	**High**	**3.00**	**1.50**
Assessment This is four independent trees, growing from an area of 1m $^{2.}$ The Dbh range between 40mm to 120mm, and a mean of 60mm. Their habits are similar. The crown class for each range from suppressed, intermediate to co-dominant. The closest dripline is 1m from the *Timber Jetty*.											**Development Impact** Major Encroachment	
123	*Avicennia marina* Grey Mangrove	5	0.12	2 x 3	Y	I, C, F	Sym.	A	**1A**	**High**	**2.50**	**1.36**
Assessment This is three independent trees, growing from an area of 1m $^{2.}$ The Dbh range between 30mm to 120mm, and a											**Development Impact** Major	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
mean of 80mm. Their habits are similar. The crown class for each range from suppressed, intermediate to co-dominant. The closest dripline is 1m from the *Timber Jetty*.											Encroachment	
124	*Avicennia marina* Grey Mangrove	5	0.10	3 x 2	Y	I, C, F	Sym.	A	**1A**	**High**	**4.00**	**1.26**
Assessment This is seven independent trees, growing from an area of 1.5m$^{2.}$ The Dbh range between 20mm to 100mm, and a mean of 65mm. There habits are similar with varying crown class. The crown class for each range from suppressed, intermediate to co-dominant. The driplines are near tangential from the *Timber Jetty*.											**Development Impact** Major Encroachment	
125	*Avicennia marina* Grey Mangrove	5	0.10	1 x 3	Y	I	Sym.	A	**1A**	**High**	**2.50**	**1.26**
Assessment This is three independent trees, growing from an area of 1m$^{2.}$ The Dbh range between 30mm to 100mm, and a mean of 60mm. Their habits are similar. The crown class for each range from suppressed, intermediate to co-dominant. The driplines are near tangential from the *Timber Jetty*.											**Development Impact** Major Encroachment	
126	*Avicennia marina* Grey Mangrove	6	0.16	13 x 12	M	D	Sym.	A	**1A**	**High**	**6.50**	**2.50**
Assessment This tree presents a habit composed of approximately five leaders that initiate from a common root crown. The crown structure is sprawling. The closest dripline is tangential to the *Metal clad building (on fill)*, and extends over the *Timber Jetty*.											**Development Impact** Major Encroachment	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
127	*Avicennia marina* Grey Mangrove	4	0.15	11 x 9	M	D	Sym.	A	**1A**	**High**	**5.80**	**2.50**
Assessment This tree presents a habit composed of approximately four leaders that initiate from a common root crown. The crown structure is sprawling. The closest dripline is 1.5m to the *Metal clad building (on fill)*, and well removed from the *Timber Jetty*.											**Development Impact** Major Encroachment	
128	*Avicennia marina* Grey Mangrove	6	0.27	5 x 9	M	C	NW	A	**1A**	**High**	**3.24**	**1.91**
Assessment Provides the habit typical for the species. The closest dripline is tangential to the *Metal clad building (on fill)*,.											**Development Impact** Major Encroachment	
129	*Avicennia marina* Grey Mangrove	6	0.21	5 x 4	M	I	Sym.	A	**1A**	**High**	**2.52**	**1.72**
Assessment Provides the habit typical for the species. The closest dripline is tangential to the *Metal clad building (on fill)*,.											**Development Impact** Major Encroachment	
130	*Avicennia marina* Grey Mangrove	6	0.28 0.21	8 x 8	M	D	Sym.	A	**1A**	**High**	**4.20**	**2.13**
Assessment Provides the habit typical for the species. The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 1m.											**Development Impact** Major Encroachment	
131	*Avicennia marina* Grey Mangrove	5	0.16	4 x 3	M	C	E	A	**1A**	**High**	**2.00**	**1.53**
Assessment Provides the habit typical for the species.											**Development Impact** Major	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 0.5m.											Encroachment	
132	*Avicennia marina* Grey Mangrove	7	0.28	6 x 6	M	I	N	A	**1A**	**High**	**3.36**	**1.94**
Assessment Provides the habit typical for the species, although the stem has a significant lean (45° from vertical). Some epicormic growth exists on the stem and branch structure. The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 5m.											**Development Impact** No Impact	
133	*Avicennia marina* Grey Mangrove	3	0.11	1 x 1	Y	S	Sym.	B	**3A**	**Medium**	**2.00**	**1.31**
Assessment Slender specimen, which has lost the leader, and the remaining crown structure is composed of epicormic regrowth. The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 5m.											**Development Impact** No Impact	
134	*Avicennia marina* Grey Mangrove	7	0.27	4 x 6	M	I	N	A	**1C**	**High**	**3.24**	**1.91**
Assessment Provides the habit typical for the species, although the stem has a significant lean (30° from vertical). Some epicormic growth exists on the stem and branch structure. A large synthetic rope (25mm diameter) is wrapped around the stem and should be removed before the secondary growth is constricted and wounded. The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 3m.											**Development Impact** No Impact	
135	*Avicennia marina* Grey Mangrove	5	0.15	3 x 2	M	I	W	A	**3A**	**Medium**	**2.00**	**1.49**
Assessment Slender specimen, which has lost the leader, and the remaining crown structure is composed of epicormic											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
regrowth. Some stem wounds exist and decay occurs in the root crown. The closest dripline extends over the roof of the *Metal clad building (on fill)*, by 4m.												
136	*Avicennia marina* Grey Mangrove	5	0.26	5 x 5	M	C	NE	A	**2A**	**High**	**3.12**	**1.88**
Assessment The stem has a significant dogleg, from where the leader has broken out, and the remaining crown structure is composed of epicormic regrowth. The closest dripline extends tangential and partially over the roof of the *Metal clad building (on fill)*.											**Development Impact** Major Encroachment	
137	*Avicennia marina* Grey Mangrove	6	0.22	3 x 3	M	I	Sym.	A	**1A**	**High**	**2.64**	**1.75**
Assessment Provides the habit typical for the species. The closest dripline extends 4m away from the *Metal clad building (on fill)*,.											**Development Impact** Major Encroachment	
138	*Avicennia marina* Grey Mangrove	4	0.29	4 x 4	M	C	NE	A	**2A**	**High**	**3.48**	**1.97**
Assessment This tree has failed, and the resulting stump has formed two mature epicormic shoots, which provide the crown structure. A significant cavity extends through the stump, which will reduce the integrity of the crown structure. The closest dripline is tangential with the *Metal clad building (on fill)*,.											**Development Impact** Major Encroachment	
139	*Avicennia marina* Grey Mangrove	6	0.19	4 x 6	M	C	NE	A	**1A**	**High**	**2.28**	**1.65**
Assessment Provides the habit typical for the species. The closest dripline extends 4m away from the *Metal clad building (on fill)*.											**Development Impact** No Impact	

Tree No.	Botanical Name[1] Common Name	Height (m)	DBH (m)	Crown Spread (m)	Age	Crown Class	Crown Aspect	Vitality Rating	SULE Rating	STARS[2] Rating	TPZ[3]	SRZ
140	*Avicennia marina* Grey Mangrove	3	0.29	2 x 4	M	D	N	B	**3A**	**Medium**	**3.48**	**1.97**
Assessment Composed of a stump which has failed, and the remaining crown structure is composed of minor epicormic regrowth. The foliage is chlorotic and has been since the initial assessment of the site. No apparent reason exists for the poor vitality. The dripline is well removed from any structures.											**Development Impact** No Impact	
141	*Avicennia marina* Grey Mangrove	5	0.29	7 x 6	M	C	N	A	**1A**	**High**	**3.48**	**1.97**
Assessment This tree provides typical form other than the northern bias, where the entire crown structure is semi-circular and initiates from the bole. The co-dominant growth response is related to the oyster sheds, or it may have been related to mangroves removed for the shed construction. Timber have been attached to the branch structure. The dripline extends on a tangent to the *Metal clad building (on timber piers)* and *Metal clad building*.											**Development Impact** Remove	
142	*Avicennia marina* Grey Mangrove	3	0.17	3 x 2	M	S	NE	A	**3A**	**High**	**2.04**	**1.57**
Assessment This tree offers a slender and scant habit due to the suppressed class with TN 141. The stem has an extensive wound with decay extending along the tension side. The crown mass bows entirely northeast and forms a small portion of the crown from the TN 141. Exposed root system on the western side suggests possible windthrow has initiated. Timber have been attached to the branch structure. The dripline is removed from any structure											**Development Impact** Remove	

A. Incomplete identification of species due to insufficiently available plant material
B. Diameter taken below 1.4m due to low stem bifurcation
C. Estimate due to the overgrown area and/or limited access

Note 1: The tree species is identified as *Avicennia marina* subsp. *australasica*, although for the purpose of report formatting has been limited to the species description of *Avicennia marina.*

Note 2: The STARS rating applied has considered these trees based on the environmental significance and legislative protection assigned. Because they do not reside within an urban environment for which the rating is designed, the amenity value has been ignored as has risk factors unless a high use target zone exists. For this reason, the predominant trees are rated as ‘High’ and those trees that present an obvious limited SULE rated as ‘Medium’.

Note 3: The TPZ has been reassigned an additional area of protection. This is described in Section 7.0.1. This will supersede the calculated zones contained in this column unless further instruction issued by the project arborist.

7.0 Site Assessment

The area of assessment comprises the infrastructure that forms part of the oyster lease. This includes the area adjacent and to the north, forming the area of assessment related to the Arboricultural Assessment Report[7] issued as part of the initial site works. For this reason, some trees located on the boundary of the overlapping areas of work have been included in this report, being trees No. 3, 8, 14, 29, and 30.

The area has been divided between three areas for discussion, being the area east of the 'timber' jetty, west of the 'timber' jetty, and the island.

<u>East of the *Timber jetty*[8]</u>

This area contains a *Metal clad building (on timber piers)*, *pontoon*, *awning* (over water), further smaller *metal-clad buildings* (on piers), *wooden decking,* and two *wooden jetties* connecting to the *Timber jetty* that services all these structures from the shoreline. Each of these structures resides in the tidal area, where land containing the footings and Mangroves is exposed at low tide. The areas containing the trees are level and contain consistent covering of pneumatophores. The root system is consistent throughout the entire area, including beneath all structures. Debris, including lumber, building materials, and other flotsam, occurs throughout the bed. The area contained by the seawall (recently constructed) contains no root system. This is based on the known depth of the piles and sheets utilised for this structure.

<u>West of the *Timber jetty*[8]</u>

This area contains a *Metal clad building (on fill)*, and although not illustrated in the survey, are several derelict barges, ranging up to an estimated 8m long and 3m wide. Approximately six barges occur in this area. Although not all were assessed, all but one appear to have pneumatophores growing through the bottoms. The single barge secured to the *Timber Jetty* and adjacent to trees No. 116, 119, and 121 have been referred by the tenants of the Oyster Farm to be in disuse and planned to be scrapped. This barge is still buoyant and requires decommissioning. Each of these structures resides in the tidal area, where land containing the footings and Mangroves is exposed at low tide. The areas containing the trees are level and contain consistent covering of pneumatophores. The *Metal clad building (on fill)*, although referred to be constructed on fill, is at least partially supported by piers, and observation of the underfloor area discloses extensive pneumatophores. This area is assumed to contain a continuation of the root system. Therefore, the root system is

[8] All descriptions in italics are as referenced on the survey drawing (see Section 4.3.8).

consistent throughout the entire area, that is, beneath all structures. Debris, including lumber, building materials, and other flotsam, occurs throughout the bed. The area contained by the seawall (recently constructed) contains no root system. This is based on the known depth of the piles and sheets utilised for this structure.

Island

The island is located approximately 30m north of the oyster farm sheds. A shallow channel divides the shoreline from the island. This island contains trees No. 96-109. The area is submerged at high tide and only apparent by the mangroves. At low tide, the area provides for an elevated mound that contains substantial pneumatophores that extend predominately south towards the oyster sheds. The remaining ground area has building refuse (brick and tile) as well as substantial oyster growth throughout the bed. The location of these trees is sporadic, and each provides an inconsistent crown bias. This is likely associated with the attrition of other mangroves since decayed and removed from the area. The increased light exposure is likely causing the epicormic growth throughout the tree structure, that is, stem and branches. Many of the trees have visible root systems (predominately first order support roots) and is attributed to the increasing exposure to tidal currents, that is, erosion and increased tendency for wind throw.

7.0.1 Observation: Estimation of the zones of protection

The calculations for the zones of protection are based on the generic formulae provided in the AS 4970. The products of these are described in the columns labeled TPZ (Tree Protection Zone) and SRZ (Structural Root Zone) of Table 1, Section 5.0. These zones are further defined in Appendix A. The Australian Standard provides scope for modifying this zone, however, with supporting evidence. The root extension described for the species (Grey Mangrove) is referred to be extensive yet shallow[9]. Accounting for the nature of the edaphic environment and observation on site[10] of a grafted root system, coupled with the consistency of the pneumatophores, supports a potential for a single communal root system[11] throughout the area. This is relevant regarding the beneficial support offered to individual trees that have succumbed to stress[12]and the proposed development works. Yet, such a morphology can also offer detriment from any toxins that enter the root zone (i.e. TPZ) from related

[9] Farooqui N. U, Dangi C. B. S. , 2018, Distribution and Morphological Adaptations of *Avicennia marina* in the Sundarbans. Biosci Biotech Res Asia ;15(1)

[10] See Tree No. 107, Table 1, Section 6.0

[11] Graham B.F., Borman F.H., 1966, Natural Root Grafts, Botanical Review, Volume 32, pp 255-292

[12] Tarroux E., DesRochers A., Krause C., 2010, Effect of natural root grafting on growth response of jack pine (*Pinus banksiana*) after commercial thinning, Forest Ecology and Management 260: pp 526-535

works, referred to as 'backflash'[13]. This will reflect on the work methodology employed, where roots will require protection during development works and in particular toxins. This does not reduce the opportunity for root encroachment by development work but should encourage the design to reduce any impact on the zones of protection.

The zones of protection also include the driplines, and the low sprawling habit of the species further supports the area of protection to be extended, as a minimum to the extent of the driplines. However, the biased crown span exhibited by many trees due to the forest type environment will limit such a variable for use to represent the Tree Protection Zone. Based on this premise, the nominated TPZ relative to the assessed monoculture is illustrated in Figure 1.

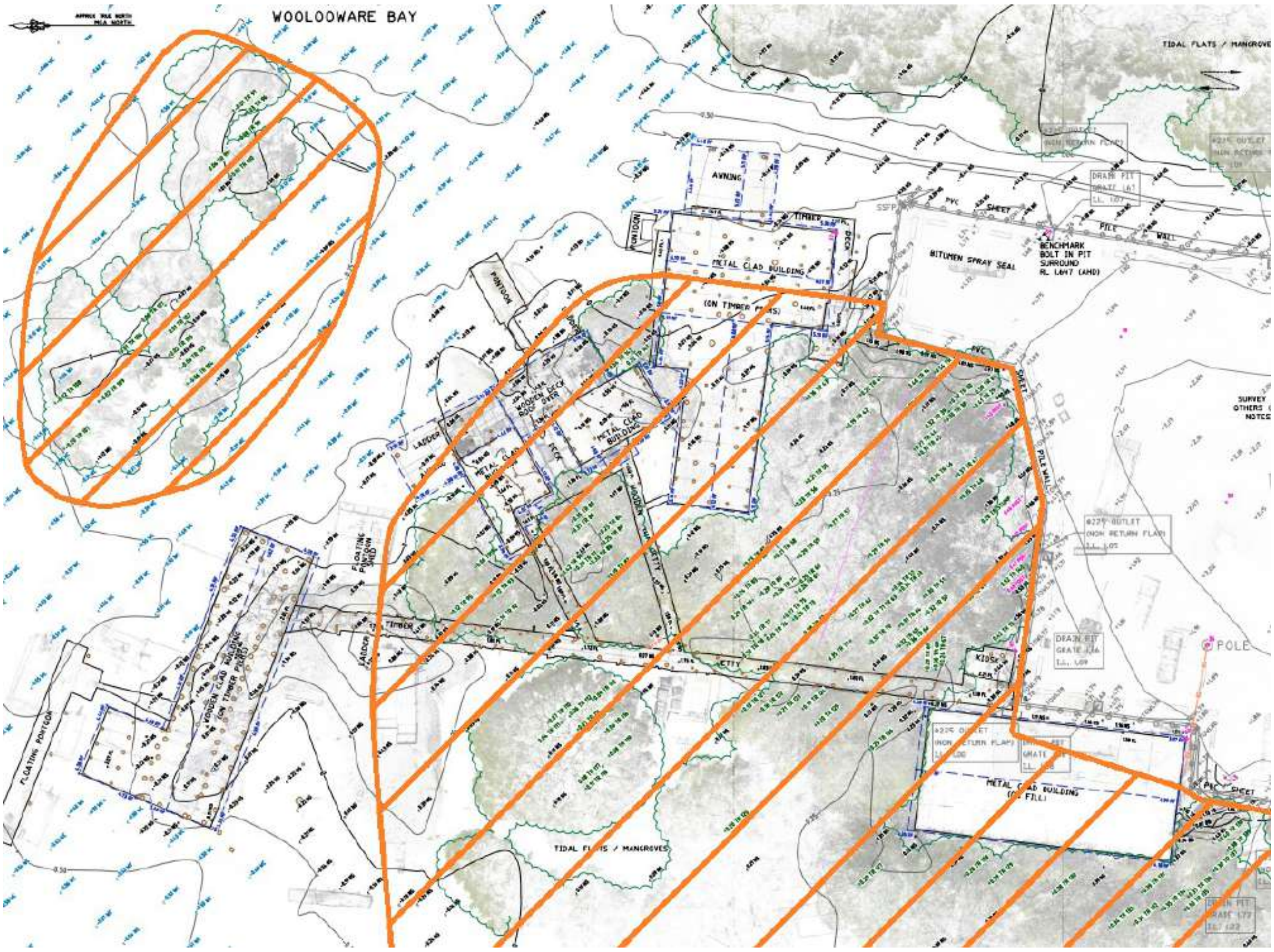


Figure 1: Hatched area represents the overall TPZ for the area.
Not to scale
Source: Adapted from *CMS Surveyors P/L*, Sheet 2, see Section 4.4.1

[13] Thomas P., 2000, Trees: Their natural history, Cambridge University Press, Cambridge, UK

7.1 Proposed development

The proposed development consists of demolition and construction. The demolition consists of existing site structures, being sheds/jetties and floating structures[14], although it has not included derelict barges. The construction will be new buildings/sheds, walkways, floating structures, and associated services[15] for use as an oyster farm. Both the demolition and construction are discussed relative to the tree impact and mitigation available and based on the methodology included in the Constructability Assessment (Section 4.4.3). The discussion will consider the Tree Protection Zone (TPZ) to conform to the area illustrated in Figure 1. The following assumptions form part of the discussion.

<u>Assumption 1; Stormwater</u>: No stormwater drawings have been included as part of the document set, and all stormwater is assumed to be ducted directly back into the waterway, that is, *Woolooware Bay* and not the area referred to as the *Tidal flats/Mangroves*. That is, no excavation in the area of assessment is assumed to be required for this work.

<u>Assumption 2; Utilities</u>: Sewer and utilities (electricity, communications, water, etc.) are assumed to be routed to Captain Cook Drive and currently exist within the area of recent past works. That is, outside the area of assessment and potential impact on Mangroves. These services are assumed to extend into the proposed new buildings at the northeastern projection of the new seawall, therefore pose no impact on any Mangrove of the TPZ's. Within the proposed structure, they are referred to *either be run under the floor/deck structure or at high level through roof spaces*[16], therefore presenting no further impact to surrounding trees.

<u>Assumption 3; Derelict barges</u>: Several derelict timber (and possible composite construction) barges occur amongst the mangroves on the western side of the site and up to 30m from the *PVC Sheet Pile Wall*. These are partially described in Section 7.0, *West of the Timber jetty.* No proposal has been included for these barges and therefore are assumed to be retained on site. The age of these barges could be considered to present historical providence related to the oyster farming. Any pollutants related to these barges are unknown. The root systems (pneumatophores) have grown through the bottom of some barges (incomplete assessment). Therefore, removal attempts will increase impacts to the surrounding environment, including trees. Such removal work has not been considered as part of this report.

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[14] Tonkin, 2021, <u>Constructability Assessment</u>, See Section 6.1 and 6.2
[15] Tonkin, 2021, <u>Constructability Assessment</u>, See Section 7.0-7.2
[16] Tonkin, 2021, <u>Constructability Assessment</u>, See Section 7.1

Assumption 4; Other constraints: The calculations included in the following discussion has not considered;

- subsurface utilities that have not been included in the design,
- Work methods related to subsurface utilities, for example, concrete encasing or replacement of existing lines
- work methods related to construction (stockpiling, site sheds, scaffolding) unless otherwise specified.

These may also increase the encroachment and tree impact and, therefore, the opportunity for tree retention.

This report discusses the impact of the proposed design on the trees. One-hundred and ten (110) trees have been listed within this report based upon the vicinity of the proposed works. This has included any tree where any part of the zones of protection, Tree Protection Zone (TPZ), and dripline encroach into or adjacent to the area proposed for work. Recommendations based on the tree significance and condition, together with the impact on these trees regarding the proposed development (based on the documents contained in Section 4.2) follow.

7.2 Demolition

Based on the drawings referenced in Section 4.4.2, the following trees are within a zone adjacent to the demolition. This includes any tree part that extends into the area of impact as illustrated on Drawing S0400 (B) by the blue dashed line where specific trees subject to impact are shaded with green hatching. This drawing is illustrated in Figure 1.

7.2.1 Trees within the zone of demolition

Trees No. 67-69, 78, 92 and 95

These trees are within the zone of conflict identified for proposed work and will require removal, that is, reduction to stump, which can allow clearance for the *20 tonne tracked machine*[17].

Trees and parts of adjacent to the zone of demolition

Trees No. 41, 43, 55, 56, 58, 65, 66, 70-72, 76, 77, 81, 84, 87-91, 94, 104, 112, 113, 121-131 and 136-138

These trees provide extension of the dripline (crown mass) into the zones adjacent to and within areas identified for proposed work. These trees will be subject to pruning and or tie back of branches to avoid conflict.

[17] Tonkin, 2021, Constructability Assessment, See Section 10.3

Figure 1; Proposed works in relation to impact on Mangroves, illustrated by the green hatching.
Source: Adapted from *Transport for NSW, Hydrographic Survey,* Drawing No: S0400(B), see Section 4.4.2

7.2.2 Work Methods and related conditions for tree protection

The following discussion refers to the demolition work based on the methodology described in the Constructability Assessment (Section 4.4.3). The assigned conditions apply to all trees; however, those trees identified in Section 7.2.1 will be most susceptible.

All structures are timber, as are the floors and jetty decking. No masonry structures are obvious. The structures appear poorly engineered and degraded, therefore unlikely to support machines. For this reason, large machinery is unlikely to be capable of use, and the predominant structures are considered to be capable of removal up to the footings by hand tools and small machines. The following conditions are required as part of the demolition.

1. No machine will be permitted to track across the bed in the TPZ.
2. All debris should be removed via land in preference to access via water. The use of barges is not supported due to nominated inefficiency within the Constructability Assessment, Section 10.1.
3. The Constructability Assessment, Section 10.2, refers to the use of Jack Up barges. Accounting for the potential size, must not enter the nominated TPZ.

Other structures, for example, the Floating Pontoon Shed, are likely able to be towed via a barge, pending the buoyancy available and water depth[18]. However, some impact can occur to exposed roots. Otherwise, they have the opportunity to be broken up on site and removed via land.

4. Removal of floating structures by towing shall be restricted to high tide and require flat bottom water craft. The process must avoid grounding in the area of the TPZ. The project arborist shall be notified for purpose of a potential assessment during works where any opportunity for grounding exists in the TPZ.

The Progressive Overwater Construction referred to in the Constructability Assessment; Section 10.3 poses the potential for tree impacts and predominately the area of the existing jetties and proposed jetties. The proposed machine, although *anticipated to be approximately 20 tonne tracked machine,* will be suspended on platform above the bed. Therefore, reducing impacts to the root system. The existing pathway offered by the jetties is nestled tightly between Mangroves where both stems and branches encroach. Although the replacement of these jetties, which are of similar width, allow for retention of these trees. The proposed approximate 20 tonne tracked machine offers potential dimensions that could significantly exceed the existing design width. The drawing S0400(B) includes a blue dashed line referred to as the *Extent of mangrove Impact* and is the distance required for machine clearance

[18] Tonkin, 2021, Constructability Assessment, See Section 8.1

including boom slew. The *Extent of mangrove Impact* over the werstern jetty is offset and allows for boom slew. Based on the limited height of the Mangroves, the boom is considered capable of slew over the top of the Mangroves; therefore impacts to the crown mass in the nominated zone is considered to be limited to the track width. The dimensions for the specific machine are unknown. Therefore an example of a track width for the nominated machine size has been used and 3000mm wide. Accounting for clearance either side of an additional 1000mm, the area of clearance required for calculations of tree impact is 4000mm. This will be the primary element that can offer additional impact to the trees. Based on the the methodology, the following conditions are required to mitigate impacts.

5. The proposed approximate 20 tonne tracked machine shall require a machine that poses limited width to avoid unnecessary pruning/removal of trees.

6. Trees that provide driplines that extend closely adjacent that are within 2m of the proposed machine/work will require to be tied back or braced to avoid conflict with branches. The tieback of branches must occur just before works occur and are released immediately after completion of works. This may require staged tiebacks of tree groups based on the stage of work. This is due to damage related to the long-term tie back of branches.

7. Within some circumstances, pruning may be required; however, it must not proceed without the project arborist on site. The pruning must proceed in accordance with Section 2.4. Pruning will need to be identified by the project arborist and include specific identification of branches. This shall include a pruning report that identifies the branch type, diameter, length, proportion of crown mass, and potential impact based on industry standards.

8. The nominated concrete filling of piles shall require measures that prevent overfill and spill. Measures including overflow trays must be included to prevent concrete spill into the bed (rhizosphere). A written mitigation strategy for the cleanup of concrete spills into the bed is required.

As part of the environmental control[19] is the installation of floating booms with silt curtains. Experience from past work illustrated the tidal movement to cause the silt curtains and floating booms to cause conflict and damage to pneumatophores. For this reason, measures for the placement of this control are considered.

9. The floating booms should be located outside of the TPZ so that tidal movement can remove the silt curtain from tangling with the pneumatophores.

10. The floating booms will require a routine assessment to ensure sufficient distance from obstructing trees and roots.

[19] Tonkin, 2021, Constructability Assessment, See Section 11.1

The demolition of the building and content will likely result in accidental debris fallout into the water and bed. This has been addressed in the Constructability Assessment, Section 11.3. To mitigate pollutants related to the demolition, the following conditions are required.

11. As part of the induction, all contractors must be instructed to avoid any debris from entering the bed or water as well as access to the bed where pneumatophores occur.

12. Catch scaffolds are required beneath all shed-type structures, and these shall extend outside the shed's footprint.

13. Extendable hand grab tools (reachers, grabbers), both pincer and magnetic type, must be available for contractors to use on each area of demolition to retrieve debris missed by the catch scaffold. Contractors should not enter the bed to avoid unnecessary damage to pneumatophores.

The removal of the piles addressed in Section 11.5 of the Constructability Assessment refers to the preference for complete removal by machine. Such methodology has already been included and will require any machine to avoid the bed. Although, based on the unknown viability for pile removal, the option for cutting piles is proposed at 300mm below the bed level. The method for which is not included. However, irrespective of the method employed will require excavation of the surrounding bed to an estimated 400mm and up to 500mm around the pile. Therefore, severance of surrounding pneumatophores, placing aside further injury to those surrounding the excavation required for the nominated cutting method. Accounting for the decrepit condition of many piles and, in particular, the decayed section between the bed and the high tide level, partial failure during the removal process is likely. Therefore, increasing the necessity for cutting and reducing the pile to the nominated level. For this reason, the following conditions are required to reduce impact on the bed and root system.

14. The requirement for cutting at 300mm below the bed height shall be reviewed, with the proposal to be cut at bed level.

15. Based on a necessity to cut below bed level, the options for cutting require to be reviewed and in discussion with the project arborist. The method employed will require the least impact on bed and root system.

In relation to the installation of new piling[20] and referral to an alternative method by use of a mini crawler crane to install FRP framing behind the pile installation. The following condition, which has been previously included, is required for this alternative method;

1. No machine will be permitted to track across the bed in the TPZ.

[20] Tonkin, 2021, Constructability Assessment, See Section 11.7

In relation to the installation of new floor framing[21] and referral to an alternative method by use of a mini crawler crane to install FRP framing behind the pile installation. The following condition which has been previously included, shall proceed this alternative method;

2. No machine will be permitted to track across the bed in any area consumed by the TPZ.

The installation of prefabricated wall and roof frames[22] for the outer building is referred for use by a crane located on a Jack Up barge. This method will refer to the following condition, which has been previously included.

3. The Constructability Assessment, Section 10.2, refers to the use of Jack Up barges. Accounting for the potential size, must not enter the nominated TPZ.

7.3 Construction

Based on the drawings referenced in Section 4.4.2, the following impacts are assigned to these trees during construction.

7.3.1 Trees directly conflicting with the design

Trees No. 141 and 142

These trees are located in the footprint of the proposed design and would require removal based on this premise alone. The conflict is summarised as the footprint of the proposed building (north eastern) and related jetty.

7.3.2 Trees subject to a major encroachment

Trees No. 41, 43, 67, 68, 69, 78, 92, 95, 112, 113, 121-126, 128-131 and 136-138

These trees are not directly located in the footprint of the proposed design, however, are located close and adjacent to the design footprint and subject to a *major encroachment*, that is, in excess of 10% of the TPZ. The type of encroachment for each tree is divided between the;

- Impact by proposed structure to the root zone.
- Impact by proposed structure to the crown mass

Each area is discussed relative to the work and available mitigation

Impact by proposed structure to the root zone (TPZ)

The design is not considered to impose an adverse impact on the root system (TPZ) for the majority of trees. That is, the number of piles relative to the location of the trees will not impact the vitality of most trees.

[21] Tonkin, 2021, Constructability Assessment, See Section 11.8

[22] Tonkin, 2021, Constructability Assessment, See Section 11.9

Although some trees (trees No. 67, 68, 69, 78, 92, and 95) have piles proposed within the SRZ and could offer some impact. The Australian Standard requires evidence to identify the extent of encroachment, although the viability for collating further evidence, for example, the exercise for root mapping, is considered to warrant additional impacts on the root system and therefore dismissed.

Based on the minor sector of impact imposed by a pile, the impacts are unlikely to be significant. Coupled with the grafted root zones, the support offered by adjacent trees is considered to provide sufficient remediation within circumstances that first-order roots are damaged. The sole opportunity for reducing such impact by design is reserved for relocation of the pile.

Impact by proposed structure to the crown mass

These trees provide an extension of the dripline (crown mass) into the zones adjacent to and within areas identified for proposed design. Some of these trees will require pruning and or tie back of branches to avoid conflict. A single tree (No. 78) resides flush with the western jetty and will require removal due to the excessive impact by both design and work method.

Stormwater

The outlet points for stormwater are proposed to be ducted into down pipes that are directed onto the walkways/jetties. The pipe exit will be elevated 300mm above the surface (fibre reinforced plastic) of the jetty which dampens and sufficiently disperses the flow through and over the jetty into the waterway, therefore preventing erosion. This method offers no tree impact.

7.4 Protection measures

Tree protection measures will be required during the demolition and construction stage. However, the design of these will be pending the work methodology and final design. The project arborist shall be contracted after the completion/confirmation of design work for the instruction of the protection measures implementation, that is, the Arboricultural Method Statement. Examples of the protection measures are contained in Appendix B.

8.0 Protection Specification

The retention and protection of these trees requires the remaining Tree Protection Zone (TPZ) not subject to encroachment to conform to the conditions outlined below. These conditions provide the limitations of work permitted within the area of the Tree Protection Zone (TPZ) and must be adhered to unless otherwise included in prior conditions.

A. No machine or person shall enter the bed within the TPZ. No pneumatophores shall be subject to foot traffic, machinery, material storage, or any other possible impact without prior consultation with the project arborist.

B. No pruning of any tree is to proceed without prior consultation with the project arborist. The opportunity for tying back/bracing branches will supersede pruning.

C. The bed grade within the TPZ must remain the same. Any excavation within the TPZ must have been previously specified and allowed for by the project arborist.

D. No form of material or structure, solid or liquid, is to be stored or disposed of within the TPZ.

E. No lighting of fires is permitted within the TPZ.

F. All drainage runoff, sediment, concrete, mortar slurry, paints, washings, toilet effluent, petroleum products, and any other toxic wastes must be prevented from entering the TPZ.

G. No activity that will cause excessive soil compaction is permitted within the TPZ. That is, machinery, excavators, etc. must refrain from entering the area of the TPZ unless measures have been taken, in consultation with the project arborist.

H. No site sheds, amenities or similar site structures are permitted to be located or extend into the area of the TPZ unless the project arborist provides prior consent.

I. No form of construction work or related activity such as the mixing of concrete, cutting, grinding, generator storage or cleaning of tools is permitted within the TPZ.

J. No part of any tree may be used as an anchorage point, nor should any noticeboard, telephone cable, rope, guy, framework, etc. be attached to any part of a tree.

K. All excavation work within the TPZ will utilise methods to preserve root systems intact and undamaged. Examples of methods permitted are by hand tools, hydraulic, or pneumatic air excavation technology.

- Any root unearthed which is less than 50mm in diameter must be cleanly cut and dusted with a fungicide, and not allowed to dry out, with minimum exposure to the air as possible.

- Any root unearthed which is greater than 50mm in diameter must be located regarding their directional spread and potential impact. A project arborist will be required to assess the situation and determine future action regarding retaining the tree in a healthy state.

9.0 Summary of tree impact by design

The proposed development consists of the demolition of existing site structures (sheds/jetties) and the construction of new buildings/sheds and walkways (jetties) for use as an oyster farm. The proposal is divided between the demolition of existing site structures and construction, and each task has been discussed separately.

The sole tree species included in this report is the remnant *Avicennia marina* subsp. *Australasica*. This is predominately rated as 'High' retention value, irrespective of tree condition, and based on the environmental significance and legislative protection assigned. Therefore, efforts to retain, protect and limit any impact, including pruning, have been deemed paramount.

The following impacts are imposed by design and work methods.

<u>Nominated tree removal</u>

Based on the proposed design and work methodology, the following trees will require removal based on conflict.
Trees No. 67, 68, 69, 78, 92, 95, 141 and 142

<u>Nominated pruning/branch tieback</u>

Based on the proposed design, the following trees are subject to a major encroachment although capable of retention by pruning and/or branch tieback.
Trees No. 41, 43, 55, 56, 58, 65, 66, 70-72, 76, 77, 81, 84, 87-91, 94, 104, 112, 113, 121-131 and 136-138

The following conditions are a requirement for the proposed work.

1. No machine will be permitted to track across the bed in the TPZ.
2. All debris should be removed via land in preference to access via water. The use of barges is not supported due to nominated inefficiency within the Constructability Assessment, Section 10.1.
3. The Constructability Assessment, Section 10.2, refers to the use of Jack Up barges. Accounting for the potential size, must not enter the nominated TPZ.
4. Removal of floating structures by towing shall be restricted to high tide and require flat bottom water craft. The process must avoid grounding in the area of the TPZ. The project arborist shall be notified for purpose of a potential assessment during works where any opportunity for grounding exists in the TPZ.

5. The proposed approximate 20 tonne tracked machine shall require a machine that poses limited width to avoid unnecessary pruning/removal of trees.

6. Trees that provide driplines that extend closely adjacent that is within 2m of the proposed machine/work will require to be tied back or braced to avoid conflict with branches. The tieback of branches must occur just before works occur and are released immediately after completion of works. This may require staged tiebacks of tree groups based on the stage of work. This is due to damage related to the long-term tie back of branches.

7. Within some circumstances, pruning may be required; however, it must not proceed without the project arborist on site. The pruning must proceed in accordance with Section 2.4. Pruning will need to be identified by the project arborist and include specific identification of branches. This shall include a pruning report that identifies the branch type, diameter, length, proportion of crown mass, and potential impact based on industry standards.

8. The nominated concrete filling of piles shall require measures that prevent overfill and spill. Measures including overflow trays must be included to prevent concrete spill into the bed (rhizosphere). A written mitigation strategy for the cleanup of concrete spills into the bed is required.

9. The floating booms should be located outside of the TPZ so that tidal movement can remove the silt curtain from tangling with the pneumatophores.

10. The floating booms will require a routine assessment to ensure sufficient distance from obstructing trees and roots.

11. As part of the induction, all contractors must be instructed to avoid any debris from entering the bed or water as well as access to the bed where pneumatophores occur.

12. Catch scaffolds are required beneath all shed-type structures, and these shall extend outside the footprint of the shed.

13. Extendable hand grab tools (reachers, grabbers), both pincer and magnetic type, must be available for contractors to use on each area of demolition to retrieve debris missed by the catch scaffold. Contractors should not enter the bed to avoid unnecessary damage to pneumatophores.

14. The removal of the piles poses a requirement for cutting at 300mm below the bed height. This shall be reviewed, with the proposal to be cut at bed level and without excavation.

15. Based on a necessity to cut below bed level, the options for cutting require to be reviewed and in discussion with the project arborist. The method employed will require the least impact to bed and root system.

16. The trees nominated for retention requires the remaining Tree Protection Zone (TPZ) not subject to encroachment to conform to the conditions outlined in Section 8.0, Protection specification, being A – K. These conditions provide the limitations of work permitted within the area of the Tree Protection Zone (TPZ) and must be adhered to unless otherwise included in prior conditions.

The opinions expressed in this report by the author have been provided within the capacity of a Consulting Arborist. Any further explanation or details can be provided by contacting the author.

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REGISTERED HORTICULTURIST 0032 AIH

10.0 Appendix A- Terminology Defined

Height
Is a measure of the vertical distance from the average ground level around the root crown to the top surface of the crown, and on palms - to the apical growth point.

DBH
Diameter at Breast Height – being the stem diameter in meters, measured at 1.4m from ground level, including the thickness of the bark.; Mult. refers to multiple stems, that is in excess of 4 stems.

Crown Spread
A two-dimension linear measurement (in metres) of the crown plan. The first figure is the north-south span, the second being the east-west measurement.

Age
Is the estimate of the specimen's age based upon the expected lifespan of the species. This is divided into three stages.

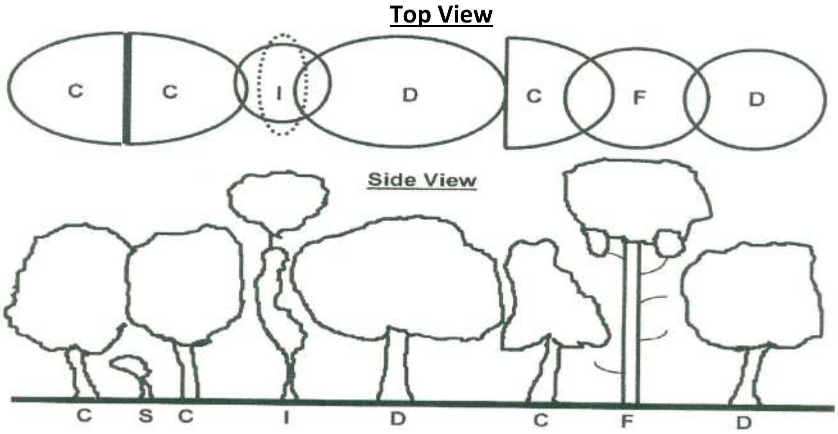
Young (Y)	Trees less than 20% of life expectancy.
Mature (M)	Trees aged between 20% to 80% life expectancy.
Over-mature (O)	Trees aged over 80% of life expectancy with probable symptoms of senescence.

Crown Aspect
In relation to the root crown, this refers to the aspect the majority of the crown resides in. This will be either termed Symmetrical (Sym.) where the centre of the crown resides over the root crown or the cardinal direction the centre of the crown is biased towards, being either North (N), South (S), East (E) or West (W).

Vitality Rating
Is a rating of the health of the tree, irrespective and independent of the structural integrity, and defined by the 'ability for a tree to sustain its life processes' ((Draper, Richards, 2009). This is divided between three variables, and based on the assessment of symptoms including, but not limited to; leaf size, colour, crown density, woundwood development, adaptive growth formation, and epicormic growth.
A: Normal vitality, typical for the species
B: Below average vitality, possibly temporary loss of health, partial symptoms.
C: Poor vitality; obvious decline, potentially irreversible

Crown Class
Is the differing crown habits as influenced by the external variables within the surrounding environment. They are:

D	– *Dominant*	Crown is receiving uninterrupted light from above and sides, also known as emergent.
C	– *Codominant*	Crown is receiving light from above and one side of the crown.
I	– *Intermediate*	Crown is receiving light from above but not the sides of the crown.
S	– *Suppressed*	Crown has been shadowed by the surrounding elements and receives no light from above or sides.
F	– *Forest*	Characterised by an erect, straight stem (usually excurrent) with little stem taper and virtually no branching over the majority of the stem except for the top of the tree which has a small concentrated branch structure making up the crown.



D C, I & S, and side view, after (Matheny, N. & Clark, J. R. 1998, Trees Development, Published by International Society of Arboriculture, P.O. Box 3129, Champaign IL 61826-3129 USA, p.20, adapted from the Hazard Tree Assessment Program, Recreation and Park Department, City of San Francisco, California).

Levels of assessment

Level 1: Limited visual: a visual tree assessment to manage large populations of trees within a limited period and in order to identify obvious faults which would be considered imminent.

Level 2: Basic assessment: a standard performed assessment providing for a detailed visual assessment including all parts of the tree and surrounding environment and via the use of simple tools.

Level 3: Advanced assessment: specific type assessments conducted by either arborist who specialise with specific areas of assessment or via the use of specialised equipment. For example, aerial assessment by use of an EWP or rope/harness, or decay detection equipment.

TPZ; Tree Protection Zone

Is an area of protection required for maintaining the trees vitality and long-term viability. Measured in meters as a radius from the trees centre. The requirements of this zone are outlined within the Protection Specification, Section 8.0, and are to be adhered to unless otherwise stated.

The size of the Tree Protection Zone (TPZ) has been calculated from the *Australian Standard, 4970; 2009* – Protection of Trees on Development Sites

The TPZ does not provide the limit of root extension, however, offers an area of the root zone that requires predominate protection from development works. The allocated TPZ can be modified by some circumstances; however will require compensation equivalent to the area loss, elsewhere and adjacent to the TPZ.

SRZ; Structural Root Zone

Is the area around the tree containing the woody roots necessary for stability. Measured in meters as a radius from the trees centre. The requirements of this zone are outlined within the Protection Specification, Section 8.0, and are to be adhered to unless otherwise stated.

Protection Measures

These are required for the protection of trees during demolition/construction activities.

Protective barriers are required to be installed before the initiation of demolition and/or construction and are to be maintained up to the time of landscaping. Samples of the recommended protection measures are illustrated in Appendix B.

All other definitions are referenced from;

Draper D.B., Richards P.A., 2009, Dictionary for Managing Trees in Urban Environments
CSIRO Pub., Australia

Significance Rating, Significance of a Tree Assessment Rating System (S.T.A.R.S), IACA, 2010[23]

Tree Significance – Assessment Criteria

1. High Significance in landscape

- The tree is in good condition and good vitality;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions.

2. Medium Significance in landscape

- The tree is in fair-good condition and good or low vitality;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ.

3. Low Significance in landscape

- The tree is in fair-poor condition and good or low vitality;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the

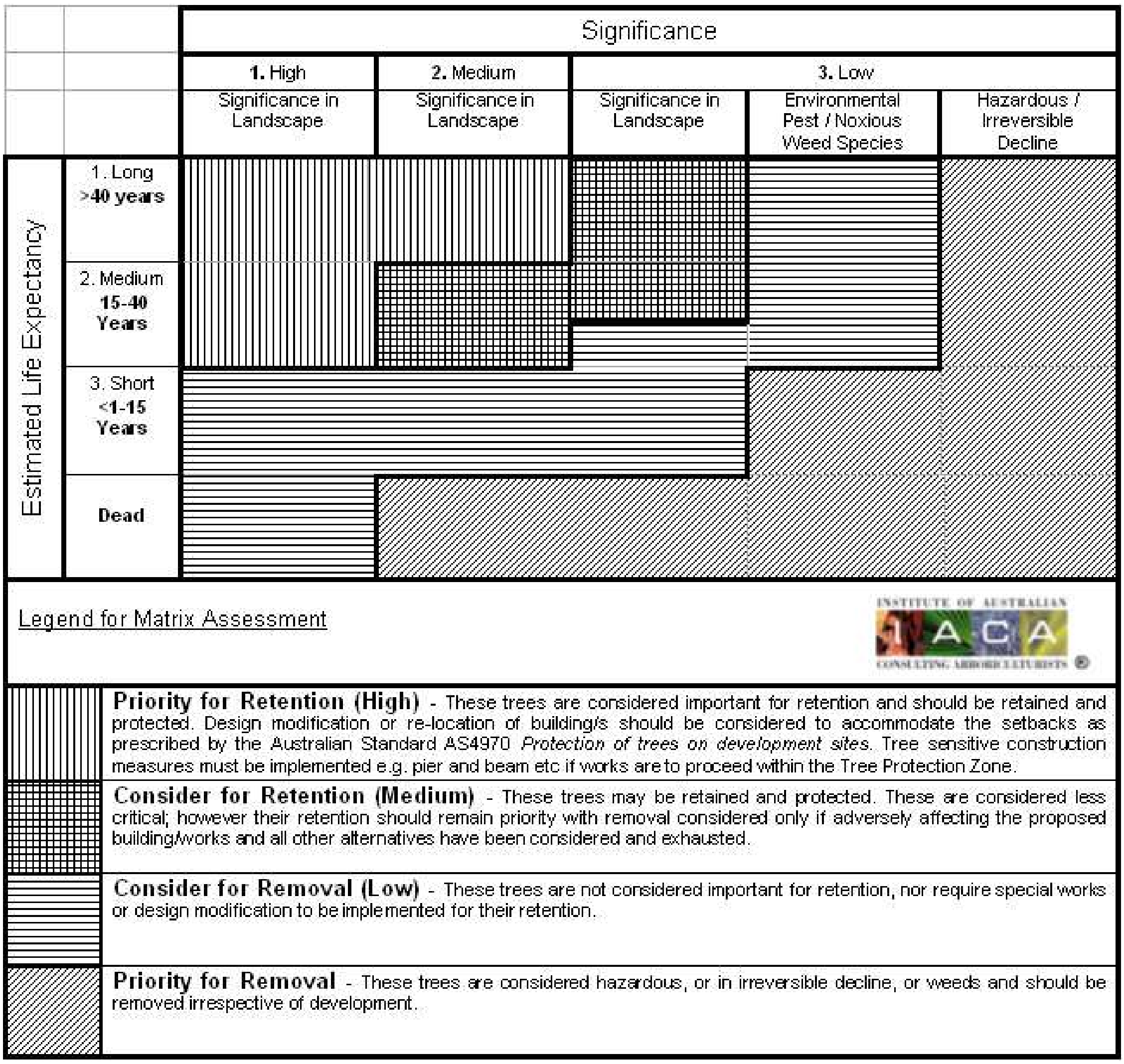
[23] IACA, 2010, IACA Significance of a Tree, Assessment Rating System (STARS), Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.
Environmental Pest / Noxious Weed Species
- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.
Hazardous/Irreversible Decline
- The tree is structurally unsound and/or unstable and is considered potentially dangerous, - The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short-term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g.

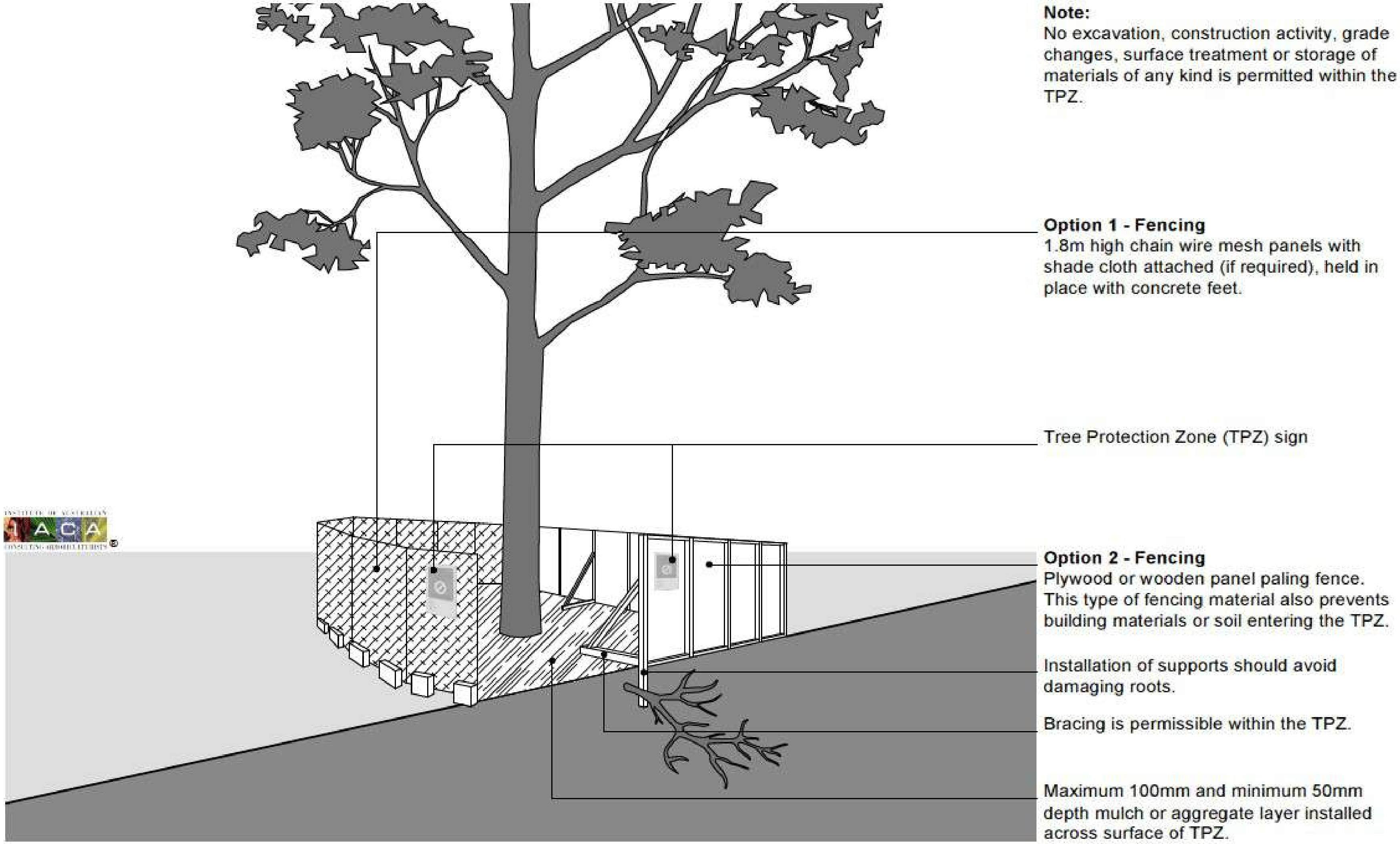
Table 3; Tree Retention Value – Priority Matrix.



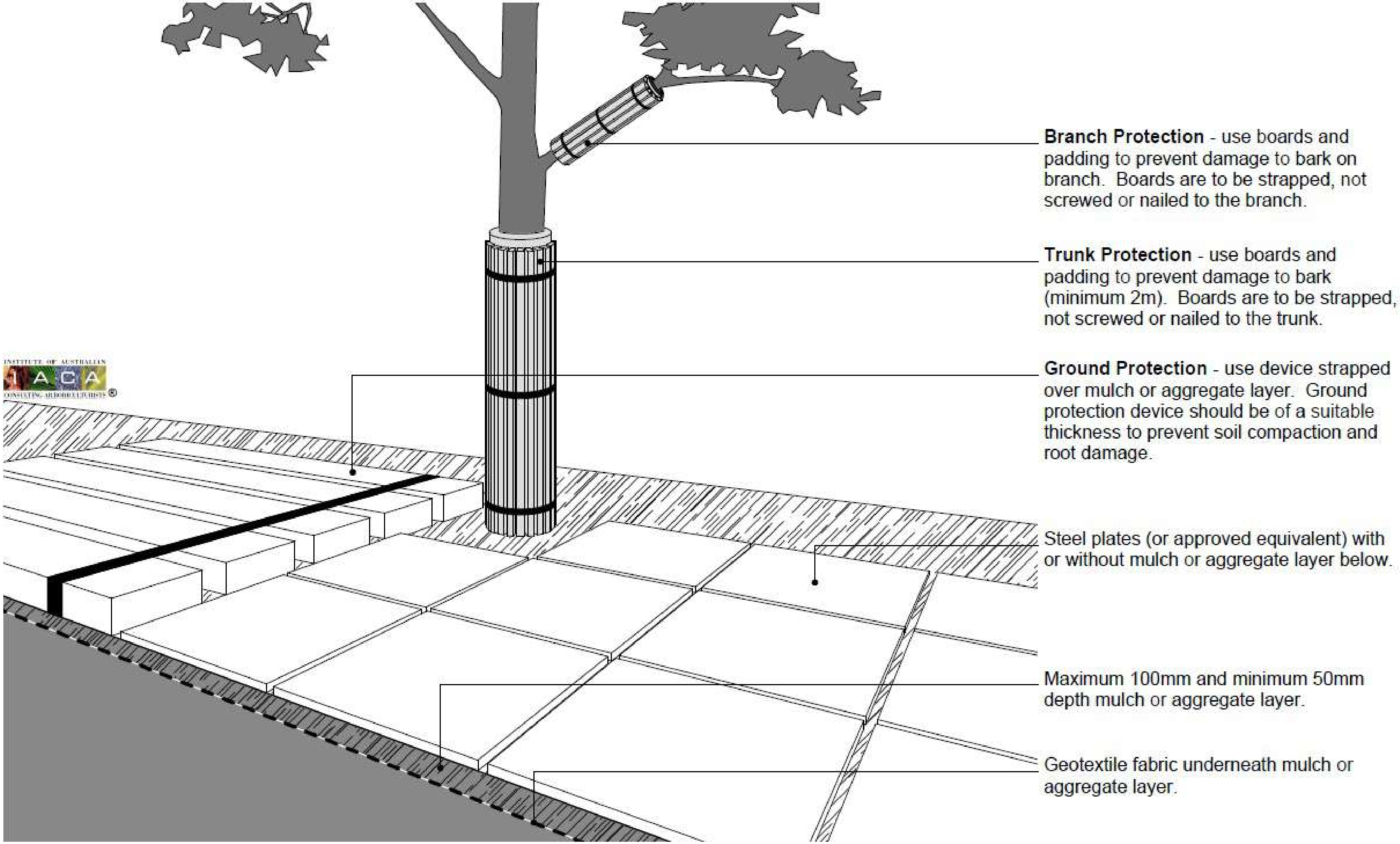
Safe Useful Life Expectancy – S.U.L.E (Barell 1995)

	1. Long	2. Medium	3. Short	4. Removal	5. Moved or Replaced
	Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 15 – 40 years with an acceptable level of risk.	Trees that appeared to be retainable at the time of assessment for 5 – 15 years with an acceptable level of risk.	Trees that should be removed within the next 5 years.	Trees which can be reliably moved or replaced.
A	Structurally sound trees located in positions that can accommodate future growth.	Trees that may only live between 15 and 40 years.	Trees that may only live between 5 and 15 more years.	Dead, dying, suppressed or declining trees through disease or inhospitable conditions.	Small trees less than 5m in height.
B	Trees that could be made suitable for retention in the long term by remedial tree care.	Trees that may live for more than 40 years but would be removed for safety or nuisance reasons.	Trees that may live for more than 15 years but would be removed for safety or nuisance reasons.	Dangerous trees through instability on recent loss of adjacent trees.	Young trees less than 15 years old but over 5m in heights
C	Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.	Trees that may live for more than 40 years but would be removed to prevent interference with more suitable individuals or to provide space for new planting.	Trees that may live for more than 15 years but should be removed to prevent interference with more suitable individuals or to provide space for new planting.	Damaged trees through structural defects including cavities, decay, included bark, wounds or poor form.	Trees that have been pruned to artificially control growth.
D		Trees that could be made suitable for retention in the medium term by remedial tree care.	Trees that require substantial remedial tree care and are only suitable for retention in the short term.	Damaged trees that are clearly not safe to retain.	
E				Trees that may live for more than 5 years but should be removed to prevent interference with more suitable individuals or to provide space for new plantings.	
F				Trees that are damaging or may cause damage to existing structures within 5 years.	
G				Trees that will become dangerous after removal of other trees for reasons given in (A) to (F).	

Appendix B- Protection measures; Protective fence



Stem and Ground protection



Appendix F

Constructability Assessment (70% design)

Constructability Assessment

Woolooware Bay Oyster Lease Overwater and Floating Structures

Transport for NSW

12 November 2021
Issue No: 0
Status: Final
Ref: 202079

tonkin

Building exceptional outcomes together

Document History and Status

Issue No	Status	Date	Prepared By	Approved by	
				Name	Signature
A	Draft	15/10/2021	M Baker		
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Appendices

Appendix A: Drawings

S0100 Rev B	Existing Site Plan
S0200 Rev B	Demolition Plan
S0310 Rev B	Construction Staging Plan - Stage 1
S0320 Rev B	Construction Staging Plan - Stage 2
S0350 Rev A	Construction Sequence Plan
S0400 Rev B	Flora Impact Plan
S1000 Rev B	Overwater Structure Site Plan
S1010 Rev B	Floor Framing Plan - Building 1
S1020 Rev B	Floor Framing Plan - Building 2
S1030 Rev B	Floor Framing Plan - Building 3
S1031 Rev A	Floor Framing Plan - Building 3 Pontoons and Gangway
S1110 Rev B	Roof Framing Plan - Building 1
S1120 Rev B	Roof Framing Plan - Building 2
S1130 Rev B	Roof Framing Plan - Building 3
S1310 Rev A	Floating Structure Elevations and Details

Appendix B: Construction Equipment

1 Introduction

This report has been prepared at the request of Transport for NSW to provide constructability advice on the proposed replacement of all overwater and floating structures at the Woolooware Bay Oyster Lease located at the southern shore of Woolooware Bay off Captain Cook Drive, Woolooware.

This report is intended to assist the project approval via a Review of Environmental Factors. It is also intended to inform the future construction should the project be approved.

2 Limitations

The design is currently at preliminary stage. Structural framing and details are yet to be fully resolved.

This assessment should be considered as preliminary only. The construction contractor will be required to finalise the plan to suit their proposed equipment, methods and staging.

3 Assessment Method

This assessment has been prepared based on:

1. Several site visits previously undertaken by the author, including detailed reviews in 2017,
2. Preliminary general discussions with one experienced maritime contractor,
3. Discussions with Transport for NSW, and
4. Tonkin's previous project experience.

The assessment was based on ensuring that the works must be constructible having regard for the identified constraints, using readily available materials, and using the plant, equipment and expertise expected to be available to the construction contractors likely to be engaged for the project.

4 Inputs

The following inputs were available for the preparation of this report:

1. Hydrographic Survey 717-024/01 dated March 2021 prepared by Transport for NSW
2. Detail Survey 20571 dated August 2021 prepared by C.M.S. Surveyors Pty Limited
3. Architectural Drawings dated November 2021 prepared by Paterson Design Studio
4. Geotechnical Report 31381ZRrpt dated April 2018 prepared by JK Geotechnics
5. Geotechnical Report 31381RRrpt2 dated October 2019 prepared by JK Geotechnics
6. Seawall Plans and Details Drawings 2017-17 S.00, S.01, S.02. S.03, S.04, S.05, S.06, S.07, S.08, S.09, S.10, S.11, S.12 and S.13 Revision E dated April 2019 prepared by Australian Ports and Marinas
7. Condition Report – Overwater Structures and Seawalls Ref 17168 Issue 2 dated September 2017 prepared by Taylor Lauder Bersten Pty Ltd (now Tonkin)

5 Project Scope

Refer to drawings S0100, S0200 and S1000 in Appendix A.

The project scope includes:

1. Demolition and disposal of all existing overwater structures including support piles
2. Demolition and disposal of all existing floating structures, including restraint piles and gangways
3. Construction of new overwater structures with a design life of 50 years
4. Construction of new floating structures and gangways with a design life of 25 years

The new facilities are intended to be leased to oyster farmers for their operational use. Some areas may be set aside for industry research use.

The project does not include the new seawalls as these have already been constructed as part of landside remediation works.

6 Existing Structures

Refer to drawing S0100 in Appendix A.

6.1 Overwater Structures

The existing overwater structures consist of:

- driven timber piles, timber posts and timber stumps,
- timber floor framing,
- timber flooring,
- timber decking,
- timber wall framing,
- corrugated metal and other light timber wall cladding, and
- timber roof framing with some structural steel elements and corrugated metal roof cladding.

All existing overwater structures are in poor condition.

6.2 Floating Structures

The existing floating structures consist of:

- proprietary type concrete pontoons,
- steel pontoons,
- timber restraint piles, and
- various types of hinged access gangways.

7 Proposed Structures

Refer to drawings S1000, S1010, S1020, S1030, S1110, S1120 and S1130 in Appendix A.

7.1 Overwater Structures

The new overwater structures are proposed to consist of:

- driven steel circular piles with HDPE sleeves for corrosion protection,
- concrete fill to the tops of the piles (down to bed level) to facilitate connection to the structure over,
- fibre reinforced plastic (FRP) floor framing (bearers and joists) spanning between the piles,
- FRP mesh as external decking,
- FRP solid top mesh panels as internal flooring,
- timber wall framing (possibly with some structural steel elements) with light weight cladding, and
- timber roof framing (with some structural steel elements) with metal and polycarbonate roof sheeting.

The wall and roof framing may be supplied to site as prefabricated wall panels and roof trusses similar to normal domestic type construction.

Services to the overwater structures will be provided from land and will include:

- Water (including wet fire systems)
- Power
- Communications
- Sewer
- Trade waste

While most product cleaning will be required to take place on the water, the trade waste system will be designed to capture waste from final cleaning operations undertaken within the over water buildings. The waste will be filtered. Trapped solid waste will be moved by hand or small equipment onto land for appropriate disposal. Liquid waste will be discharged to the sewer system as trade waste using pumps and rising mains.

Building services will either be run under the floor/deck structure, or at high level through roof spaces.

7.2 Floating Structures

Refer to drawings S1020, S1030, S1031 and S1310 in Appendix A.

The new floating structures are proposed to consist of:

- proprietary pontoons with HDPE floats, aluminium framing, and FRP mesh decking,
- driven steel circular restraint piles with HDPE sleeves for corrosion protection, and
- aluminium framed hinged gangways with FRP mesh decking.

The floating pontoons will include proprietary services bollards with a light, water and power. Supply services will be run on the underside of the gangway and within services ducts in the pontoons in the usual way for marinas.

8 Constraints

8.1 Water Depth

There is limited water depth at the site (refer to drawing S0200 in Appendix A). There is also limited water depth for quite some distance out from the shore. We have no detailed hydrographic survey information for Woolooware Bay beyond the site. However, online nautical charts show that 0.7m water depth at low tide is not achieved until 1.2km from shore, and 2m of water depth at low tide is not achieved until 1.4km out from shore.

Over the footprint of the existing and new buildings and walkways, bed levels generally vary from approximately +0.25 to -0.40 AHD. Tide heights vary from +0.925 to -1.175AHD. Therefore, the bed starts to become exposed above mid tide level and is completely exposed at most low tides.

Over the footprint of the existing and new floating structures, bed levels generally vary from approximately 0.00 to -0.65 AHD. Therefore, they will sit on the bed at mid tide level and below.

8.2 Environmental

The site is environmentally sensitive and is a declared marine park. There are dense mangrove stands surrounding and abutting the site.

Tracking of equipment across the bed and regular grounding of floating construction barges and vessels at low tides are not considered acceptable due to environmental concerns.

8.3 Geotechnical

The geotechnical reports have included the drilling of 10 bores in the landside part of the site. No geotechnical investigations have yet been undertaken on the overwater part of the site. It is anticipated that the landside boreholes provide a good indication of what the soil profile will be below the bed.

The boreholes show layers of peat, clayey silt, sandy silt, sandy clay, clayey sand, silty clay, silty sand, clay, and gravelly sand over weathered sandstone bedrock. The bedrock level generally falls to the north.

For the extent of the overwater structures the bedrock level is expected to vary from 10m below the bed to 13m below the bed.

Preliminary assessment of pile loads against the geotechnical soil profile indicates that piles will need to be driven to and socketed a small distance into the weathered sandstone bedrock.

8.4 Current occupants

Several of the existing overwater buildings and floating structures at the northern end of the site are currently occupied by an oyster farmer. Staged demolition and construction would need to be used to allow this farmer continuous occupation.

8.5 Condition of Structures

The existing overwater structures are generally in poor condition. They do not have the capacity to support heavy demolition and construction equipment. It is anticipated that light equipment such as elevated work platforms and small crawler cranes can be used to assist with demolition.

9 Opportunities

9.1 Land side access

The landside part of the site has recently been remediated. A new seawall has been installed and new compacted fill and surface finishes have been placed. The site falls to the seawalls where grated stormwater inlet pits have been installed which discharge through the seawall. The site is currently served with water, power and sewer.

There is good access to the landside part of the site from Captain Cook Drive. This provides a large and currently vacant area which can be utilised to facilitate the demolition and construction of the overwater and floating structures.

9.2 Neighbours

There are no neighbouring sites that will be adversely impacted by the noise or traffic of the demolition and construction activities.

10 Available Construction Equipment and Methods

10.1 Floating Barges

The use of floating maritime barges will be constrained by the lack of water depth for much of the time. Floating barges would either ground on the bed at anything other than high tide, or if this was not acceptable, would need to be removed a long distance to deeper water as the tide recedes and be brought back to site as the tide rises. While this may be workable for occasional use, it would be quite inefficient for daily construction use.

10.2 Jack Up Barges

The use of jack up barges would be feasible. They can be delivered from land by truck or can be towed into place via water. Delivery set up and removal of the barges would be constrained to high tides. Small barges with limited load capacity are available with a shallow draft of 250mm. Larger barges with suitable capacities of up to 80 tonnes have a deeper draft of approximately 800mm. They could be towed into place around the outer perimeter of the site at suitably high tides. Once jacked up, they could remain in place for all tides and so be available for construction activities all the time.

The specification sheet for a suitable jack up barge is included in Appendix B.

10.3 Progressive Overwater Construction

This technique involves progressively installing piles and floor structure starting from the land and progressing out over the water. The piling equipment is supported on the completed piles and reaches out to install the next row of piles. The tops of the piles could be concrete filled by the piling equipment using concrete kibble buckets or a concrete pumping line. Alternatively, the tops of the piles could be concrete filled by following equipment.

Using this method minimises the need for barges.

Progressive demolition of structures could also be part of this process. Demolition of the next section would precede installation of the next row of piles.

For lightly loaded structures such as those proposed for this site, the loads imposed by the piling equipment can govern the design of the piles and the substructure framing. Therefore, the piling equipment needs to be carefully selected to be as light as possible but still capable of doing the required work. We anticipate that an approximately 20 tonne tracked machine will be suitable for this project. Equipment of this size is expected to be able to reach forward 5-6m to install the next piles out.

The piles are proposed to be steel driven to rock and so will readily have the capacity required to support this equipment.

The deck framing is proposed to be FRP and so is unlikely to have the capacity to support this equipment. Therefore, it will be necessary to use fabricated structural steel equipment platforms to span between 4 piles and support the machine. Several platforms will be needed to allow them to be leapfrogged forward as work progresses. Leapfrogging of the frames will require slewing or swinging action of the equipment. Regular pile grids will limit the number of different equipment platforms needed.

Referring to drawing S0400 in Appendix A, for most of the site this procedure will have no or minimal effect on the mangroves. However, some impact will occur when working is progressing on the western boardwalk. Tying back and trimming of branches are likely to be required.

Construction of the final FRP deck structure can then be undertaken by lighter following equipment such as a Maeda Crawler Crane and small scissor lifts. A specification sheet for a suitable crawler crane is included in Appendix B.

10.4 Land Based Equipment

Large cranes and piling equipment can operate from the landside of the site. They will need to be set back inside the seawall so that they do not exert lateral pressures on the seawalls for which they were not designed.

10.5 Small Work Boats

Small work boats and manual handling could be used at suitable tides to assist construction work.

11 Anticipated Demolition and Construction Method

It is anticipated that the following demolition and construction method will be used, and it is considered to be feasible. Refer to drawings S0310, S0320 and S0350 in Appendix A.

11.1 Environmental Controls

Floating booms with silt curtains will be installed around the work area. Filters will be installed around the landside stormwater inlet pits.

11.2 Internal Strip Out

Internal strip out will be undertaken manually with the assistance of small access equipment. This will include capping off and removal of services, removal of furniture and furnishings, removal of stored material, and removal of tanks and equipment. Demolished material will be removed to the land manually or by using small trolleys, and then correctly disposed of.

11.3 Building Superstructure Demolition

Many of the building superstructures are reasonably small and are of light weight construction. It is anticipated that demolition of the superstructures not close to land will be undertaken by installing catch scaffolds within the buildings and using a staged manual process. Demolition waste will be removed to the land manually or by using small trolleys, and then correctly disposed of. Alternatively, it could be removed to barges at suitable tides.

For the building superstructures close to land, we anticipate that land-based equipment will undertake or assist demolition. Structures will need to be internally braced and propped, then manually cut into suitably small segments to allow controlled removal by crane or excavator directly to a stockpile on land ready for correct disposal.

11.4 Floor Structure Demolition

The timber floor boards and decking can be sawn into manageable lengths, be manually pried from the supporting joists, and then removed to the land manually or by using small trolleys, and then correctly disposed of.

As the timber bearers and joists are heavier, we anticipate that they will be progressively removed as part of the over water construction of the new structures. Where the new structures are not being built over the existing structure locations, temporary piles will need to be installed so that the equipment used can get sufficiently close to the structures to be demolished. These temporary piles can then be removed as the equipment moves back to the new building area.

For the structures close to land, land-based equipment will undertake or assist demolition of the bearers and joists. They will need to be progressively cut and manually disconnected from the supporting piles to allow controlled removal by crane or excavator directly to a stockpile on land ready for correct disposal.

11.5 Pile Removal

It is preferable if all piles are completely withdrawn from the bed. They will then not be a navigation hazard and will not be an impediment to driving the new piles. The embedment of the existing piles is not known. The deeper the embedment, the harder it will be to remove them. The condition of the piles is also variable, with some in very poor condition. Where piles cannot be withdrawn because the load to withdraw is found to be too high, or because of their condition, they should be cut off approximately 300mm below bed level and their location should be clearly identified on as built drawings.

Where piles are close to land, pile removal should be done using land-based equipment.

Where piles are too far out from land, they should be progressively removed as part of the overwater construction of the new structures. Where the new structures are not being built over the existing structure locations, temporary piles will need to be installed so that the equipment used can get sufficiently close to the piles to be able to withdraw them. These temporary piles can then be removed as the equipment moves back to the new building area.

11.6 Floating Structure Removal

The floating structures should be disconnected and towed to a nearby boat ramp or slipway where they can be lifted out of the water by crane and be suitably disposed of. The hinged gangways could be removed with them at the same time. The tide will need to be sufficiently high for the pontoons to be floating for this operation.

The floating structure restraint piles are remote from land and the buildings and so will need to be removed using suitable equipment on a jack up barge.

11.7 New Piling

Where piles are sufficiently close to land, they should be installed using land-based equipment. Piles that are further out will need to be installed using the progressive overwater construction technique described above.

11.8 New Floor Framing

Installation of the new floor framing will follow the progressive over water installation of the piles. Once the temporary equipment platforms have been moved forward, the same equipment could lift the FRP floor framing into place as individual elements. Alternatively, a mini crawler crane could be used to progressively install the FRP framing and decking at some distance behind the piling installation, which would minimise clashes and delays.

11.9 New Superstructures

As previously noted, it is anticipated that the wall and roof frames will come to site as prefabricated panels. There will also be some structural steel elements. Manhandling of these elements into place will not be feasible. Cranes large enough to hold and install the frames will be too heavy to be supported on the new flooring. Therefore, erection of the wall and roof framing would be undertaken using a land-based crane, and for the buildings further out, a crane on a jack up barge.

Roof sheeting bundles would be lifted into place by the same cranes.

Wall cladding, doors and windows would be installed manually and painted from scaffolding external to the buildings. Where there is no deck area outside a building wall, temporary platforms cantilevering out from the underside of the floor framing will be installed to support scaffolding.

11.10 Staged Construction

Some of the existing overwater and floating structures at the northern end of the site are currently occupied by an oyster farmer. Staged demolition and construction would need to be used to allow this farmer continuous occupation. Refer to drawings S0310 and S0320 in Appendix A. The proposed staging would be:

11.10.1 Stage 1

- Installation of environmental controls around Stage 1.
- Demolition of the eastern overwater structures and construction of the new structures in a progressive manner as outlined above. The western part of the new northern building would be commenced so that the equipment could be temporarily located there ready for Stage 2. Alternatively, the equipment could be removed using a crane and jack up barge to await the commencement of Stage 2 if this might be delayed.
- Removal of the existing eastern floating structures and installation of the new pontoons and piles.
- Clean up and commissioning of Stage 1, and removal of environmental controls.
- The farmer moves into the new overwater and floating structures.

11.10.2 Stage 2

- Installation of environmental controls around Stage 2.
- Demolition of the western overwater structures and construction of the new structures in a progressive manner.
- Progressive demolition and reconstruction of the western overwater walkway, which will return the construction equipment to land at the north western corner of the seawall.
- Removal of the existing eastern floating structures and installation of the new pontoons and piles
- Clean up and commissioning of Stage 2, and removal of environmental controls.

11.11 New Services

The construction and commissioning of all services can be staged to suit the staged construction requirements.

12 Conclusion

This assessment has shown that the scope of demolition and construction works can be undertaken with regard to the specific constraints of limited water depth and protection of the environmentally sensitive site.

The construction contractor will need to refine this plan to suit their operations and equipment, but without having a greater impact on the environment.

Appendix A – Drawings

SCALE 1 : 400

EXISTING SITE PLAN

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APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
EXISTING SITE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
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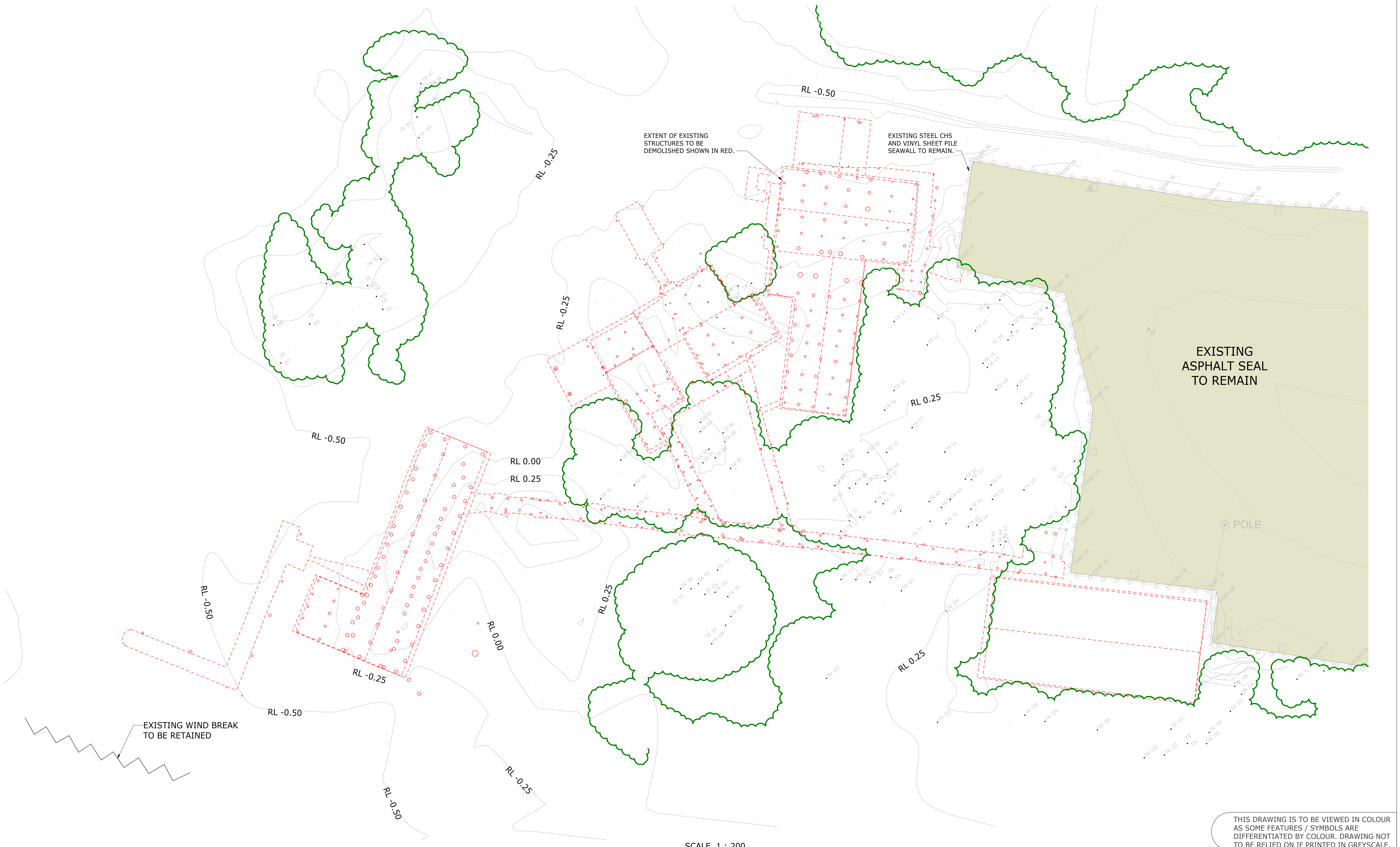

SCALE 1 : 200
DEMOLITION PLAN

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
DEMOLITION PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
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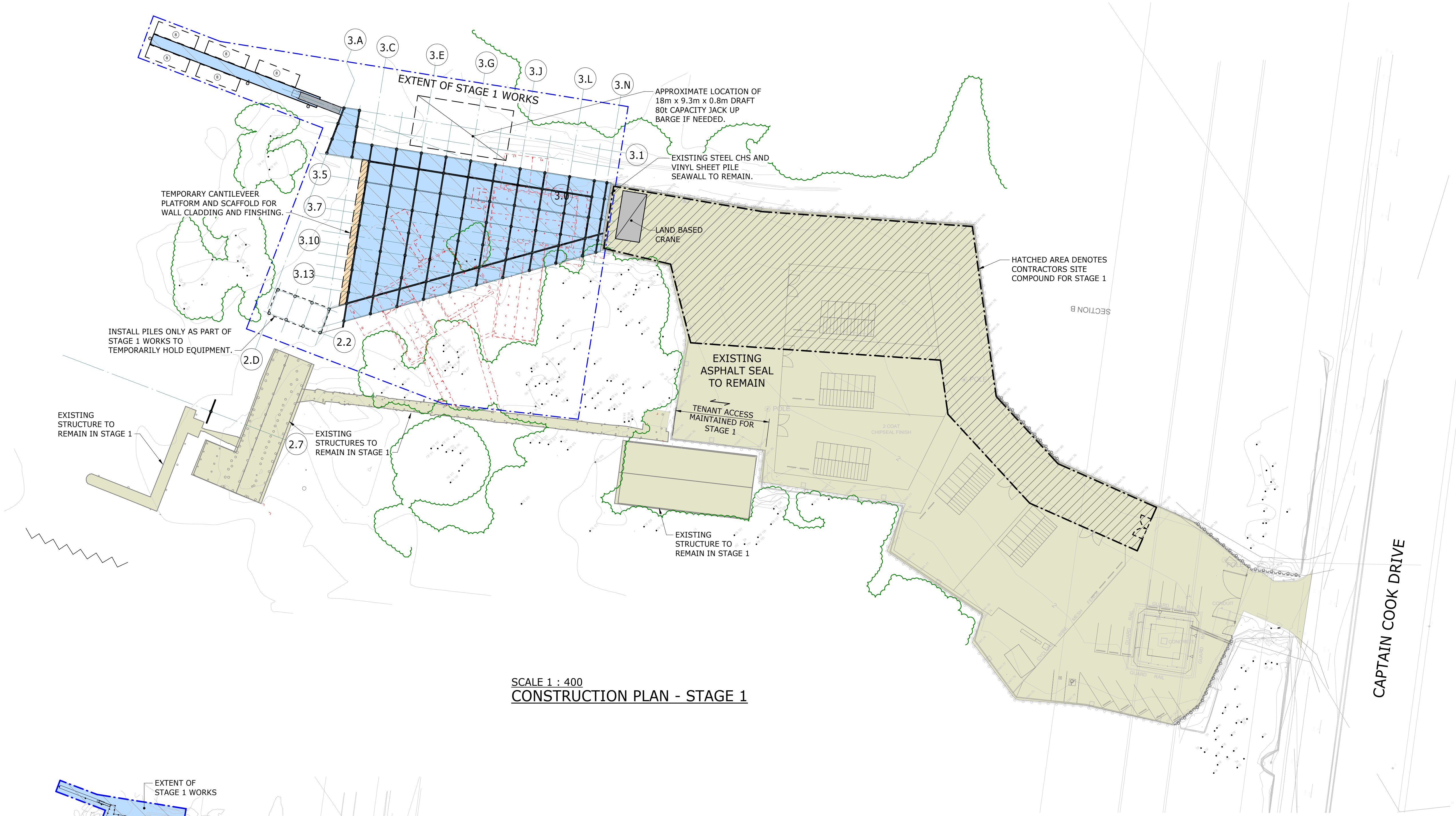

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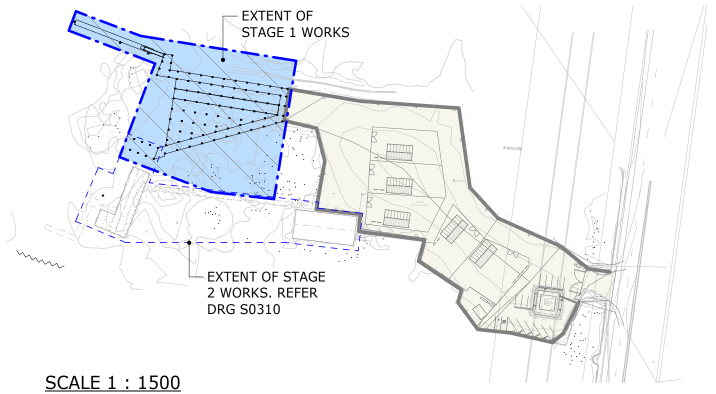
CONSTRUCTION PLAN - STAGE 1



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CONSTRUCTION STAGING KEY PLAN STAGE 1

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WOOLOOWARE BAY OYSTER LEASE
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CONSTRUCTION STAGING PLAN - STAGE 1

PROJECT NUMBER	SHEET NUMBER	REVISION
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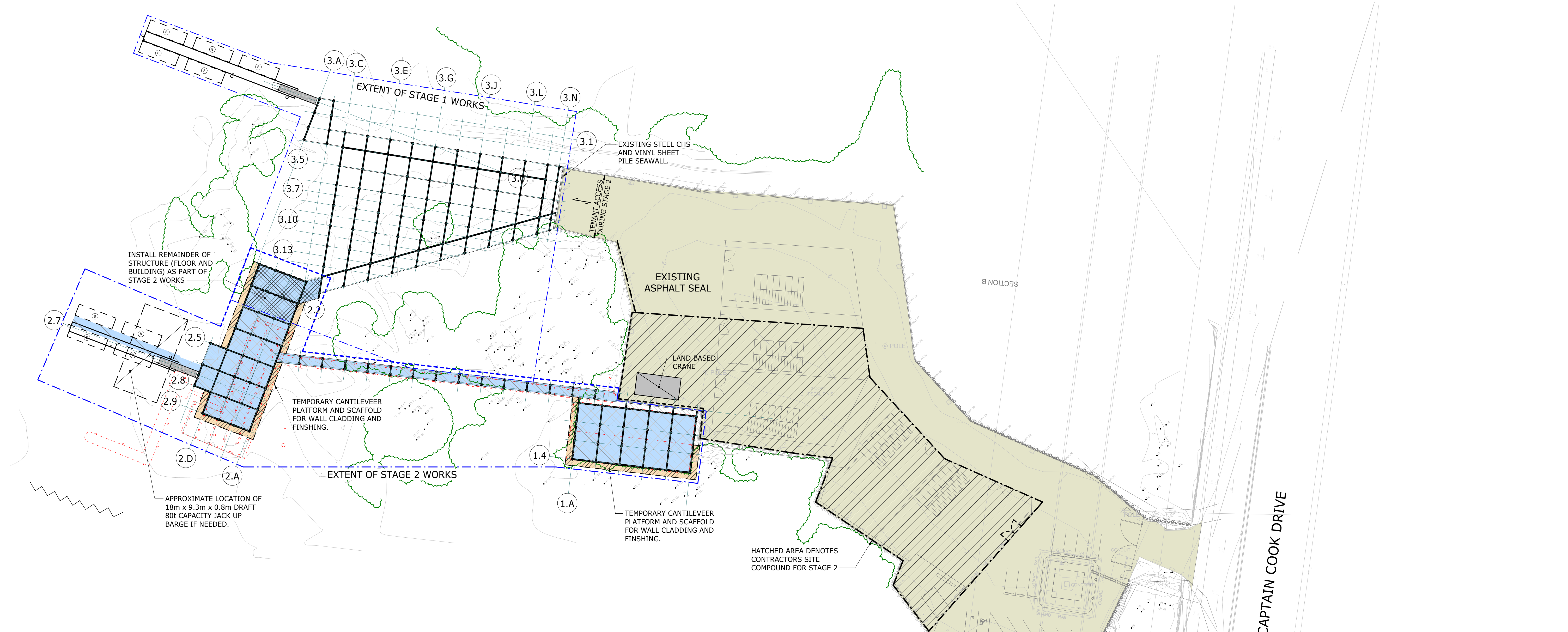

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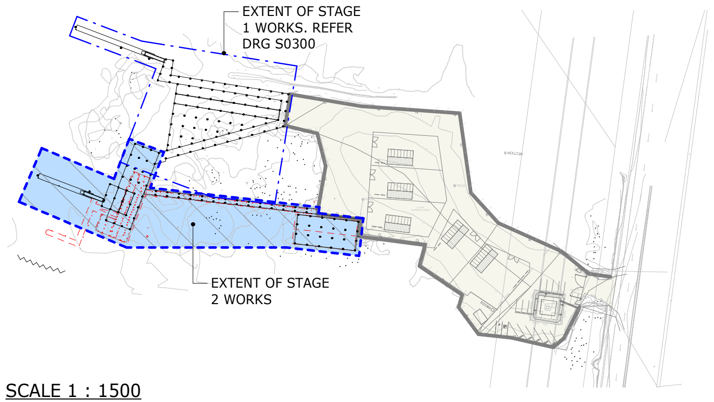
CONSTRUCTION PLAN - STAGE 2



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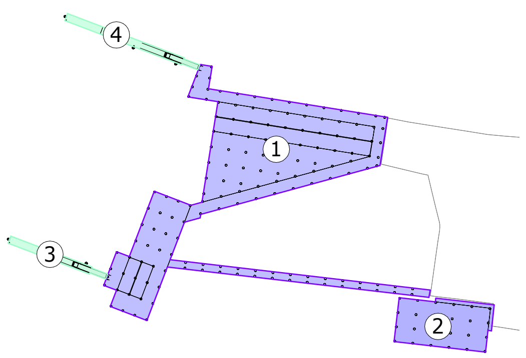
CONSTRUCTION STAGING KEY PLAN STAGE 2



SCALE 1 : 1000
DEVELOPMENT AREAS

DEVELOPMENT AREAS	
AREA No.	AREA
1	1613 m²
2	306 m²
TOTAL AREA OF NEW OVERWATER FIXED STRUCTURES - STAGE 1 & STAGE 2	1920 m²
3	52 m²
4	72 m²
TOTAL AREA OF NEW FLOATING STRUCTURES & GANGWAYS - STAGE 1 & STAGE 2	125 m²

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WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
CONSTRUCTION STAGING PLAN - STAGE 2

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CONSTRUCTION SEQUENCE - SUBSTRUCTURE DEMOLITION AND PILING

STAGE 1

1. INSTALL STEEL CHS PILES AT 3.4/3.N & 3.5/3.N FROM LAND
2. INSTALL HDPE SLEEVES OVER PILES AT 3.4/3.N & 3.5/3.N
3. INSTALL PILING MAT SPANNING FROM LAND TO PILES ON GRID 3.N
4. POSITION RIG ON PILING MAT
5. DEMOLISH FLOOR STRUCTURE AND REMOVE PILES AHEAD
6. INSTALL STEEL CHS PILES AT 3.4/3.M & 3.5/3.M
7. INSTALL HDPE SLEEVES OVER PILES AT 3.4/3.M & 3.5/3.M
8. WITHDRAW RIG TO LAND AND MOVE PILING MAT OUT SO IT SPANS FROM LAND TO PILES ON GRID 3.M
9. POSITION RIG AT PILING MAT
10. DEMOLISH FLOOR STRUCTURE & PILES AHEAD.
11. INSTALL STEEL CHS PILES AT 3.4/3.L & 3.5/3.L
12. INSTALL HDPE SLEEVES OVER PILES AT 3.4/3.L & 3.5/3.L
13. INSTALL SECOND PILING MAT SPANNING FROM PILES ON GRID 3.M TO PILES ON GRID 3.L
14. MOVE RIG FORWARD

REPEAT STEPS 10-14

MOVE SIDEWAYS IN A SIMILAR FASHION. INTRODUCE NEW PILING MATS TO SUIT GEOMETRY AS NEEDED. ON COMPLETION OF STAGE 1, PARK RIG ON EASTERN PILES OF BUILDING 2. ALTERNATIVELY, LIFT RIG OFF USING JACK UP BARGE.

STAGE 2

SIMILAR TO STAGE 1. WORK BACK TO LAND OR OUT FROM SEAWALL.

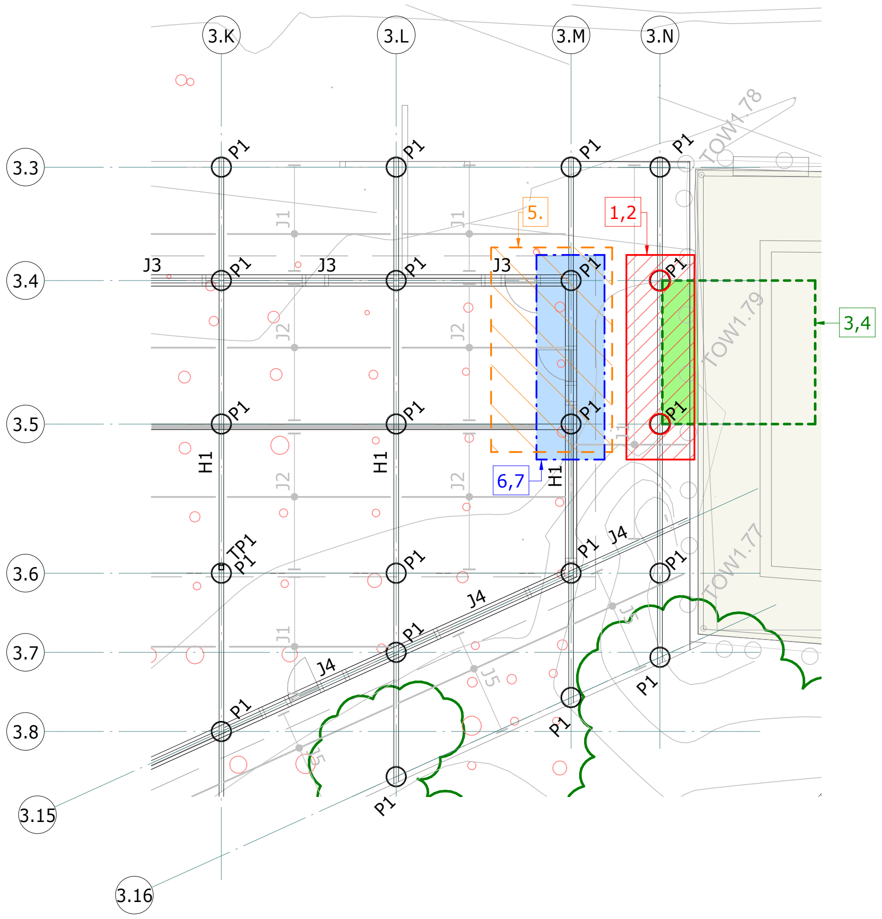
CONSTRUCTION SEQUENCE - FLOOR, WALL & ROOF FRAMING

15. CONCRETE FILL PILES ON GRIDS 3.N & 3.M
16. INSTALL HEADSTOCKS 3.N & 3.M
17. INSTALL JOISTS AND DECKING OUT TO GRID 3.M
18. USING TEMPORARY SUPPORT BEAM FOR THE CONCRETE PUMP LINE, CONCRETE FILL PILES ON GRID 3.L.
19. INSTALL HEADSTOCKS ON GRID 3.L
20. INSTALL JOISTS AND DECKING OUT TO GRID 3.L

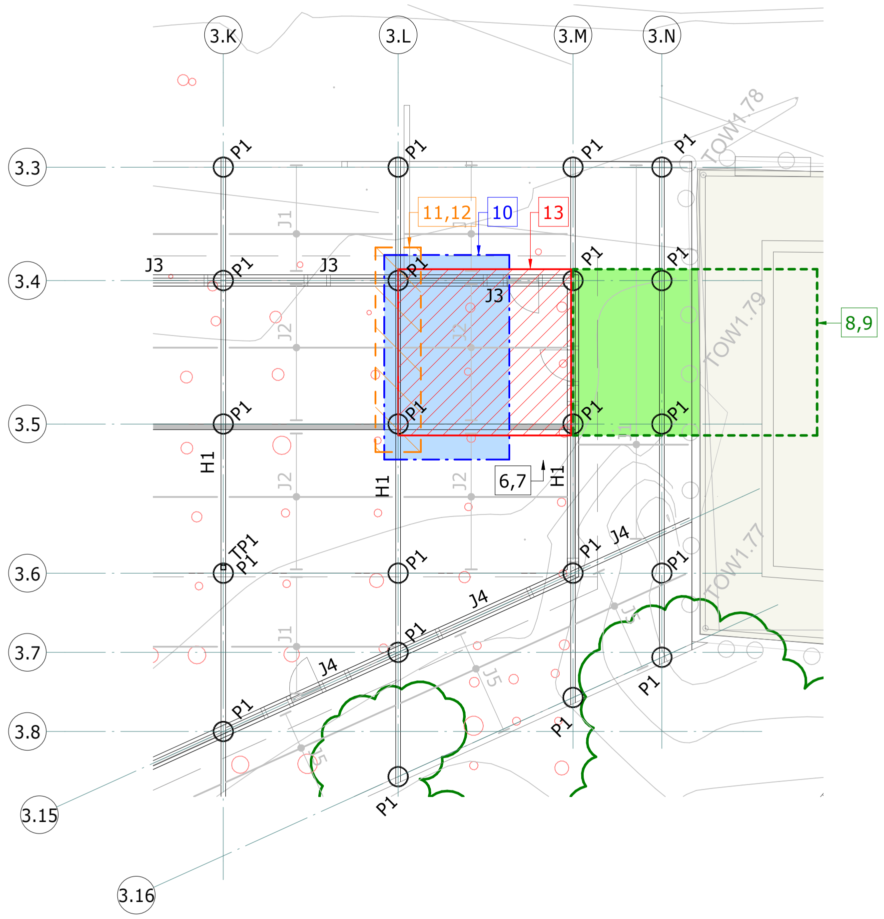
REPEAT STEPS 18-20
LIFTING CAN BE DONE USING A SMALL MAEDA CRAWLER CRANE OR SIMILAR ON THE FINISHED DECKING.

ALTERNATIVELY, LIFTING CAN BE DONE USING LAND BASED AND/OR JACK-UP BARGE BASED CRANES.

WALL AND ROOF FRAMING TO BE CONSTRUCTED USING LAND BASED AND JACK UP BARGE BASED CRANES.



SCALE 1 : 100
CONSTRUCTION SEQUENCE PLAN No. 1-7



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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE OVERWATER STRUCTURES
CONSTRUCTION SEQUENCE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
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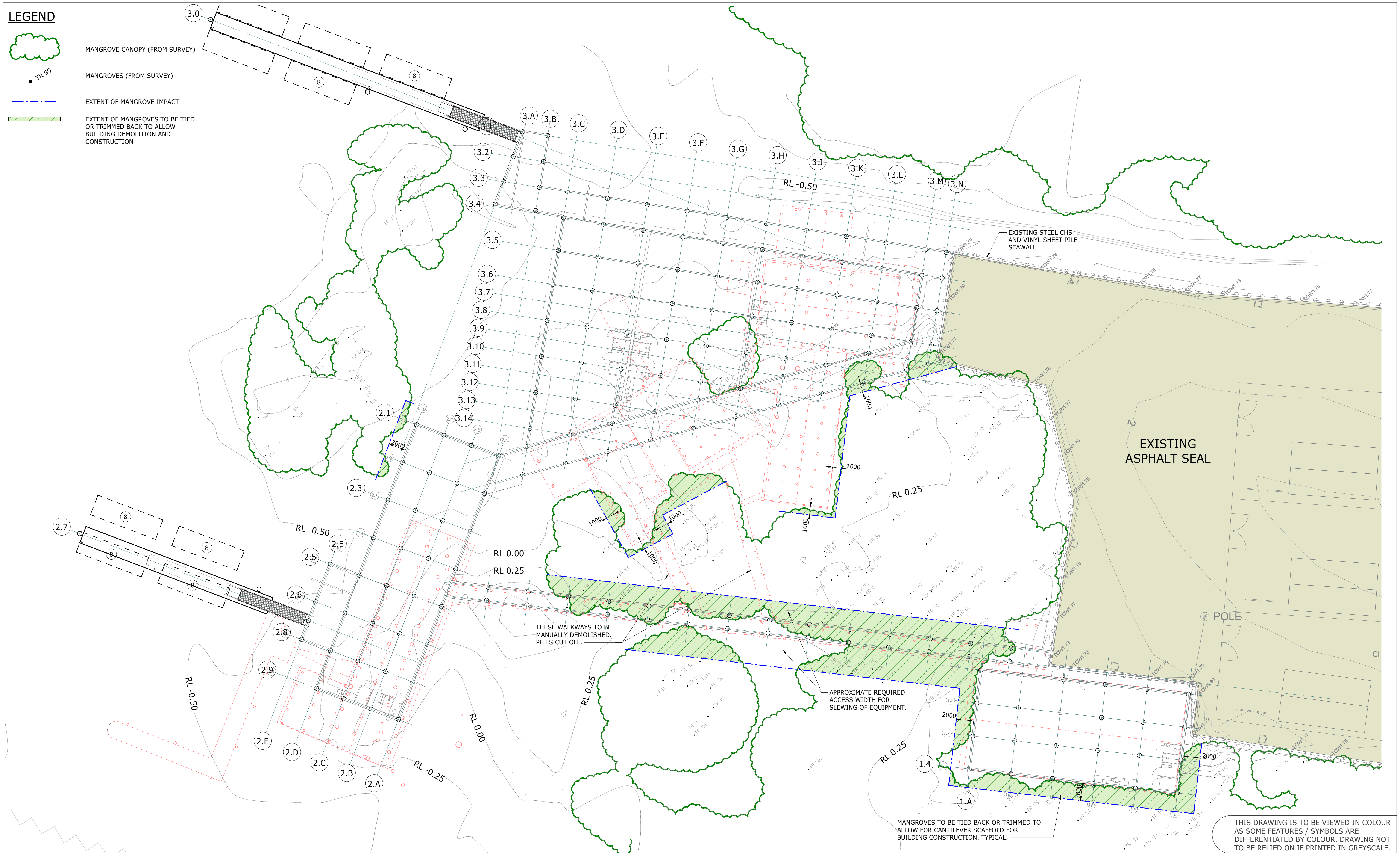

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SCALE 1 : 200
FLORA IMPACT PLAN

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLORA IMPACT PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
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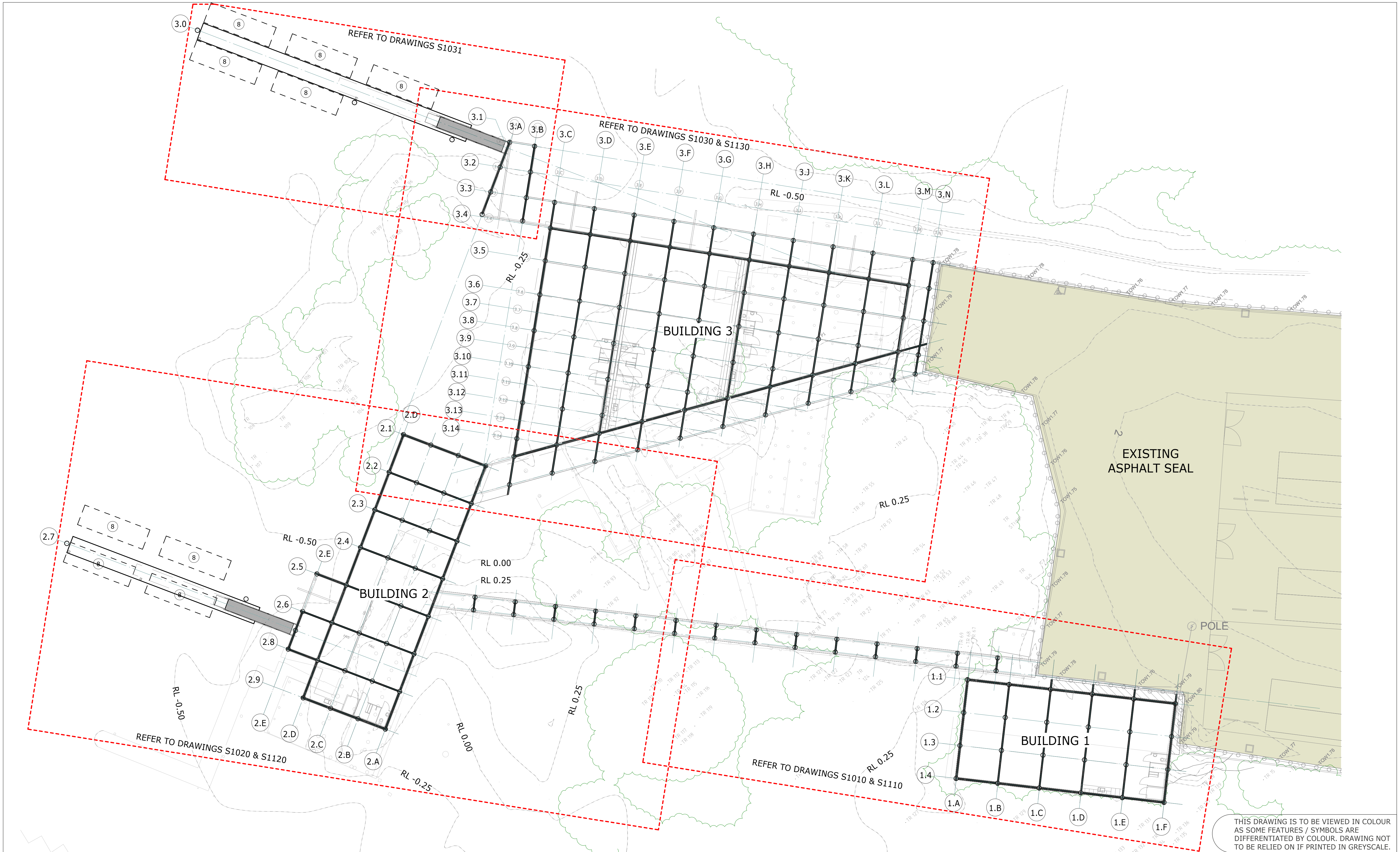

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SCALE 1 : 200

OVERWATER STRUCTURE SITE PLAN

REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE A1

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TRANSPORT FOR NSW

WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES

OVERWATER STRUCTURE SITE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
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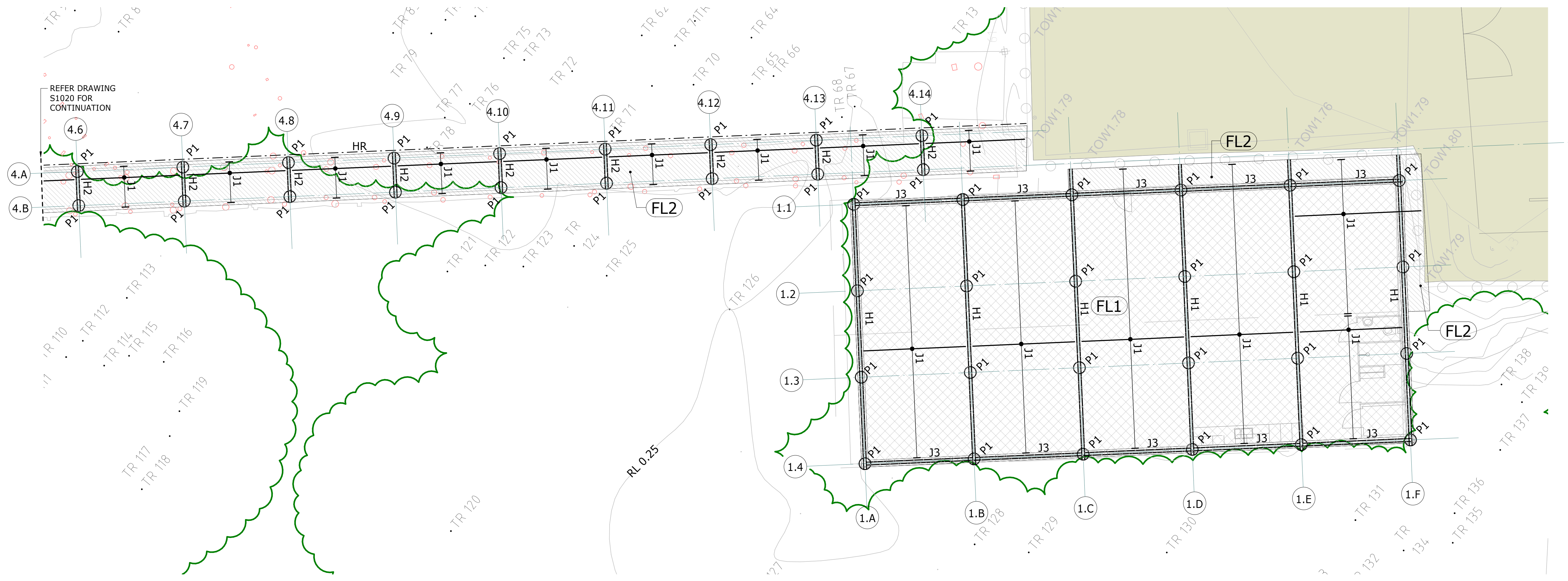

SCALE 1 : 100
FLOOR FRAMING PLAN - BUILDING 1

LEGEND

MANGROVE CANOPY (FROM SURVEY)
MANGROVES (FROM SURVEY)
EXISTING PILE TO BE DEMOLISHED
HANDRAIL
SERVICES BOLLARD (LIGHT/POWER/WATER)
BERTH LENGTH
PONTOON. HDPE FLOATS, ALUMINIUM FRAMING AND FRP MINIMESH DECKING. REFER PLAN FOR SIZE
8m LONG HINGED GANGWAY:
- ALUMINIUM FRAMED
- FRP MINIMESH DECKING
- TRUSSES AND HANDRAILS EACH SIDE
- 1000MIN. INTERNAL WIDTH BETWEEN HANDRAILS. (1400 APPROX. OVERALL WIDTH).

REFER DRAWING S1310 FOR DETAILS

MEMBER SCHEDULE

MARK	SIZE	NOTES
FL1	38mm FRP 'WEBFORGE' MINI-MESH	
FL2	43mm FLAT TOP FRP 'WEBFORGE' MINI-MESH	
H1	2/250x125x6.5 WAGNERS BRB	HEADSTOCKS. 2 SPAN
H2	2/250x125x6.5 WAGNERS BRB	
J1	250x125x6.5 WAGNERS BRB	JOISTS AT 600 MAX. CTS.
J2	250x125x6.5 WAGNERS BRB	JOISTS AT 600 MAX. CTS. LAID TO SUIT FALL IN FLOOR
J3	2/250x125x6.5 WAGNERS BRB	JOISTS
J4	3/250x125x6.5 WAGNERS BRB	JOISTS
P1	STEEL CHS PILE WITH HDPE SLEEVES	
P2	STEEL CHS PILE WITH HDPE SLEEVES	
TP1	POST TO SUPPORT MIDSPAN OF TR3 OVER TBC	

TRUSS SCHEDULE

MARK	SIZE
TR1	PARALLEL CHORD TRUSS BY OTHERS
TR2	PARALLEL CHORD TRUSS BY OTHERS
TR3	PARALLEL CHORD TRUSS BY OTHERS
TR4	TRIANGULAR TRUSSES BY OTHERS
TR5	TRIANGULAR TRUSSES BY OTHERS
TR6	PITCHED TRUSSES BY OTHERS
TR7	PITCHED TRUSSES BY OTHERS

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REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
M. Baker

NOT FOR CONSTRUCTION

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 1

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1010	B

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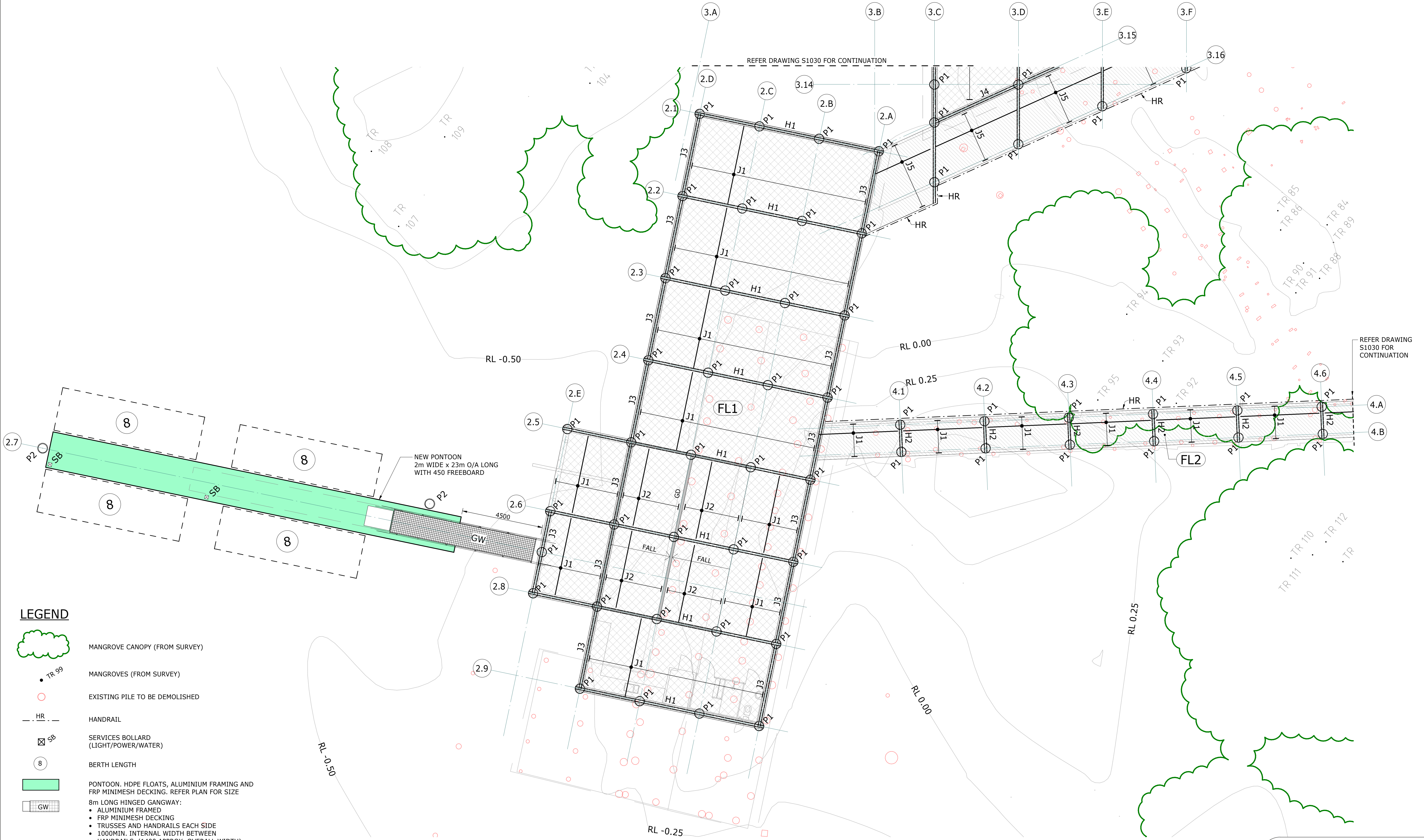

LEGEND

	MANGROVE CANOPY (FROM SURVEY)
TR 99	MANGROVES (FROM SURVEY)
	EXISTING PILE TO BE DEMOLISHED
HR	HANDRAIL
SB	SERVICES BOLLARD (LIGHT/POWER/WATER)
8	BERTH LENGTH
	PONTOON. HDPE FLOATS, ALUMINIUM FRAMING AND FRP MINIMESH DECKING. REFER PLAN FOR SIZE
GW	8m LONG HINGED GANGWAY: • ALUMINIUM FRAMED • FRP MINIMESH DECKING • TRUSSES AND HANDRAILS EACH SIDE • 1000MIN. INTERNAL WIDTH BETWEEN HANDRAILS. (1400 APPROX. OVERALL WIDTH). REFER DRAWING S1310 FOR DETAILS

SCALE 1 : 100

FLOOR FRAMING PLAN - BUILDING 2

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REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 2

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1020	B

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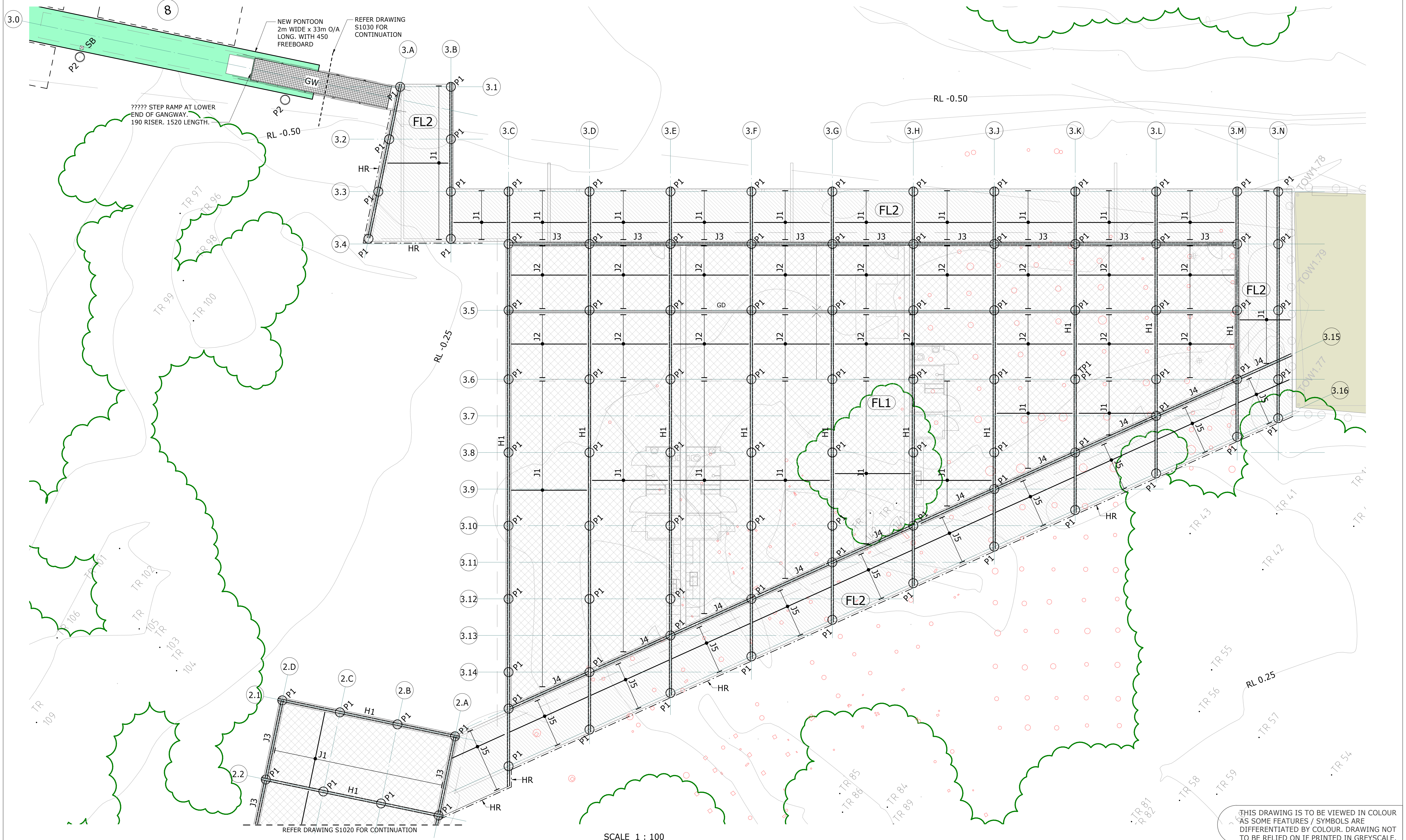

SCALE 1 : 100

FLOOR FRAMING PLAN - BUILDING 3

REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE A1

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLOOR FRAMING PLAN - BUILDING 3

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1030	B

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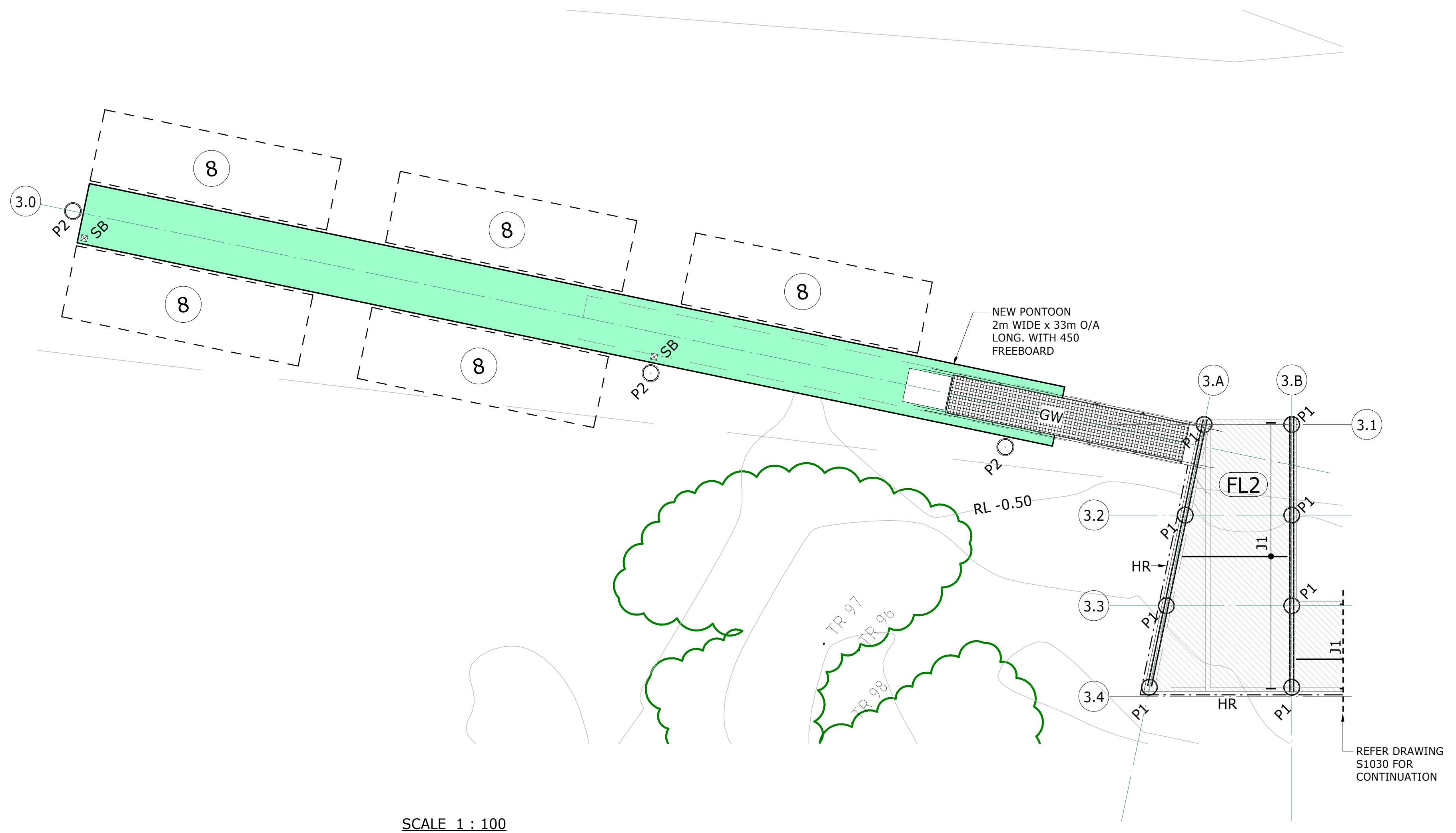

SCALE 1 : 100

OVERWATER STRUCTURE - BUILDING 3 PONTOON

LEGEND

MANGROVE CANOPY (FROM SURVEY)

TR 99 — MANGROVES (FROM SURVEY)

EXISTING PILE TO BE DEMOLISHED

HR — HANDRAIL

SB — SERVICES BOLLARD (LIGHT/POWER/WATER)

8 — BERTH LENGTH

PONTOON. HDPE FLOATS, ALUMINIUM FRAMING AND FRP MINIMESH DECKING. REFER PLAN FOR SIZE

GW — 8m LONG HINGED GANGWAY:
- ALUMINIUM FRAMED
- FRP MINIMESH DECKING
- TRUSSES AND HANDRAILS EACH SIDE
- 1000MIN. INTERNAL WIDTH BETWEEN HANDRAILS. (1400 APPROX. OVERALL WIDTH).

REFER DRAWING S1310 FOR DETAILS

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SHEET SIZE A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
A	70% ISSUE	11.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : As indicated
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES

FLOOR FRAMING PLAN - BUILDING 3 GANGWAY

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1031	A

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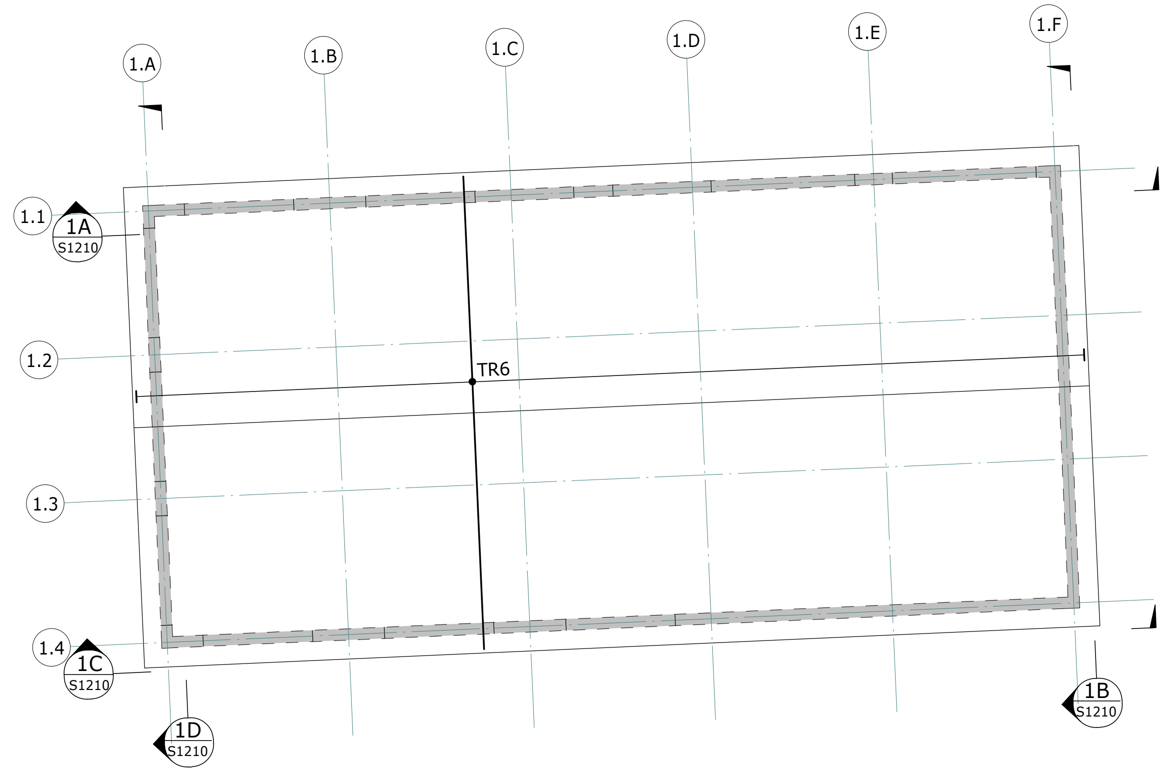

SCALE 1 : 100
ROOF FRAMING PLAN - BUILDING 1

REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
ROOF FRAMING PLAN - BUILDING 1

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1110	B

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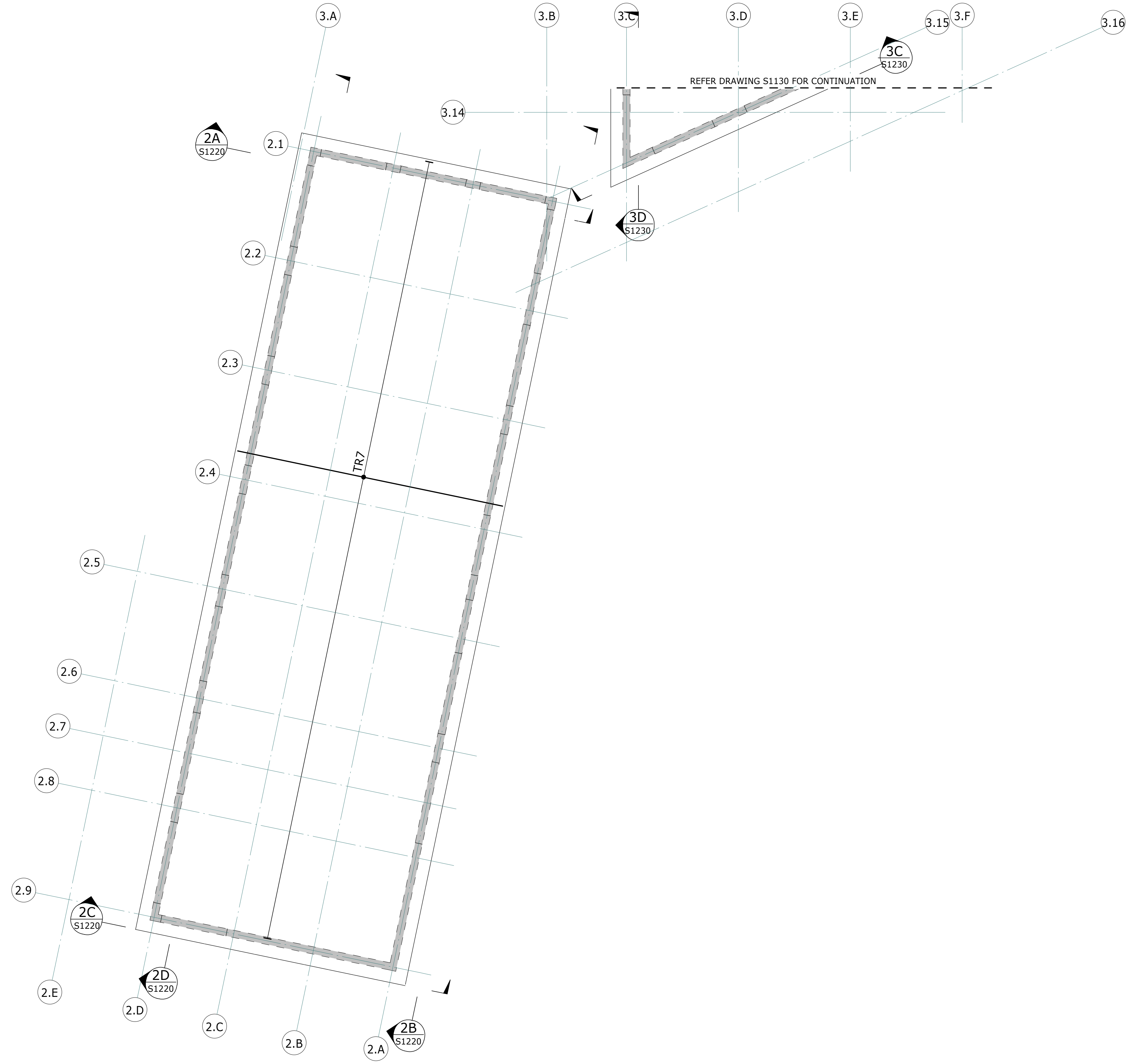

SCALE 1 : 100
ROOF FRAMING PLAN - BUILDING 2

REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
ROOF FRAMING PLAN - BUILDING 2

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1120	B

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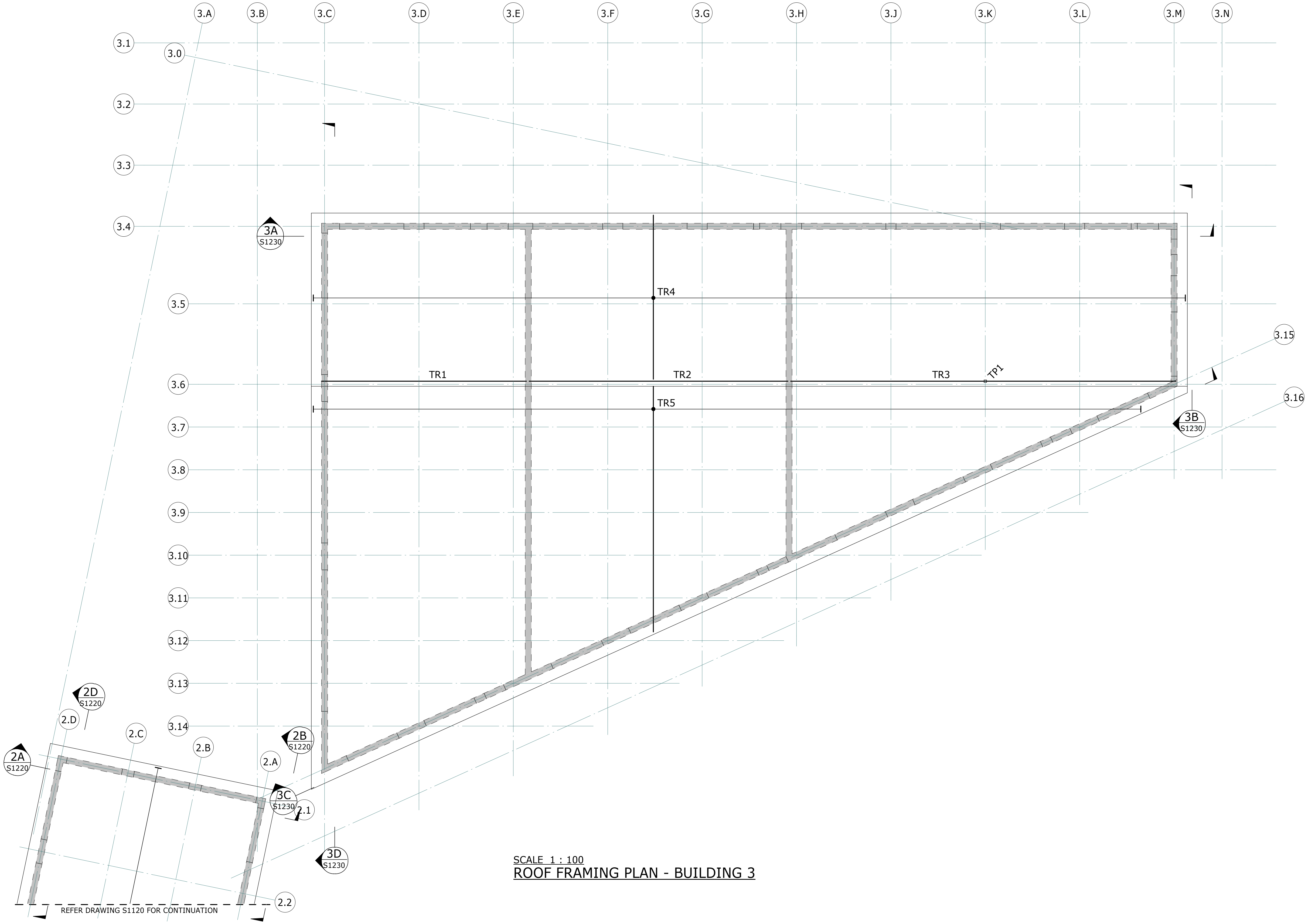

SCALE 1 : 100
ROOF FRAMING PLAN - BUILDING 3

REFER TO DWG. No.'s S0010 - S0013 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : 1 : 100
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
ROOF FRAMING PLAN - BUILDING 3

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1130	B

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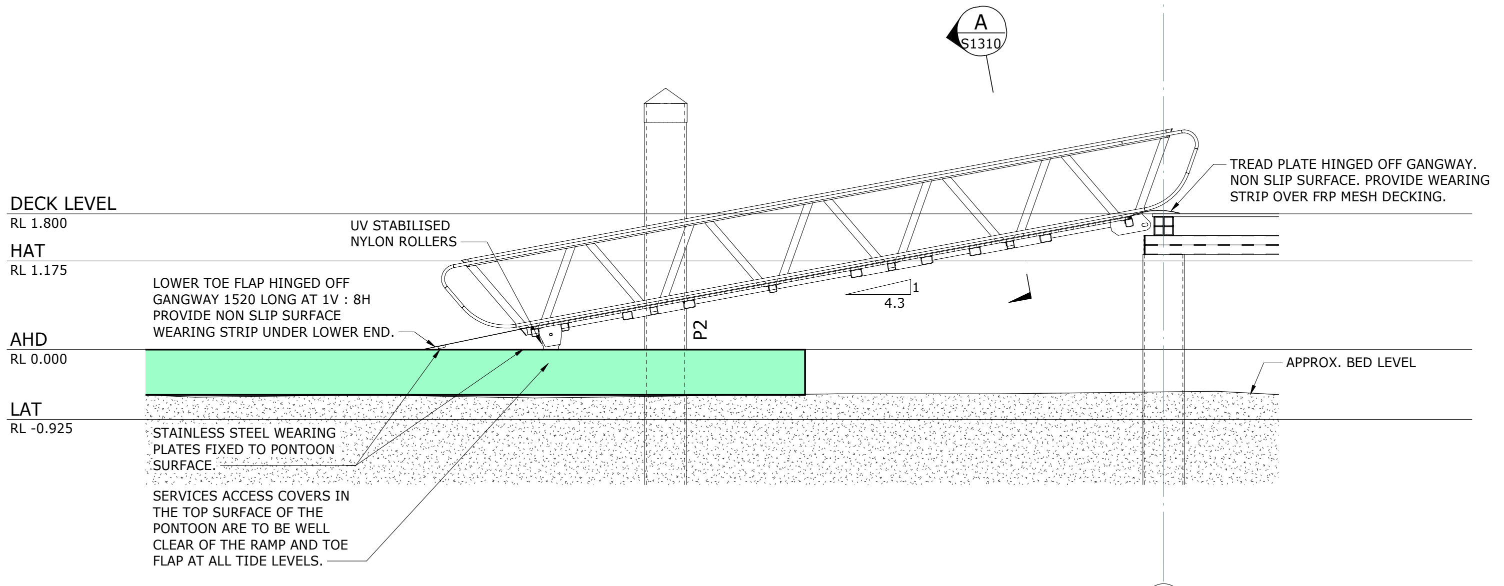

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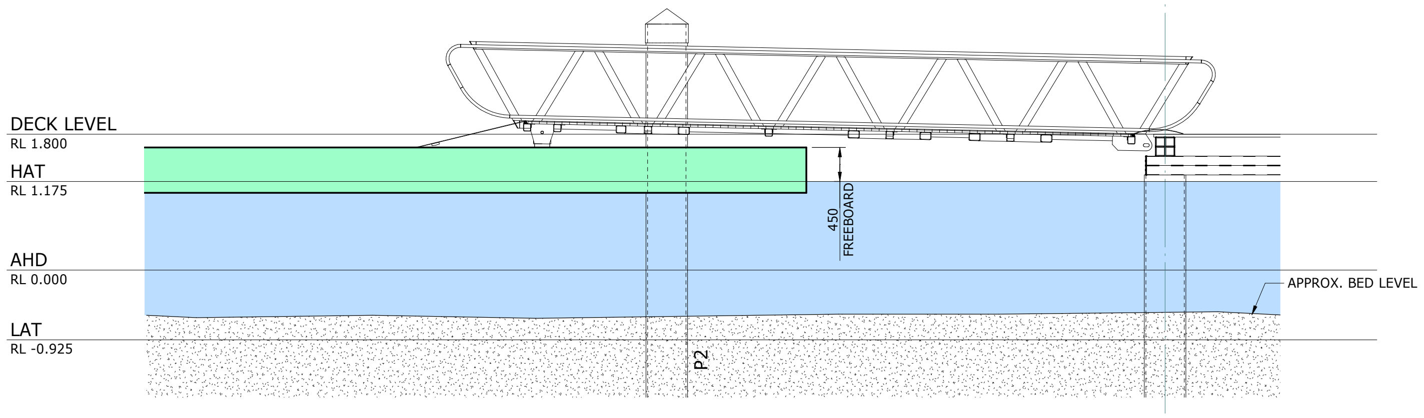
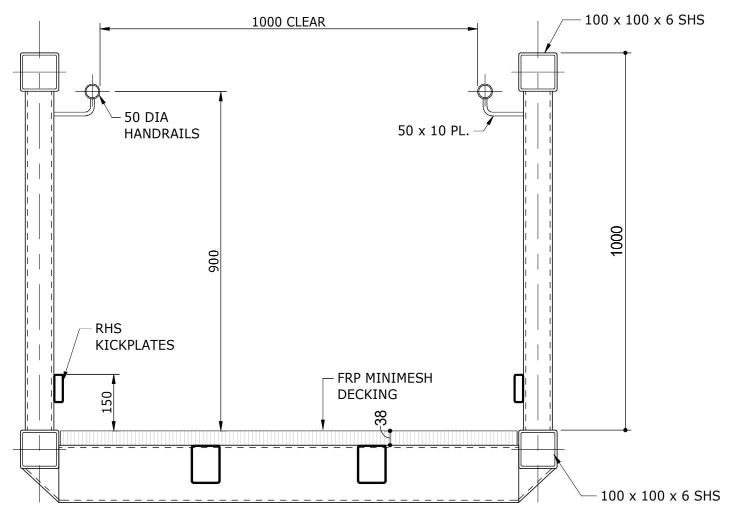
RAMP ELEVATION - WATER LEVEL AT LAT



SCALE 1 : 50

RAMP ELEVATION - WATER LEVEL AT HAT



A
S1310

RAMP SECTION

SCALE 1 : 10

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SHEET SIZE
A1

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
A	70% ISSUE	11.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD
SCALE : As indicated
SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21
APPROVED / PROJECT LEADER
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TRANSPORT FOR NSW
WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES
FLOATING STRUCTURE ELEVATIONS AND DETAILS

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1310	A

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Appendix B – Construction Equipment

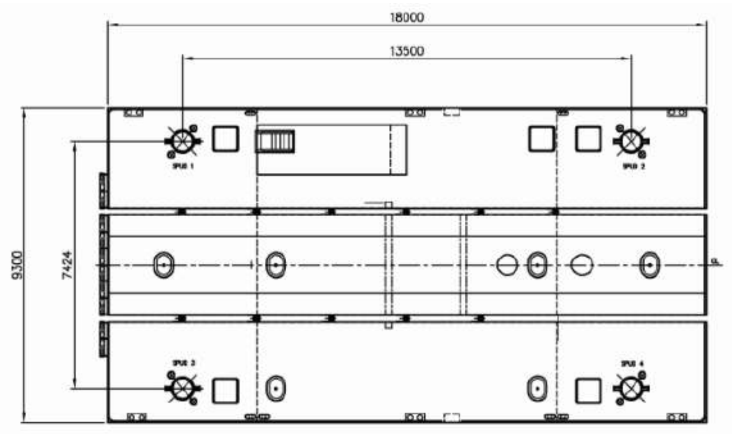
Australian Barge Hire

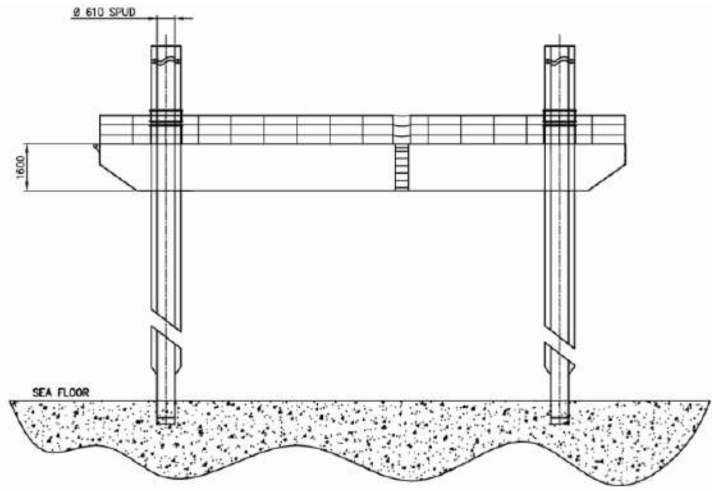
SEA LIFT 1

JACK-UP

BARGE SELF ELEVATING PLATFORM

SEA LIFT 1





General

Type	Jack Up Barge
Operator	Australian Barge Hire Pty Ltd
Survey	Australian Maritime Safety Authority
Classification	AMSA 2D and 2C
Built	Singapore
Construction	Steel
Road Transport	7 Extendable Semi Trailers
Working Depth	Up to 22 metres

Main Dimensions

Length Overall	18.00	metres
Beam	9.30	metres
Depth	1.60	metres
Draft	0.80	metres
Displacement	100	tonnes (unladen)

Jacking System

Jacking system	Electronic over hydraulic	
Jacking Rate	13	metres per hour
Load Lift Capacity	80	tonnes
Spud Length	12, 18, 30	metres
Power Unit	100	kW

Features

- 600mm Diameter Moon Pool
- 600 mm Diameter Rod Rack
- Onboard Site Office
- Remote control gangway access
- Remote controlled jacking operation
- Certified man riding crane
- Environmental spill containment equipment
- Night lights

Operation

“Sea Lift 1” employs electric over hydraulic controls for all barge operations. “Sea Lift 1” in standard configuration has four 12,18 or 30 m spuds, one in each corner. A central generator provides power to two electric hydraulic pumps which provide hydraulic pressure for barge operations. A mobile control panel, enables the operator to easily sight all operations.

Electronic interlocks and sensors provide the operator with status indications at the control panel and prevent inadvertent operation at the spud control. All of the hydraulic mechanisms and control systems to operate “Sea Lift 1” are located below deck to minimise the risk of both environmental and mechanical damage.

Australian Barge Hire
10 Pembury Road Minto NSW 2566
Phone: 02 9531 2900 Email: info@australianbargehire.com

SPIDER CRANE

MC285C-3

Crane Capacity	Max. working radius	Max Lifting Height
2.82t × 1.4m	8.205m × 0.15t	8.7m

NEW

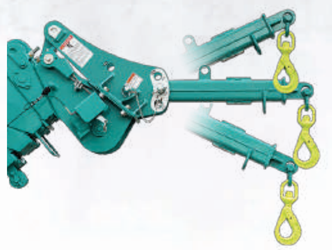
- Slim Body Width : 750mm
- Slew Angle Limit Setting
- Multi Outrigger Positions
- Multi Outrigger Lifting Mode
- Crane/Outrigger Interlock System
- Digital Feedback Remote Control
- 4 Fall/2 Fall Hook Block
- EU Stage V Compliant Engine

Paddle Lever
Radio Remote Control

Programmable
Moment Limiter

Detachable Electric Motor
(Option)

Auxiliary Winch (Option)



Searcher Hook (Option)

SPIDER CRANE

MC285C-3

Specifications

Model		MC285C-3
Crane capacity		2.82t x 1.4m
Max. working radius		8.205m x 0.15t
Max.lifting height (on the ground)		8.7m
Max.lifting height (underground)		-10.1m (4 falls)
Max.lifting height (underground)(optional auxiliary winch)		-100m (single fall)
Winch system	Hook speed	9.3m/min (4 layers, 4 falls)
	Hoist wire rope	IWRC 6 X Fi (29) 0/0, ϕ7×48.0m
Telescoping system	Type	Fully automatic 5-section pentagonal telescopic boom (3 to 5 section : simultaneous telescoping)
	Boom length	2.535m - 8.575m
	Boom telescoping stroke / time	6.04m /22sec
Boom hoist system	Hoist angle / time	0 to 80deg / 14.0sec
Slew system	Slew angle / time	360deg / 0.88rpm
Outrigger system	Type	1st stage with flexible stay damper, 2nd stage manual pullout hydraulic cylinder direct acting type
	Max.extended width (between outside of OR adapters)	(Lateral) 4,782mm x (Front) 4,718mm x (Rear) 3,990mm
Travel system	Type	Hydraulic motor driven , stepless speed changer
	Travel speed	0 - 2.2km/h
	Gradability	20deg
	Crawler ground length x width	975mm x 200mm
	Ground pressure (MC285CWM-3)	50.0kpa (0.510kgf/cm²)
	Ground pressure (MC285CWME-3)	54.3kpa (0.554kgf/cm²)
Engine(diesel)	Model	YANMAR 2TNV70-NMBA
	Displacement	569cc (0.569L)
	Rated output	7.4kw (10.1PS) / 2,500rpm
	Starting method	Electric starting
	Fuel / Fuel tank capacity	Diesel / 12.0L
Motor (MC285CWME-3)	Motor model	IKKH-FBK8G-4P-5.5kw
	Motor type	Totally enclosed fan-cooled motor 5.5kw, 4P 380V
	Starting system	Inverter system (30Hz-60Hz)
Remote control system	Type	Radio & paddle type control
Overall length × width ×height (MC285CWM-3)		2,800mm x 750mm x 1,470mm
Overall length × width ×height (MC285CWME-3)		3,285mm x 750mm x 1,470mm (Detachable E-motor)
Machine weight (MC285CWM-3)		1,990kg (2,160kg with Aux winch)
Machine weight (MC285CWME-3)		2,160kg (2,330kg with Aux winch)
Safety device		Overwind protection, Angle indicator, Hydraulic safety valve, Wire rope latch, Level, Machine body inclination alarm, EMO switch, Moment limiter, Working status lamp, Data logger, Crane & Outrigger interlock device
Options		White rubber tracks, Single fall hook, 850kg searcher hook, 900kg auxiliary winch

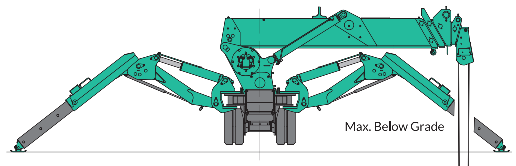
Rated Total Load Chart (4falls)

Outrigger extended to maximum							
2.535m / 4.075m Boom		5.575m Boom		7.075m Boom		8.575m Boom	
Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)
1.4 or less	2820	3.0 or less	1220	3.6 or less	820	4.0 or less	550
1.5	2520	3.5	970	4.0	740	4.5	400
2.0	1920	4.0	780	4.5	580	5.0	340
2.5	1570	4.5	630	5.0	480	5.5	300
3.0	1220	5.0	530	5.5	430	6.0	270
3.5	970	5.205	530	6.0	380	6.5	230
3.705	920			6.5	350	7.0	200
				6.705	330	7.5	180
						8.0	150
						8.205	150

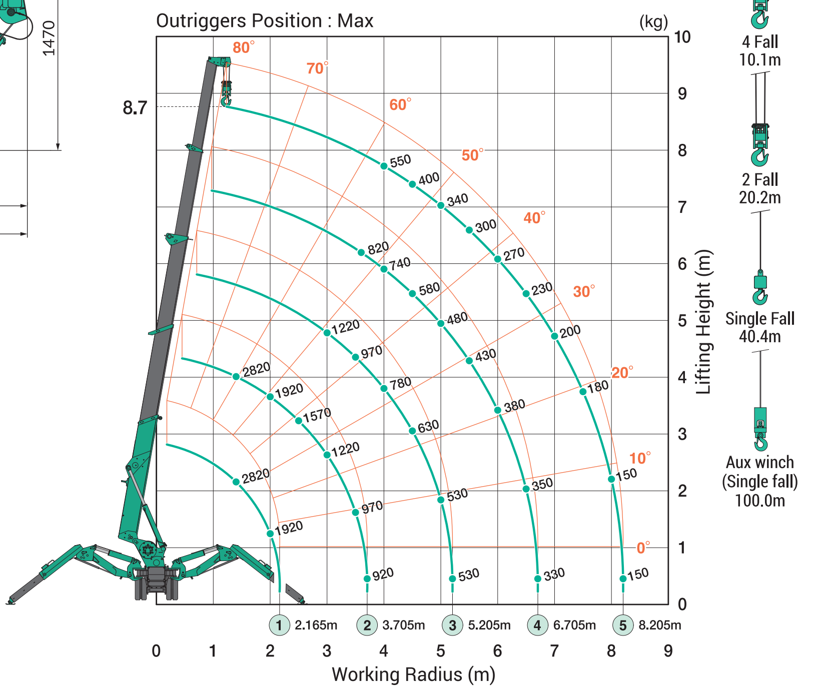
Outrigger extended to other than maximum							
2.535m / 4.075m Boom		5.575m Boom		7.075m Boom		8.575m Boom	
Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)	Working radius(m)	Rated total load(kg)
1.5 or less	1720	3.0 or less	510	3.6 or less	400	4.0 or less	330
2.0	1070	3.5	410	4.0	330	4.5	280
2.5	630	4.0	330	4.5	280	5.0	230
3.0	520	4.5	280	5.0	230	5.5	180
3.5	390	5.0	200	5.5	180	6.0	160
3.705	350	5.205	200	6.0	160	6.5	130
				6.5	130	7.0	100
				6.705	120	7.5	80
						8.0	70
						8.205	60

* The Rated Total Load Chart is based on actual working radius including boom deflection.
* The weight of hook block (standard 4 fall / 2 fall-30kg) must be included as part of the load shown in the Rated Total Load Chart.
* When using two falls hook or single fall hook, use the appropriate four falls Rated Total Load Chart shown above but with a maximum load of : -1410kg for two falls and -710kg for Single fall.

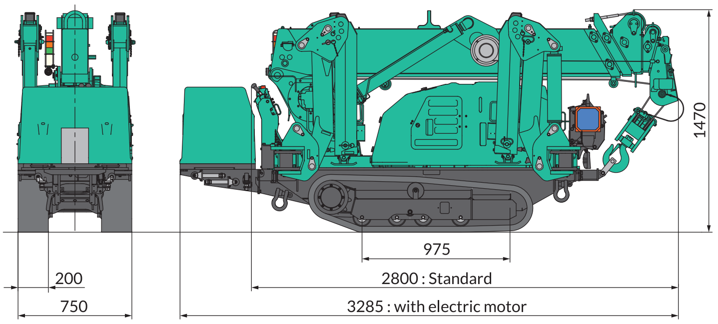
MAX. Reach Below Ground

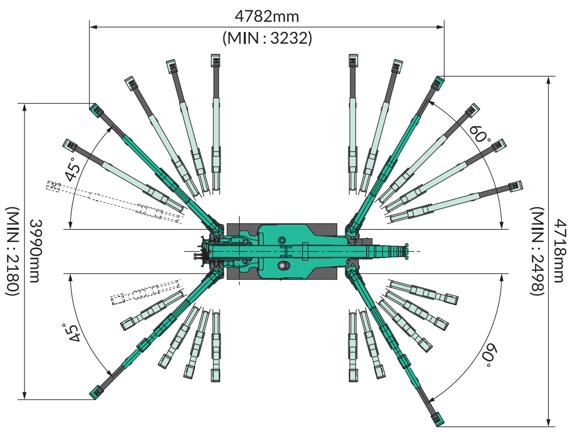


Working Range Chart (4falls)



Dimensions





* Due to improvements, the specifications are subject to change without notice.

Before use, please read the Operation Manual

MAEDA

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Head office
No.1095, Onbegawa, Shinonoi, Nagano-City, Nagano-Pref. 388-8522 Japan
TEL.+81(0)26 292 2228 FAX.+81(0)26 293 8499
URL : www.maedaminicranes.com E-mail : contact@maeda-minicranes.com

Appendix G

Environmental Management Plan

Transport for NSW

Long Term Environmental Management Plan

'Captain Cook Drive Remediation'
Captain Cook Drive
Woolooware, NSW

17 March 2022

51163/138935 (Rev 1)

JBS&G Australia Pty Ltd

www.jbsg.com.au

Transport for NSW

Long Term Environmental Management Plan

'Captain Cook Drive Remediation'
Captain Cook Drive
Woolooware, NSW

17 March 2022

51163/138935 (Rev 1)

JBS&G Australia Pty Ltd

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material
AF/FA	Asbestos Fines/Fibrous Asbestos
AHD	Australia Height Datum
bgs	below ground surface
BS	British Standard
BT	Butyltins
CS	Characteristic Situation
CIRIA	Construction Industry Research and Information Association
CH_4	Methane
CO_2	Carbon Dioxide
CO	Carbon Monoxide
COC	Contaminants of Concern
Council	Sutherland Shire Council
DP	Deposited Plan
EPA	NSW Environment Protection Authority
GSV	Gas Screening Value
HGG	Hazardous Ground Gas
HGGRA	Hazardous Ground Gas Risk Assessment
JBS&G	JBS&G Australia Pty Ltd
LAA	Licensed Asbestos Assessor
LEL	Lower Explosive Limit (of methane)
LTEMP	Long Term Environmental Management Plan
PAHs	Polycyclic Aromatic Hydrocarbons
PPE	Personal Protective Equipment
RAP	Remedial Action Plan
RMS	Roads and Maritime Services (now TfNSW)
SAS	Site Audit Statement
SWMS	Safe Work Method Statement
TfNSW	Transport for New South Wales
TRHs	Total Recoverable Hydrocarbons
WHS	Work Health and Safety

1. Introduction

1.1 Introduction

JBS&G Australia Pty Ltd (JBS&G) was engaged by APP Corporation Pty Ltd (APP) on behalf of Transport for NSW (TfNSW, the client) to prepare a Long-Term Environmental Management Plan (LTEMP) for 'Captain Cook Drive Remediation' located on Captain Cook Drive, Woolooware, NSW (the 'site'). The site is formally identified as part Lot 3 in DP1165618 and occupies an area of approximately 5,000 m^2. The site location is shown in **Figure 1**, the site setting is shown on **Figure 2** and the site layout is shown on **Figure 3**.

Previous investigations at the site (JBS 2012[1] and JBS&G 2018a[2]) identified that soils and groundwater were impacted with polycyclic aromatic hydrocarbons (PAHs) and total recoverable hydrocarbons (TRH) (C>10 fractions). These contaminants are associated with the historical use of tars on the site to treat timbers associated with oyster farming. Additionally, butyltins (BTs) and asbestos were also identified at the site. The 2018 investigation (JBS&G 2018a) recommended that tar based contamination, acting as potential source material, within the extent of the site was removed and an EMP be prepared for the site. A Remedial Action Plan (RAP JBS&G 2020[3]), was prepared to guide the remediation and validation procedures to make the site suitable for the proposed commercial/industrial land use.

The site was subject to remediation from 2018 to 2021 which included excavation, waste classification and off-site disposal of tar impacts and associated wastes resulting from remedial excavations across the site. Following remediation and validation of excavations, a marker and capping layer was installed across the site to encapsulate remaining TRH, PAH, BT and asbestos impacted soils in accordance with the RAP (JBS&G 2020) to make the site suitable for the proposed commercial/industrial land use. Documentation of the validation works are detailed in the Validation Report (JBS&G 2022a[4]) prepared for the site. Tar impacts remain within the 5 metre Ausgrid tower easement to the north and west of the tower footprint (**Figure 5**) and require ongoing management in accordance with this LTEMP.

As part of the validation works soil vapour sampling identified concentrations of methane and carbon dioxide above the adopted threshold for action of 1 % volume/volume (v/v) and 1.5 % v/v[5] respectively. As such, a detailed hazardous ground gas risk assessment (HGGRA, JBS&G 2022b[6]) was completed in accordance with *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2020). The HGGRA identified that the site is classified as Characteristic Situation (CS) 3, with specific gas mitigation management or controls required for construction of future buildings under proposed commercial/industrial land use.

This LTEMP applies to the site and it will be the responsibility of the site owner (TfNSW) and operator to implement this plan following issue of the Site Audit Statement (SAS) by the Site Auditor.

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[1] *Environmental Site Assessment rev 0*, 'Oyster Farm', Captain Cook Drive, Woolooware NSW, September 2012 (JBS&G 2012)

[2] *Additional Contamination Assessment rev 1,* The Oyster Farm', Captain Cook Drive, Woolooware, NSW, JBS&G, 4 June 2018 (JBS&G 2018a[2]))

[3] *Remedial Action Plan rev 4*, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware, NSW, JBS&G, 29 June 2020 (JBS&G 2020)

[4] *Validation Report, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware, NSW*, JBS&G Australia Pty Ltd, 18 February 2022, ref: 51163:141090 Rev 0 (JBS&G 2022a)

[5] Carbon dioxide 1.5% (v/v) above established natural background levels. Background concentrations of carbon dioxide were not known at the time of monitoring.

[6] *Hazardous Ground Gas Risk Assessment, 'Captain Cook Drive Remediation', Captain Cook Drive Woolooware, NSW*, JBS&G Australia Pty Ltd, 10 February 2022, ref: 51163/142292 (Rev 1) (JBS&G 2022b).

This LTEMP is required to ensure that the identified TRH, PAH, BT and asbestos impacted soils and hazardous ground gases beneath the site are appropriately managed for continued protection of human health for future site workers, occupiers, visitors and contractors engaged to undertake work at the site.

This LTEMP has been prepared in accordance with the requirements outlined in the NSW EPA *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd edition)*[7] and the *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land*[8]. The plan has been designed to ensure activities which could potentially or directly result in exposure of future site users to the contaminated soils beneath the physical barrier are precluded or limited / controlled.

The plan includes:

a) description of the nature and location of contamination remaining on site;

b) the objectives of the LTEMP;

c) procedures for residual contamination management measures to be implemented to address the identified environmental impacts at the site, including options of protection measures for future developments to ensure hazardous ground gas is not present at accumulated concentrations which would cause potential harm to human health;

d) responsibilities for the LTEMP implementation; and

e) an implementation schedule for each action in the LTEMP.

This LTEMP has also been prepared in accordance with the requirement for an LTEMP as stipulated within the Review of Environmental Factors (REF, RMS 2017[9]) prepared for the remediation of the site. The LTEMP is required to detail the management and maintenance of the residual contamination post remediation. This LTEMP forms an attachment to the final Site Audit Statement (SAS[10]) prepared for the site and its implementation is a requirement of the SAS. The site shall be maintained for the duration of the site occupation and operation in accordance with the requirements of the LTEMP.

1.2 Objectives

The purpose of this LTEMP is to provide consistent management of contamination including ground gas management controls across the site to protect the health and safety of site users, workers and visitors and to prevent degradation of the environment.

The objectives of this LTEMP are to:

- Protect the health of site occupants, workers, contractors and visitors from TRH, PAH, BT and asbestos in soil as well as ground gas accumulation hazards during the future operation of the site;
- Outline ongoing management requirements to ensure that the risk posed by impacted soils and hazardous ground gases identified at the site is properly managed and maintained;
- Provide guidance on the responsibilities of maintaining the requirements of this LTEMP;
- Document ongoing environmental monitoring, inspection and reporting requirements;

[7] *Contaminated Sites – Guidelines for the NSW Site Auditor Scheme (3rd Edition).* NSW Environment Protection Authority 2017 (EPA 2017)
[8] *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land*, NSW Environment Protection Authority, May 2020
[9] *Remediation of The Captain Cook Drive Oyster Farm Review of environmental factors,* APP Corporation Ltd and Roads and Maritime Services (RMS 2017).
[10] TBC

- Provide guidance on the appropriate control measures to be implemented in the event that the capping layers require to be breached;
- Provide guidance on appropriate gas mitigation measures to be implemented in the event the site is redeveloped to ensure hazardous ground gas are not present at accumulated concentrations which would cause potential harm to human health; and
- Provide guidance on the appropriate procedures to manage works within impacted materials.

It is expected that this LTEMP will be incorporated into the overall maintenance and environmental management procedures for all workplaces at the site.

1.3 Previous Site Reports

Several investigations and related reports have been prepared for the site. These investigations are summarised in the Validation Report (JBS&G 2022a) prepared for the site. For the purposes of the development of this LTEMP, the Validation Report (JBS&G 2022a) and the HGGRA (JBS&G 2022b) were considered. *Readers are referred to the original reports for the full details.*

2. Summary of Site Conditions

2.1 Site Details

The location and layout are shown on **Figures 1** and **2**, respectively, and summarised in **Table 2.1**. A summary of the marker and capping layers at the site is provided on **Figure 4**.

Table 2.1: Site Identification

Lot/DP	Part Lot 3 DP1165618
Address	Captain Cook Drive, Woolooware, NSW
LGA	Sutherland Shire Council
Zoning	W1 Natural Waterways
Approximate Site Co-ordinates (MGA56)	329000.83 Easting 6232074.42 Northing
Former Use	Oyster farming
Proposed Use	Commercial/industrial use
Site Owner	TfNSW
Site Operator	TfNSW

2.2 Site Condition

A detailed site inspection was undertaken at the completion of validation works by an experienced JBS&G environmental consultant. The site comprised a fenced vacant land parcel with a lockable gate, with the ground surfaces comprising a 2-coat spray seal. Sandstone blocks encompassed the land side of the site boundaries. A high-voltage Ausgrid transmission tower (Ausgrid tower) was present in the southern portion of the site. A concrete slab encompassing the footprint of the Ausgrid tower was present with a stormwater pit in the centre of the slab. Additional stormwater pits were evenly spaced around the boundary of the site.

A PVC sheet pile sea wall defined the boundary of the site, with the exception of a small section with no sea wall in the southern portion of the site, inclusive of the site entrance and directly west.

The existing site was raised compared to the site elevation prior to remediation as a result of importation of validated materials. The site elevation was highest through the centre of the site, with the highest point in the northern portion, with elevations decreasing to the south, east and west to enable runoff to flow to the stormwater pits. Site elevations range from 1.70 m Australian Height Datum (m AHD) to 2.28 m AHD, with a lower elevation within the Ausgrid tower footprint of 1.37 m AHD to 1.44 m AHD. The marker layer is present beneath a 500 mm capping layer that facilitates onsite containment of asbestos, PAH, TRH and TBT impacted soils (refer **Figure 4**).

The site is currently used as a car park and open space storage area for existing oyster farmers operating to the north of the site.

2.3 Geology and Soil

Review of the regional geologic map (DMR 1993)[11] indicated the site is underlain by organic-rich muddy marine sand.

Review of the regional soil map (DCLM 1993)[12] indicated that the local area is located on tidal mudflats with a relief of less than 3 m and a slope of less than 3 %. The local soils consist of waterlogged calcareous sands and siliceous sands.

Previous investigations encountered:

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[11] *Wollongong – Port Hacking Geological Series Sheet 9029 (Edition 1) 1993*. Geological Survey of NSW Department of Mineral Resources, (DMR 1993).

[12] *Soil Landscape Series Sheet 9029*. Department of Conservation and Land Management of NSW, 1993 (DCLM 1993).

- Fill to a depth of greater than 2.2 m, comprising gravelly silty sand with inclusions of shell fragments and igneous gravels; and
- Underlying natural material generally consisted of a dark grey silty clay with some organic material inclusions.

Subsequent remedial works encountered the above conditions, with tar impacted fill excavated and replaced with imported validated imported material or validated site won material. Residual fill remains in small quantities, underlain by silty clay mangrove muds. The top 500 mm comprises a capping layer of a minimum 300 mm validated sandstone and 200 mm validated quarried road base, overlain by a 2 coat seal.

2.4 Acid Sulfate Soils

According to the New South Wales Acid Sulfate Soils (ASS) risk maps[13], the site is located in an area of high probability of occurrence of acid sulfate soil materials at or near the ground surface.

2.5 Local Hydrology/Hydrogeology

The nearest surface water receptor is the marine ecosystem of Woolooware Bay located directly to the north of the site. Following remediation, a minimum 500 mm compacted capping layer comprising a 300 mm crushed sandstone layer overlain by a 200 mm road base layer and a 2-coat seal occupies the top surface levels of the site. As such, rainfall runoff within the site is directed towards the installed stormwater network surrounding the site, draining into the adjacent Woolooware Bay.

The HGGRA (JBS&G 2022b), identified groundwater levels between 0.51 m AHD to 0.67 m AHD across the northern portion, and 0.75 m AHD to 0.83 m AHD across the southern portion. Recorded groundwater level fluctuations did not identify significant groundwater level changes over tidal phases and were not significantly influenced by rainfall events.

2.6 Summary of Identified Contamination Issues

This LTEMP has been developed with consideration to the results of the validation of the site (JBS&G 2021a) and the findings of the HGGRA (JBS&G 2021b). *Readers are referred to these original site reports for the full details and source documentation.*

Contamination issues remaining following remediation and validation of the site and assessment of HGG beneath the site are summarised below:

- Soil contaminants beneath the marker and capping layers across the site comprising TRH, PAH, BT and asbestos impacted soils;
- Tar impacted soils within the 5 metre Ausgrid tower easement to the north and west of the tower footprint;
- Natural ASS/PASS underlying fill material at depth below the water table; and
- Hazardous ground gas including, methane, carbon dioxide and depleted oxygen levels associated with residual historical imported fill materials and natural organic rich mangrove sediments.

The above contamination issues present potential human exposure risks for activities that result in disturbance of soils beneath the marker layer (i.e. where contaminated soil will be disturbed). In addition, potential accumulation of HGG in buildings/services installed during redevelopment could present a human health risk following redevelopment of the site without appropriate gas mitigation measures in place.

13 Acid Sulfate Soil Risk Maps - Edition 2, Port Hacking, Department of Land and Water Conservation, 1997.

Currently, the finished site is covered with a 2 coat seal. General surface use and maintenance activities undertaken at the site are considered to pose a low risk of exposure to underlying contamination.

Further details assessing the level of risk associated with each of the identified environmental impacts is provided in JBS&G 2021a and JBS&G 2021b.

A description of the marker layer used to identify the boundary between the capping layer and potentially impacted materials is provided in **Section 2.4**. Management measures to deal with these materials in the event that it becomes necessary for the capping layer to be breached are provided in **Section 4**.

2.7 Capping Summary

The marker layer and capping layer arrangements implemented at the site are summarised in **Table 2.2** and the extent of the capping is presented on **Figure 4** with site surveys presented in **Appendix A**.

Table 2.2: Capping

Capping Scenario	Marker Layer Type	Capping Layer	Surface Finish
500 mm cap	Bright orange geo-textile	200 mm road base (DGB 20) Min 300 mm crushed sandstone	2 coat spray seal

Illustrative capping arrangements are shown in **Photographs 1** to **4** below.

Photo 1: Placement of marker and capping layer

Photo 2: Placement of marker and capping layer

Photo 3: Placement of road base capping layer overlying sandstone

Photo 4: Finished surface – 2 coat seal

2.8 Maintenance of the Capping Layer

The installed capping layer must be maintained across the entire site in order to minimise the potential for uncontrolled exposure of future site users and/or workers to contaminated soil.

Provided the capping layer is maintained in accordance with this LTEMP, there are no unacceptable health or contaminant migration risks associated with the TRH, PAH, TBT and asbestos impacts as there are no complete pathways between humans and the contaminated soil/fill material.

In the event that the capping layer is disturbed at any time as a result of planned or unplanned activities, the procedures documented in this LTEMP are required to be implemented to repair the barrier such that there continues to be an effective barrier between the contaminated soil and future site users/workers during day to day use of the site.

No active monitoring or management of subsurface soil contaminant conditions is required during everyday operation of the site. Procedures will only be needed in the event of either planned or unplanned breaches of the physical barrier/marker layer to ensure the barrier is reinstated appropriately.

The capping layers will be inspected each quarter for the first year of placement, then following the first year, one inspection annually will be conducted, noting any redevelopment works involving breaches to the capping layer will warrant additional inspections. Inspection records will be retained in the TfNSW EMS and will be completed by the appointed TfNSW Manager completing the inspection within two weeks following the inspection. Records of the inspection shall be retained for a minimum period of four years (**Appendix C**).

If any non-conformances within the barrier layers are identified, the Site Operator must engage a suitability qualified and experienced environmental consultant to inspect the non-conformance and determine appropriate rectification of the non-conformance. Any rectification works must be undertaken in accordance with the procedures detailed in **Appendix E**, documented and records of the rectification works provided to and retained by the Site Operator.

2.9 Material Below the Marker Layer

A mixture of crushed sandstone as well as gravelly clayey sands/sandy clays with inclusions of asbestos, bricks, oyster shells, concrete, tiles, scrap metal, glass and plastic will be encountered below the marker layer. Any fill materials encountered below the marker layer must be considered to be impacted with TRHs, PAHs, TBT and asbestos. The depth of fill material below the marker layer ranges from approximately 1 to 3 metres below ground surface. The fill material is underlain by natural mangrove clays, grey-brown in colour with inclusions of mangrove roots.

It is noted that tar impacted soils remain at depths greater than 2 m bgs within the 5 metre Ausgrid tower easement, to the north and west of the tower footprint.

2.10 Passive Environmental Management System

As per NSW EPA (2020) Guidelines for Reporting on Contaminated Sites, this LTEMP is deemed passive in nature in the context of the site in its current state (without buildings).

3. Application and Enforcement of LTEMP and Responsibilities

3.1 Overview and Application of LTEMP

This LTEMP is to be implemented indefinitely during site operation under a commercial/industrial land use such that it can be demonstrated that it is no longer required, i.e that identified contamination and HGG risks onsite have been demonstrated as posing an acceptable level of risk to human health and the environment, subject to review by a NSW EPA accredited Site Auditor.

It is understood responsibility for implementation of the LTEMP will be borne by the site owner (TfNSW). Any workers on site must be made aware of the LTEMP and inducted into its requirements. This includes future development workers associated with utilities or other infrastructure on site that is not owned/controlled by TfNSW, and those undertaking activities which have the potential to disturb capped contaminated soils, such as those that involve subsurface ground excavation or future service/building maintenance.

TfNSW are to ensure the long-term implementation and on-going monitoring of the site in accordance with the LTEMP and will be required to notify the existence of this LTEMP via appropriate mechanisms i.e.identification of the LTEMP on Sutherland Shire Council (Council) Section 10.7 planning certificates. A person in a senior management position such as the WHS/Environment Manager or Facilities/Maintenance Manager within TfNSW is to be given the responsibility for ensuring the implementation and maintenance of the provisions of this LTEMP. This LTEMP will be incorporated into TfNSW's Environmental Management Systems. The existence of this LTEMP will also be noted on the planning certificate for the site.

Controls in this LTEMP apply to all operation and maintenance activities on site such as:

- Underground utility/service installation, maintenance or removal;
- Building development and maintenance; and
- Any excavations (e.g. dug, cut, bored, etc.).

Should any works involve the disturbance or exposure of contaminated soils, then site workers will be required to be trained, suitability inducted into this LTEMP, and inspections undertaken prior to and post any site works.

For general site activities, such as normal day to day use and maintenance of the above ground portions of the existing site, environmental management controls are not onerous.

It should be noted at this point that the LTEMP is in no way intended to replace or supersede existing Management Plans and/or Health Safety Plans prepared by the Site Owner (refer **Section 3.4**) or Site Operator (refer **Section 3.5**) for management of the site and associated improvements. Instead, the LTEMP should be considered as a supplement to these documents and is to deal with issues unique to residual contamination retained beneath the site and management of the potential for recontamination of the site.

This LTEMP will apply indefinitely during future site operation.

It is not intended that the LTEMP apply to major excavations, earthworks or construction activities. A specific management plan should be prepared if major works are proposed for the encapsulated area.

3.2 Enforcement of LTEMP

This LTEMP, and its preparation and implementation, will be legally enforced by registration of a public positive covenant on the land title pursuant to Section 88B of the Conveyancing Act 1919, whereby the LTEMP will be registered as a memorandum in the terms of the public positive covenant within the Section 88B instrument.

3.3 Notification of LTEMP

Future planning certificates as may be prepared by Council under s.10.7 of the *Environmental Planning and Assessment Act 1979* for subject lot(s) will document the existence of the SAS and associated LTEMP.

3.4 Management Structure and Responsibilities

3.4.1 Stakeholders

For the site in its current condition, the following stakeholders include TfNSW, Sutherland Shire Council, existing operating oyster farmers and potential future leasers of the site.

The above stakeholders will be required to be informed to any changes in site condition, noting future development works will be subject to development consent.

3.4.2 Site Owner

The site is owned and managed by TfNSW.

It is the responsibility of the Site Owner to ensure that:

- A copy of this LTEMP is provided to all organisations/persons acquiring ownership of all or part of the site (Site Owners, if the site is to be divested).
- A site owner must provide a copy of this LTEMP to any successor in Title (i.e., sale of the site to a new owner).
- A copy of this LTEMP must be provided to Site Operators.

3.4.3 Site Operator

It is the responsibility of the Site Operator, under the management of TfNSW/relevant Project Managers, to ensure that:

- A copy of this LTEMP is provided to all persons with management or control of a workplace at the site.
- A person/s with management or control of the workplace is made responsible for the implementation and maintenance of the provisions of this LTEMP.
- A person in a senior management position such as the Environmental Manager or Faculties/Maintenance Manager from TfNSW is given the responsibility for ensuring the implementation and maintenance of the provisions of this LTEMP. The nominated Manager may appoint appropriate personnel to implement the LTEMP day to day but will remain the responsible manager to whom the appointed personnel must report.
- Site personnel or contractors that must conduct any intrusive works at the site (above or below the marker layer) are inducted into the LTEMP and are aware of their responsibilities with regard to health and safety and protection of the environment.
- A copy of this LTEMP is supplied to anyone conducting intrusive works on the site.
- The requirements for HGG mitigation measures as detailed in this LTEMP have been implemented and verified as acceptable during future development works at the site.
- The integrity of the marker and capping layers are maintained by application of the procedures outlined in this LTEMP.
- Ensuring any personnel or engaged contractors undertaking work that penetrates the depth of the capping layers and marker layer are aware of their responsibilities in relation to the encapsulated contaminated materials.

- The health and safety and environmental requirements specific to the contamination issues on the site, as outlined in this LTEMP, are complied with.
- WHS incidents are reported in a timely manner to the appropriate statutory authorities, as necessary in accordance with legislation.
- Ensuring the required routine inspections of the capping layers are completed and accurate records maintained as detailed in **Section 2.8** and accurate records of each inspection are retained.
- Organising appropriate works in the event that unexpected breaches of the capping and marker layers are encountered and that any disturbance to the capping layers and marker layer are appropriately reinstated in accordance with the requirements of this LTEMP.
- Inducting relevant personnel, contractors and visitors into the requirements of this LTEMP. Detailed records of personnel inducted into the conditions of this LTEMP shall be kept (**Appendix B**).
- Documenting and updating records to reflect any works completed within the site that may have extended below the depth of the capping layers and marker layer (**Appendix C**).

3.4.4 Contractors and Personnel Undertaking Works

It is the responsibility of contractors and personnel undertaking works within the site (extent of the LTEMP) under the management of the Site Operator or TfNSW and their appointed Project Managers where applicable to ensure that:

- They do not commence any works within the site unless they have been inducted into and understand the requirements of this LTEMP; and
- They implement all the procedures documented within this LTEMP during all works at the site as well as any additional contamination and/or WHS regulatory requirements in force at that time inclusive of communications with the Site Operator.

3.5 Summary of Provisions of this LTEMP

The provisions of this LTEMP are summarised as follows:

- Site personnel or contractors required to conduct intrusive works at the site must be inducted into the LTEMP and must be aware of their responsibilities with regard to health and safety and protection of the environment;
- A copy of this LTEMP is to be supplied to all persons conducting intrusive works above or below the marker layer on the site;
- The integrity of the marker and capping layers must be maintained by application of the procedures outlined in this LTEMP; and
- The health and safety and environmental requirements specific to the TRH, PAH, TBT and asbestos in soils and HGG mitigation measures within the site as outlined in this LTEMP must be complied with.

4. Ongoing Environmental Management Controls and Monitoring

4.1 Current Use of the Site

The environmental management procedures provided in the **Appendix E** are to be implemented during all activities associated with day to day management of the site under a commercial/industrial land use, including grounds maintenance activities. Buildings and underground services should not be installed within the 5 metre Ausgrid tower exclusion zone due to residual tar impacts remaining in-situ, as shown on **Figure 5**.

4.2 Basic Personal Protective Equipment (PPE) and Hygiene

Notwithstanding the outcomes of the job risk analysis (JRA) to be completed as part of a safety plan for any works undertaken at the site, workers/external contractors who may potentially come into contact with contaminated media in the subsurface are required to wear, as a minimum, the following personal protective equipment (PPE):

- Overalls or long-sleeved shirt and long pants;
- Heavy duty outer gloves where there is a risk of cuts or abrasions (inclusive of works within the capping layer comprising traces of metal staples);
- Otherwise latex/nitrile outer gloves if in direct contact with contaminated soil;
- Steel capped boots; and
- Safety glasses.

Additional PPE is required as described below when working with potentially asbestos impacted material, including disposable Tyvek coveralls, boot covers and minimum P2-rated mask (or higher class) face respirator.

Basic hygiene rules should apply with no eating, drinking or smoking during the works. Wash hands following the works and before eating, drinking or smoking.

4.3 Emergency Contacts

Emergency contacts are listed in **Table 4.1** below.

Table 4.1: Emergency Contacts

Emergency Contact	Contact number
Transport for NSW	02 8202 2200
Caringbah Medical Centre (President Avenue, Caringbah)	9525 9477
Sutherland Hospital (Kingsway and Kareena Road, Caringbah)	9540 7111
Emergency Services (Police, Fire & Rescue, Hazmat, Ambulance)	000 / 112
NSW State Emergency Service	13 25 00
SafeWork NSW	13 10 50
NSW EPA Pollution Reporting	13 15 55
Department of Health	1800 020 103

All environmental management controls and monitoring procedures are provided in **Appendix E** and outlined in **Table 4.2** below.

Table 4.2 Environmental Management Controls and Monitoring Procedures

Procedure No.	Environmental Management and Monitoring Procedure
E1	Minor Surface Works / Maintenance Procedure
E2	Intrusive Works Procedure
E3	Hazardous Ground Gas Controls
E4	Enclosed Structure and Confined Space Maintenance Procedure
E5	Soil Contamination and Asbestos Management Plan Procedure
E6.1	Works Involving Soil Disturbance and Maintenance Procedure
E6.2	Airborne Asbestos Fibre Monitoring Procedure
E6.3	Spoil Stockpile Management Procedure
E6.4	Dust Management Procedure
E6.5	Waste Management Procedure
E6.6	Asbestos Clearance Certification and Validation Procedure
E6.7	Personal, Plant and Vehicle Decontamination Procedure
E7	Unexpected Finds Procedure
E8	Groundwater Management Procedure

5. Gas Risk Mitigation System Management

5.1 Gas Risk Mitigation System Design and Verification

Given hazardous ground gas has been identified during historical site assessments, gas mitigation measures are required for all future development works at the site. It is noted that for the suitability of the site in its current state (without buildings), the below gas risk mitigation system design and verification is not required, however, has been provided for information purposes to assist with future redevelopment planning and design.

The proposed designs require validation and verification by an independent HGG Construction Quality Assurance (CQA) inspector throughout the installation and integrity testing process in accordance with Ground Gas Construction Quality Assurance Plans (CQAP) prepared for the proposed development(s). Following development of the CQAP and implementation of the gas protection measures, a Ground Gas Verification Report will be required to document the installation and outcomes of quality performance of the gas protection measures for each development proposed at the site. The CQAP should be developed in accordance with CIRIA C735 (2014) *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases*.

As required by Section 6.5 in NSW EPA 2020*,* compliance with the LTEMP is an essential fire safety measure on the fire safety schedule issued for buildings when developed on the site. The outcome of the annual review must be provided to Sutherland Shire Council and the Commissioner of Fire and Rescue NSW in the annual fire safety statement. This is to ensure that implementation of the LTEMP occurs on buildings or until such time as it is determined that hazardous ground gas at the site is no longer deemed to pose a risk to site users when assessed in accordance with legislation, regulations or applicable guidelines.

In accordance with JBS&G 2021b, the proposed land use for the site was considered a CS 3, with specific gas mitigation management or controls required. The CS has been used to provide an initial screen of appropriate gas protection guidance values using a detailed description of the five potential building categories (**Table 5.1**).

Table 5.1: Guidance values for gas protection (NSW EPA 2020)

Characteristic gas situation (CS)	Required gas protection guidance value				
	Low density residential	Medium-high density residential (strata title)	Public buildings, schools, hospitals, shopping centres	Standard commercial buildings (offices, etc)	Large commercial (warehousing) and industrial buildings
1	0	0	0	0	0
2	3	3	3	2	1 (a)
3	4	3	3	2	2
4	6 (b)	5 (b)	5	4	3
5	6 (b)	6 (b)	6 (c)	5	4
6	6 (b)	6 (b)	6 (c)	6	6

(a) If maximum measured methane concentration exceeds 20%, increase to CS3.

(b) Residential development not recommended at CS4 and above without pathway intervention and high level of management.

(c) Consideration of evacuation issues and social risks required.

To manage risks of ground gases to a site, NSW EPA 2020 prescribes minimum management controls that can be incorporated within the built form of the development based on the measured CS value for the site. For a site with a CS of 3, NSW EPA (2020) indicates that the gas protection guidance value for the site is 2 for all commercial buildings.

It is noted that the below protection measures will apply for buildings that are proposed to be constructed on grade to the existing site surfaces. Should buildings be erected with a void space or other appropriate ventilation layers beneath the buildings, prohibiting potential HGG accumulation within these buildings, then the requirement for the installation of gas protection measures will be re-visited when development plans are provided.

Examples for compliant building protection have been provided below, noting these are provided as examples only, with the gas protection measures to be revisited following detailed development plans of proposed redevelopments:

- Storage sheds and any relatively large footprint building should be classified *Large commercial (warehousing) and industrial buildings* as per **Table 5.1**. BS8545:2015+A1:2019 as well as offices classified as *Standard commercial buildings (offices, etc)* as per **Table 5.1**. BS8545:2015+A1:2019. Therefore occupied commercial buildings installed across the sitewould require installation of a mitigation system that exceeds a score of 2 that could be achieved by:
  - Installation of a reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints (refer to **Table 5.2**); and
  - Installation of a permanent monitoring system installed in the occupied space of the building **or** installation of a proprietary gas-resistant membrane or sub-floor ventilation under independent CQA.
- Substations, where they are deemed as buildings with the potential for HGG accumulation risks to relevant human receptors are potentially higher risk structures due to the inherent sparking/ark risks from the switchgear, therefore have installed mitigation measures that exceed a score of 2:
  - Installation of a reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints (refer to **Table 5.2**);
  - Installation of a permanent monitoring system installed in the occupied space of the building **or** installation of a proprietary gas-resistant membrane or sub-floor ventilation under independent CQA;
  - The building must have good ventilation such as ceiling/roof vents; and
  - Seals installed on all incoming cables conduits and internal voids in conduits.

Table 9 of NSW EPA (2020) provides various strategies for the implementation of engineered protection measures and associated scores that can be implemented to achieve the gas protection value required for the site. Gas protection measures and scores from Table 9 of NSW EPA 2020 are provided in **Table 5.2**.

Table 5.2: Gas protection measures and scores (NSW EPA 2020).

Measure or system element	Score	Comments
Venting and dilution measures		
Passive sub-floor ventilation with very good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 0.3 meters per second (m/s) (a)	2.5	The design of the venting layer (i.e. granular medium with inlet/outlet pipes versus open-void or modular drainage system) (b) must be considered when modelling steady-state concentrations
Passive sub-floor ventilation with good performance – the steady-state concentration of methane over 100% of the ventilation layer remains below 1% v/v at a wind speed of 1 m/s and below 2.5% v/v at a wind speed of 0.3 m/s) (a)	1.5	If post-installation testing of passive ventilation indicates that it cannot meet this requirement, inlets and outlets must be upgraded. If this is unsuccessful, it will be necessary to retrofit an active system

Measure or system element	Score	Comments
Sub-floor ventilation with active abstraction or pressurization	2.5	Not appropriate for NEPM HIL A residential settings because robust management systems, including alarms, must be in place to ensure long-term operation and maintenance. Achieving the full score requires a design with adequate redundancy and full coverage of the building footprint.
Ventilated car park (basement or undercroft)	4.0(d)	Assumes that the car park is vented to deal with exhaust fumes in accordance with BCA(c) requirements. The design of a carpark and the specifications of its ventilation system need to be considered in assigning an appropriate score of up to four.
Horizontal soil barriers beneath building footprint		
Horizontal clay or amended soil barriers designed to achieve defined permeability and diffusivity of the gases of concern placed, compacted and tested under appropriate engineering supervision	(d)	Requires appropriate engineering input and integration with the building design from the earliest possible stage. This must consider the effects of any proposed piling on the gas regime
Floor slabs		
Reinforced concrete ground-bearing floor slab or waffle pod slab	0.5	At a minimum, it is good practice to install ventilation in all foundation systems to relieve pressure. Breaches in floor slabs, such as joints, must be effectively sealed against gas ingress to maintain performance
Reinforced concrete ground-bearing foundation raft slab with limited service penetrations cast into slab	1.0	
Reinforced concrete cast in situ or post-tensioned suspended slab with minimal service penetrations and water bars around all penetrations and at joints	1.5	
Fully tanked basement	2.0(d)	The design of a basement and the specifications of its ventilation system need to be considered in assigning an appropriate score. Fully tanked means designed to be waterproof under the range of groundwater conditions likely at the site, to the extent that supplementary internal drainage is not required.
Membranes		
Proprietary gas-resistant membrane with a gas transmission rate for the gases of concern on the site that is certified and appropriate to the overall design of the gas protection system. It should be installed by a specialist to an appropriate level of workmanship with documented internal CQC, including integrity testing (e.g. tracer gas or smoke testing), under independent CQA carried out by a certified specialist(e) or appropriately qualified and experienced professional with independent verification of the entire process(f)	2.0	Membrane performance depends on the membrane material and thickness specified, design and quality of the installation, protection from and resistance to damage after installation, and the integrity of joints in membranes that require joints. Materials that offer some degree of self-sealing and repair are preferred. Long- term performance depends on the durability of the material, including its resistance to chemical degradation in the environment in which it is installed
Monitoring and detection (alarms)		
Intermittent monitoring using hand-held equipment	0.5	

Measure or system element	Score	Comments
Permanent monitoring system installed in the occupied space of the building	1.0	Monitoring and alarm systems are only valid as part of a combined gas protection system. Where fitted, permanent systems should be installed in the underfloor venting system but can also be provided in the occupied space as a back-up
Permanent monitoring system installed in the underfloor venting or dilution system	2.0	
Pathway intervention external to building footprint		
Vertical barriers	(g)	Required for residential and public buildings at CS 4 and above
Vertical venting systems (source depressurization)	(g)	
(a) Verified by post-construction monitoring (b) See Appendix 6 (of NSW EPA 2020) (c) Building Code of Australia (d) Score depends on site-specific conditions and design (e) For example, Geosynthetic Certification Institute – Inspectors Certification Program (f) See Appendix 7 (of NSW EPA 2020) (g) Score depends on site-specific conditions and design, but scores of 4.0+ should be achievable		

Gas risk mitigation management procedures are provided in **Appendix F** and outlined in **Table 5.3** below.

Table 5.3 GRMS Management Procedures

Procedure No.	GRMS Management Procedure
F1	Gas Risk Mitigation System Inspection Procedure
F2	Hazardous Ground Gas Required Corrective Actions / Contingency Plan Procedure

6. Health and Safety Management

It is the responsibility of the Site Manager (TfNSW) to ensure that comprehensive health and safety programmes are implemented that are appropriate for the activities underway at a site.

Given that the LTEMP includes controls for working with contaminated soils and hazardous ground gases, and should intrusive works be undertaken, considerations need to be given to the following:

- Monitoring and controls to mitigate risks from potential hazardous ground gas, in particular methane concentrations, and other harmful hazardous ground gas accumulation, including consideration of the requirements of SafeWork Australia 2019, *Workplace Exposure Standards for Airborne Contaminants (SWA 2019)*, and SafeWork Australia 2020, *Code of Practice Confined Spaces (SWA 2020c),* should entry into excavations where there is a potential risk of hazardous ground gas accumulation;
- Monitoring and controls to mitigate exposure risks from asbestos impacted soils beneath the marker layer in accordance with SafeWork Australia 2020, *Code of Practice How to manage and control asbestos in the workplace* (SWA 2020b) and *How to safely remove asbestos (SWA 2020a)*; and
- Controls to mitigate risks from contact with potentially contaminated soils should excavations extend beneath the groundwater table i.e. ASS / PASS conditions.

The highest risk exposure pathway that can lead to health effects from asbestos is inhalation of airborne respirable fibres. Consequently, workers who may undertake ground disturbance work and potentially be exposed to dust in the atmosphere that has the potential to contain asbestos fibres, must wear appropriate respiratory protection equipment (RPE). Further, measures must be taken to ensure that asbestos fibres potentially released from impacted materials are not carried out of the work area to surrounding areas where breathing protection would not ordinarily be considered a requirement. A soil contamination and asbestos management plan including general environmental monitoring requirements (dust, odour, waste management etc.) is presented in **Appendix E.**

The Site Manager should ensure that the ground disturbance works are carried out in accordance with a relevant Job Safety Risk Assessments and/or Safe Work Method Statements and requirements outlined within this LTEMP.

All WHS management procedures are provided in **Appendix G** and are outlined in **Table 6.1** below.

Table 6.1 WHS Management Procedures

Procedure No.	WHS Management Procedure
G1	Specific Requirements for Working in Confined Spaces Procedure
G2	Specific Requirements for Working with Asbestos Procedure

7. Revision of the LTEMP

It may be necessary to revise the long term LTEMP to reflect changes to legislation and / or regulatory requirements, changes to site conditions and/or improvements in technologies or knowledge.

It is noted that the LTEMP will require updating following redevelopment and construction of buildings at the site when installation of appropriate gas protection measures have been installed and independently verified.

If no changes to the site condition occur, the LTEMP should be reviewed every 5 years for the following aspects:

- Revision of the LTEMP will be necessary if the details in the LTEMP have changed (i.e. further assessment provides additional data to inform the LTEMP, impacted material has been remediated / removed from site, additional or unexpected impacts are encountered during site works and/or material changes in relevant legislation, codes and guidelines, changes to building construction at the site (if constructed));
- Revision of the LTEMP will be necessary on completion of development works to incorporate the design details, inclusive of gas protection measures for any buildings constructed on the site;
- Revision of the LTEMP should be undertaken by an appropriately qualified and experienced Environmental Consultant;
- Copies of the revised LTEMP should be issued to Sutherland Shire Council for agreement;
- Copies of the revised LTEMP should be distributed to the current Site Manager for on-going implementation; and
- The Site Manager should ensure that the most current, up to date LTEMP is provided to all workers on site as part of induction into the LTEMP and requirement to undertake work onsite.

It is noted an annual review of the LTEMP compliance should be undertaken as part of the Fire Safety Schedule issued for buildings if constructed at the site as an 'essential fire safety measure' when developed.

Revision of the LTEMP should be undertaken by a certified contaminated land consultant (certified in accordance with schemes recognised by NSW EPA). It is recommended that the revised document be reviewed by a NSW Contaminated Site Auditor accredited under the *CLM Act 1997*.

Any future changes in the LTEMP must not result in an increased risk to human health, structures and/or the environment.

8. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Figures

Legend:

- Site Boundary (New Sea Wall Alignment)
- Site Boundary (No Sea Wall in this Area)
- Previous Site Boundary

JBS&G

Job No: 51163	
Client: RMS	
Version: R05 Rev 0	Date: 08-Dec-2021
Drawn By: JA	Checked By: JS
Scale 1:8,500	

0 100 200
metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SITE LOCATION

FIGURE 1

File Name: N:\Projects\RMS\51163 Woolooware Bay Oyster Farm Assessment\GIS\Maps\R07 Rev A\51163_01_SiteLocation.mxd
Reference: © OpenStreetMap (and) contributors, CC-BY-SA

Legend:
- Site Boundary (New Sea Wall Alignment)
- Site Boundary (No Sea Wall in this Area)

JBS&G

Job No: 51163

Client: RMS

Version: R05 Rev A | Date: 08-Dec-2021

Drawn By: RF/RH | Checked By: JS

Scale 1:4,000

0 50 100
metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SITE SETTING

FIGURE 2

File Name: 51163_02_SiteSetting
Reference: www.nearmap.com, imagery date 20210617

Legend:
Site Boundary (New Sea Wall Alignment)
Site Boundary (No Sea Wall in this Area)
Site Features
Sandstone Blocks
Transmission Tower and Associated Slab
Sample Locations
Stormwater Pits

JBS&G

Job No: 51163	
Client: RMS	
Version: R05 Rev A	Date: 08-Dec-2021
Drawn By: RF/RH	Checked By: JS
Scale 1:1,250	

0 10 20
metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SITE LAYOUT AND EXISTING FEATURES

FIGURE 3

File Name: 51163_03_SiteLayout
Reference: www.nearmap.com, imagery date 20210617

Legend:
- Site Boundary (New Sea Wall Alignment)
- Site Boundary (No Sea Wall in this Area)
- Marker Layer

JBS&G

0 9 18
metres

Job No: 51163		Scale: 1:600	
Client: RMS		Coord. Sys. GDA 1994 MGA Zone 56	
Drawn By: RF / JA	Checked By: JS	Version: R05 Rev 0	Date: 08-Dec-2021

Woolaware Bay

MARKER LAYER

FIGURE 4

File Name: N:\Projects\RMS\51163 Woolooware Bay Oyster Farm Assessment\GIS\Maps\R07 Rev A\51163_09_MarkerLayer.mxd
Reference: www.nearmap.com - Imagery 26-09-2020

Legend:
- Site Boundary (New Sea Wall Alignment)
- Site Boundary (No Sea Wall in this Area)
- Marker Layer
- 5m Transmission Tower Exclusion Zone
- Tar Remains Insitu at depth >2 mbgs

JBS&G

0 9 18
metres

Job No: 51163

Scale: 1:600

Client: RMS

Coord. Sys. GDA 1994 MGA Zone 56

Drawn By: RF / JA

Checked By: JS

Version: R05 Rev 0

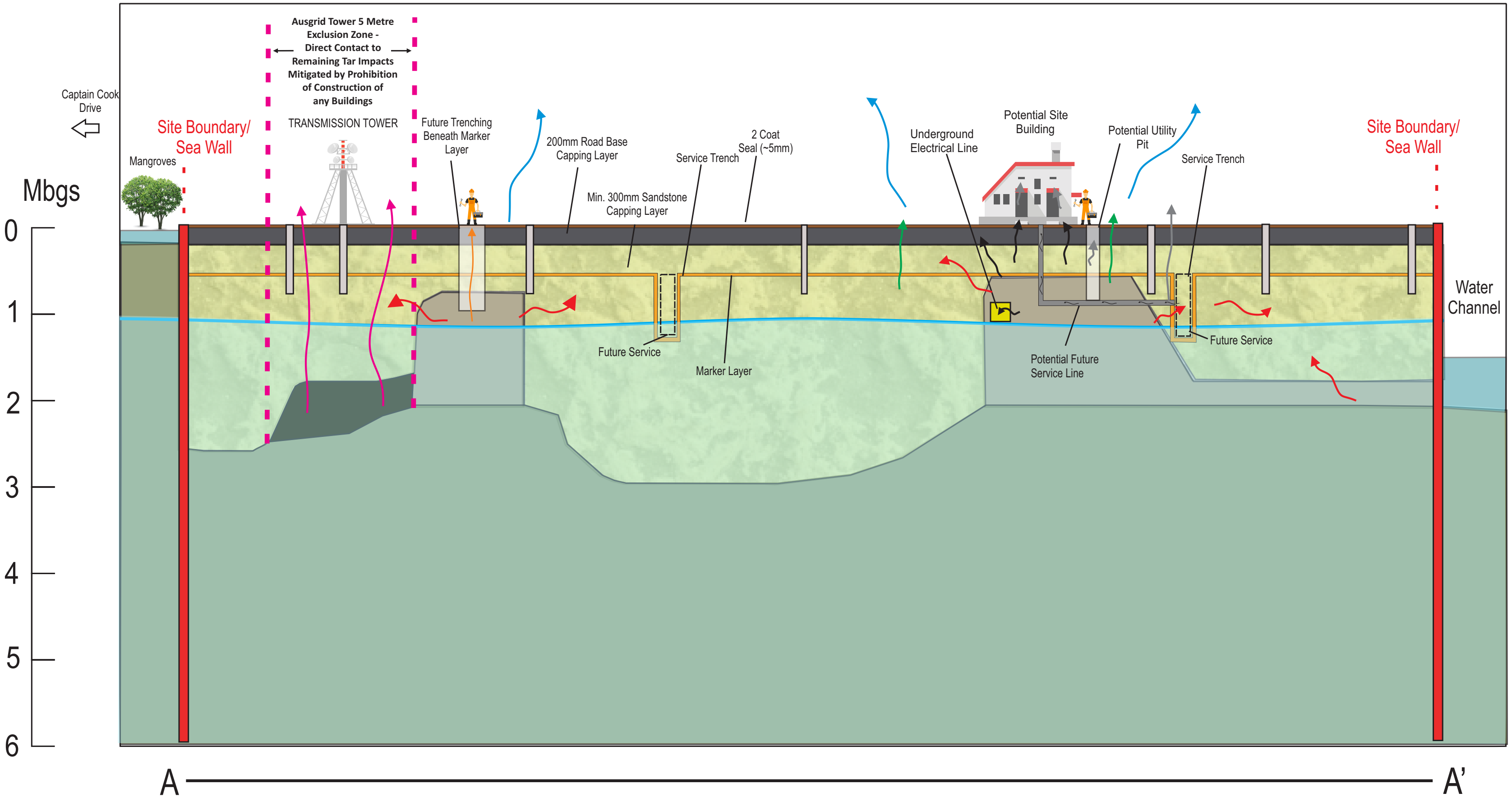
Date: 08-Dec-2021

Woolaware Bay

TAR IMPACTS REMAINING INSITU AND 5 METRE AUSGRID TOWER EXCLUSION ZONE

FIGURE 5

File Name: \\JBSG-NSW-FS01\Company Data\Projects\RMS\51163 Woolooware Bay Oyster Farm Assessment\GIS\Maps\R05 Rev A\51163_05_TarRemaining_AusGridExclusion.mxd
Reference: www.nearmap.com - Imagery 26-09-2020



Ground Gas SPR Linkages

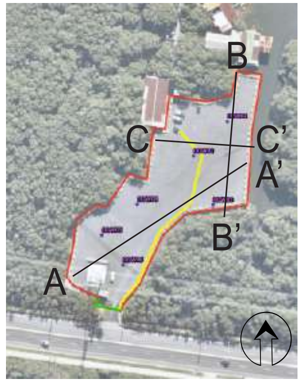
- Ground Gas release to atmosphere
- Ground Gas movement in unsaturated zone
- Ground Gas Migration Accumulation Risk
- Ground Gas Migration to Surface
- Potential Future Human Exposure Points

Remaining Contamination SPR Linkages

- Vapour Migration to Surface - Human Exposure Risk Mitigated by Prohibition of Buildings in 5 Metre Exclusion Zone
- Human Exposure Point - Inhalation of Dust/Soil Direct Contact'

Legend:

- Site Boundary / Sea Wall
- Inferred Standing Water Level
- Underground Electrical Line
- Stormwater Pit
- Sandstone
- Roadbase
- Historical Imported Uncontrolled Fill - GG Source
- Tar Impacted Fill Remaining Within 5 Metre Tower Exclusion Zone (>2 m bgs)
- Natural - Mangrove
- Site Wide 5mm 2 Coat Seal
- Marker Layer



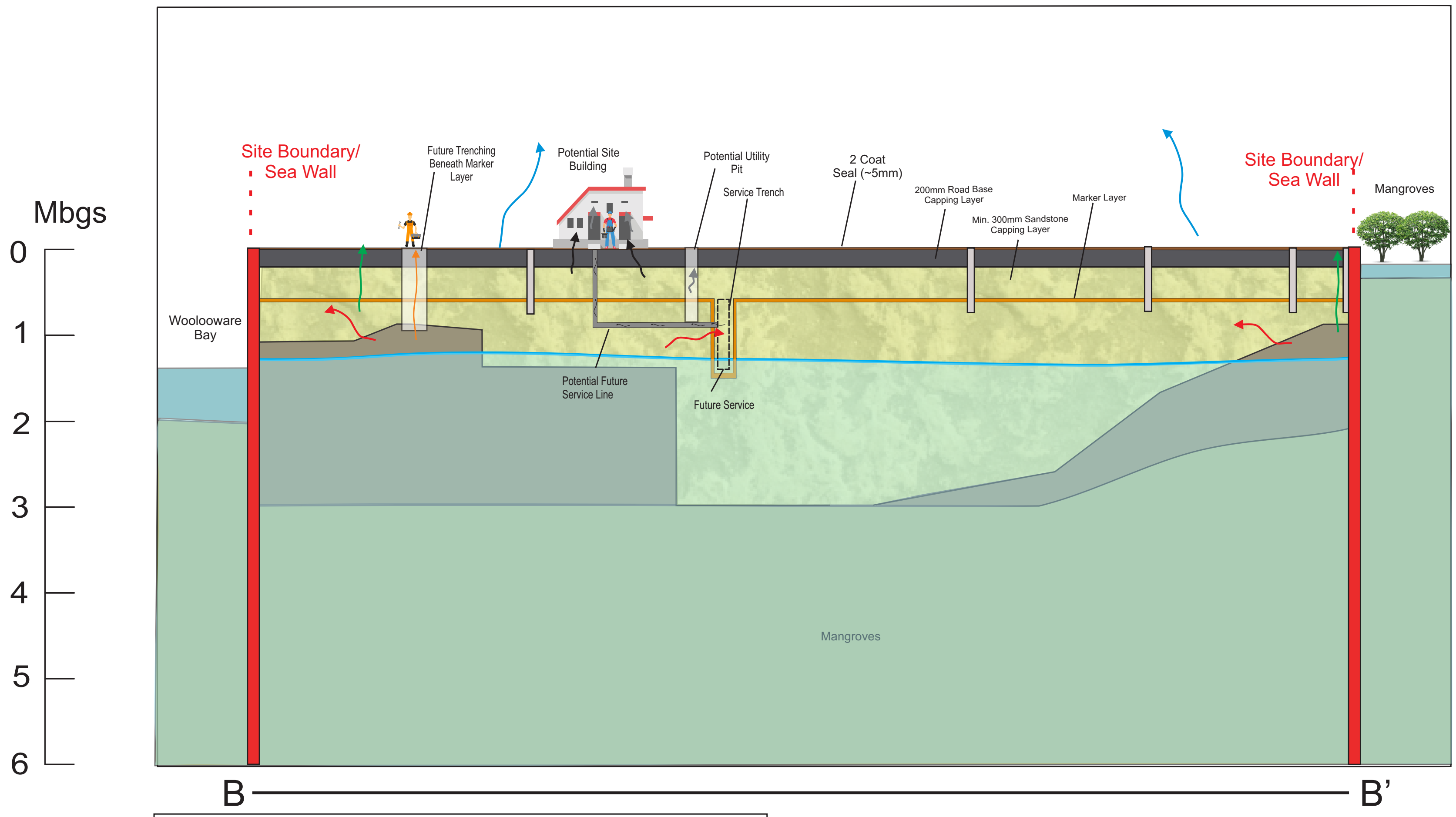
JBS&G

Job No: 51163	
Client: RMS	
Version: R05 Rev 0	Date: 24/11/2021
Drawn By: RH	Checked By: JS

Woolaware Bay, NSW

CROSS SECTION - A-A'

FIGURE 6A



Ground Gas SPR Linkages

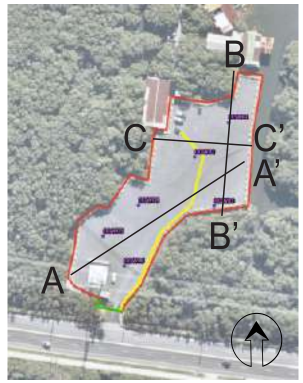
- Ground Gas release to atmosphere
- Ground Gas movement in unsaturated zone
- Ground Gas Migration Accumulation Risk
- Ground Gas Migration to Surface
- Potential Future Human Exposure Points

Remaining Contamination SPR Linkages

- Human Exposure Point - Inhalation of Dust/Soil Direct Contact'

Legend:

- Site Boundary / Sea Wall
- Inferred Standing Water Level
- Underground Electrical Line
- Stormwater Pit
- Sandstone
- Roadbase
- Historical Imported Uncontrolled Fill - GG Source
- Tar Impacted Fill Remaining Within 5 Metre Tower Exclusion Zone (>2 m bgs)
- Natural - Mangrove
- Site Wide 5mm 2 Coat Seal
- Marker Layer



JBS&G

Job No: 51163

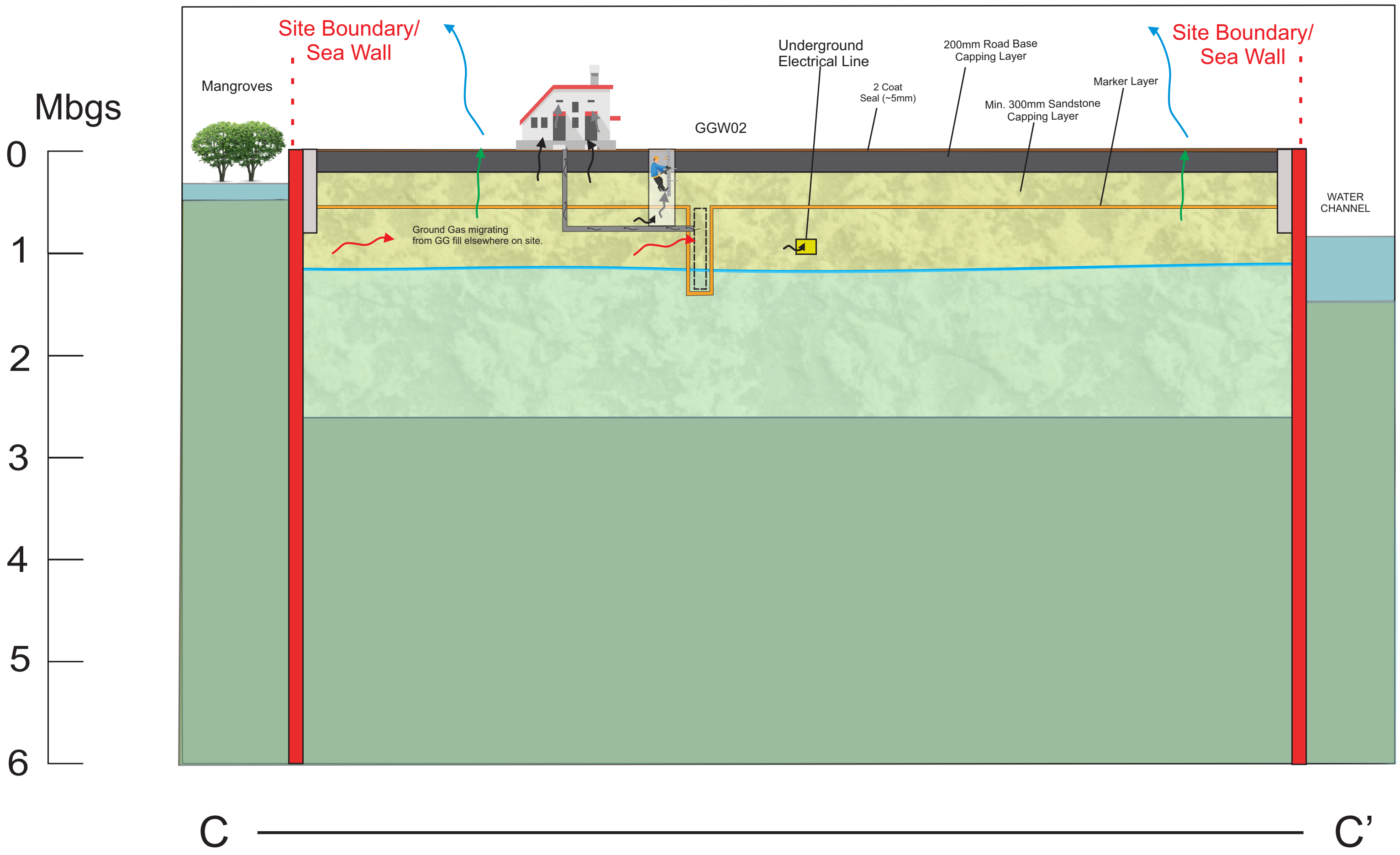
Client: RMS

Version: R05 Rev 0	Date: 24/11/2021
Drawn By: RH	Checked By: JS

Woolaware Bay, NSW

CROSS SECTION - B-B'

FIGURE 6B

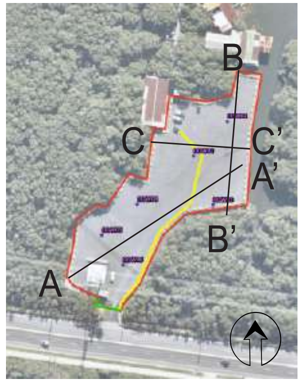


Ground Gas SPR Linkages

- Ground Gas release to atmosphere
- Ground Gas movement in unsaturated zone
- Ground Gas Migration Accumulation Risk
- Ground Gas Migration to Surface
- Potential Future Human Exposure Points

Legend:

- Site Boundary / Sea Wall
- Inferred Standing Water Level
- Underground Electrical Line
- Stormwater Pit
- Sandstone
- Roadbase
- Historical Imported Uncontrolled Fill - GG Source
- Tar Impacted Fill Remaining Within 5 Metre Tower Exclusion Zone (>2 m bgs)
- Natural - Mangrove
- Site Wide 5mm 2 Coat Seal
- Marker Layer



JBS&G

Job No: 51163	
Client: RMS	
Version: R05 Rev 0	Date: 21/12/2021
Drawn By: RH	Checked By: JS

Woolaware Bay, NSW

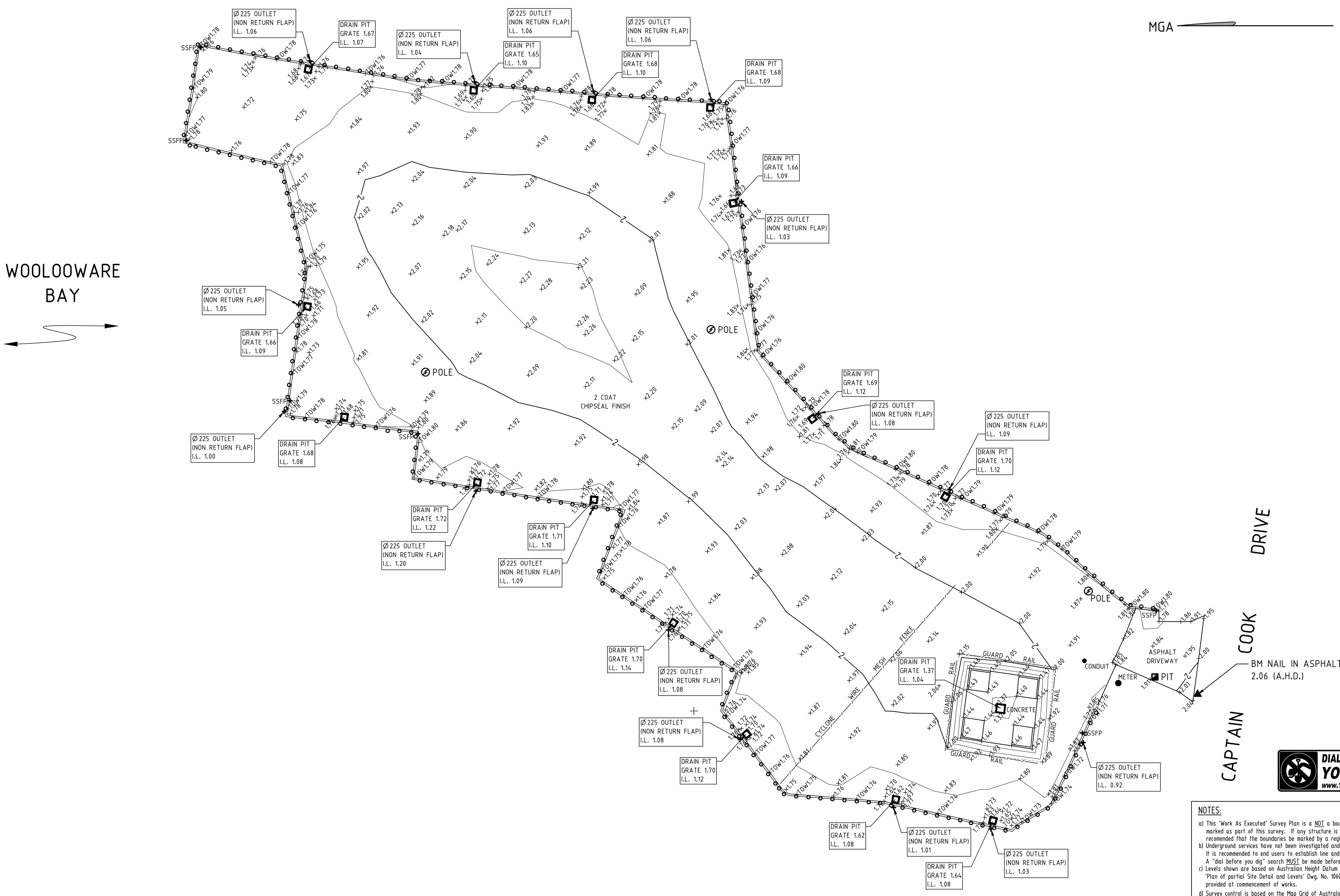
CROSS SECTION - C-C'

FIGURE 6C

Appendix A Site Surveys

WARNING

THE DIGITAL PDF VERSION CONSTITUTES THE ORIGINAL DOCUMENT.
THE BOUNDARIES HAVE NOT BEEN MARKED.
SCALING (DIGITALLY OR OTHERWISE) IS UNACCEPTABLE.



DIAL BEFORE YOU DIG
www.1100.com.au

NOTES:

a) This 'Work As Executed' Survey Plan is a NOT a boundary survey. The boundaries have not been marked as part of this survey. If any structure is to be erected upon the land then it is strongly recomended that the boundaries be marked by a registered land surveyor.
b) Underground services have not been investigated and, if shown, are in approximate positions only. It is recommended to end users to establish line and depth of buried assets prior to any excavation. A "dial before you dig" search MUST be made before any construction works can commence.
c) Levels shown are based on Australian Height Datum (origin 'B.M. Nail in Bitumen RL. 2.06' from plan 'Plan of partial Site Detail and Levels' Dwg. No. 10602-001/rev.A dated 20-9-2017 by 'Boxall' as provided at commencement of works.
d) Survey control is based on the Map Grid of Australia (origin CORSnet GNSS RTK - MGA56(GDA 94)).
e) Contours show indicative relief patterns only and are not to be used for level interpolation.
f) Contour interval = 0.2m.

BOSSI ID SU003841
Surveyor Registered under the Surveying and Spatial Information Act, 2002

5 2.5 0 5 10 15 20 25
NOTE: ALL DIMENSIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE

ROBERT FRIEND SURVEYS PTY LTD
Consulting Land Surveyor
PO Box 4209, Denistone East, NSW, 2112
Email: admin@rfsurveys.com.au Mobile: 0457 602 177

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SURVEY	DRAWN	AMENDMENTS	DATE	No.
R.F.	R.F.	ISSUED FOR INFORMATION PURPOSES ONLY	JUNE 2021	A

CLIENT: FORD CIVIL CONTRACTING PTY LIMITED

TITLE: WORKS AS EXECUTED SURVEY - 'OYSTER LEASES'
RMS LEASE AREA - CAPTAIN COOK DRIVE
WOOLOOWARE NSW 2230

SCALE 1 : 250
DRAWING No. 1802-17-A
SHEET 1 of 1
A1

===
12D MODEL - SURVEY CONFORMANCE REPORT: PAVEMENT
File: 1802-Capping Thickness 20210603.rpt
Page: 1

Original Survey File :
Lot Number : 'Oyster Farm' - RMS Lease Area
Lot Location : Captain Cook Drive, Woolooware
Lot Description : Capping Layer Thickness Analysis

Project : 1802 FORD Oyster Leases WOOLOOWARE

Design Pavement Tin : "1802 Surveyed FSL 20210514"

Depth From Design : 0 (vertical)

Tolerances Measured : vertical
Upper Tolerance : -0.500
Lower Tolerance : -100.000

Bottom of Pavement Tin : "1802 Surveyed FSL 20210514"

Point Desc	Point Easting	Point Northing	Point Level	FSL Level	Pavement Thickness
SUBGRADE	328951.344	6232027.366	1.243	1.743	-0.500
SUBGRADE	328952.623	6232024.424	1.254	1.788	-0.534
SUBGRADE	328954.827	6232053.623	1.245	1.774	-0.529
SUBGRADE	328954.929	6232048.659	1.231	1.798	-0.567
SUBGRADE	328955.432	6232037.313	1.343	1.862	-0.519
SUBGRADE	328956.920	6232023.657	1.286	1.879	-0.593
SUBGRADE	328957.110	6232026.926	1.347	1.878	-0.531
SUBGRADE	328957.513	6232031.751	1.370	1.907	-0.537
SUBGRADE	328959.072	6232036.618	1.387	1.984	-0.597
SUBGRADE	328959.161	6232041.912	1.358	1.898	-0.540
SUBGRADE	328960.750	6232047.277	1.342	1.927	-0.585
SUBGRADE	328961.049	6232051.861	1.321	1.877	-0.556
SUBGRADE	328962.284	6232036.248	1.398	2.019	-0.621
SUBGRADE	328962.633	6232019.663	1.335	1.861	-0.526
SUBGRADE	328962.932	6232059.767	1.258	1.773	-0.515
SUBGRADE	328963.180	6232022.422	1.352	1.913	-0.561
SUBGRADE	328964.356	6232041.010	1.445	2.011	-0.566
SUBGRADE	328964.735	6232063.181	1.187	1.774	-0.587
SUBGRADE	328965.388	6232045.587	1.394	1.989	-0.595
SUBGRADE	328965.760	6232017.121	1.347	1.856	-0.509
SUBGRADE	328966.173	6232035.705	1.432	2.070	-0.638
SUBGRADE	328966.293	6232050.681	1.362	1.930	-0.568
SUBGRADE	328967.937	6232021.962	1.389	1.972	-0.583
SUBGRADE	328968.236	6232061.421	1.271	1.840	-0.569
SUBGRADE	328968.315	6232057.185	1.315	1.886	-0.571
SUBGRADE	328969.477	6232039.761	1.492	2.075	-0.583
SUBGRADE	328969.607	6232016.646	1.367	1.872	-0.505
SUBGRADE	328970.086	6232044.460	1.460	2.044	-0.584
SUBGRADE	328970.673	6232025.891	1.452	2.023	-0.571
SUBGRADE	328971.369	6232034.818	1.451	2.146	-0.695
SUBGRADE	328971.431	6232030.762	1.491	2.084	-0.593
SUBGRADE	328971.642	6232049.279	1.457	2.009	-0.552
SUBGRADE	328972.056	6232021.043	1.423	1.929	-0.506
SUBGRADE	328973.249	6232054.943	1.443	1.968	-0.525
SUBGRADE	328973.640	6232025.443	1.469	1.996	-0.527
SUBGRADE	328973.660	6232038.421	1.508	2.125	-0.617
SUBGRADE	328974.283	6232043.628	1.539	2.117	-0.578
SUBGRADE	328974.444	6232058.886	1.418	1.944	-0.526
SUBGRADE	328975.123	6232030.171	1.531	2.034	-0.503
SUBGRADE	328975.963	6232033.866	1.533	2.056	-0.523
SUBGRADE	328976.765	6232048.160	1.546	2.095	-0.549

12D MODEL - SURVEY CONFORMANCE REPORT: PAVEMENT
File: 1802-Capping Thickness 20210603.rpt
Page: 2

Point Desc	Point Easting	Point Northing	Point Level	FSL Level	Pavement Thickness
SUBGRADE	328977.145	6232037.052	1.518	2.057	-0.539
SUBGRADE	328977.228	6232064.921	1.357	1.864	-0.507
SUBGRADE	328977.964	6232072.099	1.215	1.754	-0.539
SUBGRADE	328978.353	6232042.531	1.568	2.103	-0.535
SUBGRADE	328978.523	6232052.808	1.554	2.065	-0.511
SUBGRADE	328979.447	6232074.551	1.225	1.770	-0.545
SUBGRADE	328980.229	6232057.099	1.475	2.032	-0.557
SUBGRADE	328981.650	6232078.736	1.218	1.762	-0.544
SUBGRADE	328982.118	6232046.421	1.577	2.082	-0.505
SUBGRADE	328982.330	6232043.119	1.467	2.040	-0.573
SUBGRADE	328982.451	6232062.022	1.444	1.981	-0.537
SUBGRADE	328983.421	6232071.112	1.302	1.829	-0.527
SUBGRADE	328984.252	6232072.858	1.286	1.816	-0.530
SUBGRADE	328984.355	6232051.187	1.553	2.085	-0.532
SUBGRADE	328985.449	6232035.668	1.326	1.880	-0.554
SUBGRADE	328985.778	6232054.670	1.564	2.069	-0.505
SUBGRADE	328986.094	6232077.311	1.259	1.798	-0.539
SUBGRADE	328986.378	6232041.239	1.408	1.917	-0.509
SUBGRADE	328987.461	6232043.859	1.434	1.940	-0.506
SUBGRADE	328987.704	6232066.480	1.424	1.981	-0.557
SUBGRADE	328988.231	6232059.128	1.500	2.104	-0.604
SUBGRADE	328988.622	6232034.073	1.254	1.756	-0.502
SUBGRADE	328989.194	6232040.680	1.335	1.840	-0.505
SUBGRADE	328989.345	6232070.871	1.378	1.929	-0.551
SUBGRADE	328989.944	6232048.948	1.467	1.972	-0.505
SUBGRADE	328991.080	6232075.753	1.352	1.880	-0.528
SUBGRADE	328991.330	6232064.875	1.479	2.068	-0.589
SUBGRADE	328991.468	6232052.205	1.471	1.990	-0.519
SUBGRADE	328992.267	6232079.563	1.280	1.788	-0.508
SUBGRADE	328992.751	6232039.101	1.122	1.734	-0.612
SUBGRADE	328993.120	6232068.613	1.478	2.043	-0.565
SUBGRADE	328993.173	6232045.021	1.291	1.822	-0.531
SUBGRADE	328993.211	6232084.447	1.288	1.824	-0.536
SUBGRADE	328993.819	6232056.227	1.452	1.993	-0.541
SUBGRADE	328994.613	6232089.760	1.263	1.845	-0.582
SUBGRADE	328994.749	6232043.510	1.198	1.760	-0.562
SUBGRADE	328995.074	6232077.231	1.349	1.933	-0.584
SUBGRADE	328995.401	6232062.493	1.506	2.089	-0.583
SUBGRADE	328995.542	6232096.848	1.251	1.784	-0.533
SUBGRADE	328995.669	6232050.532	1.342	1.864	-0.522
SUBGRADE	328995.826	6232073.669	1.466	2.019	-0.553
SUBGRADE	328996.504	6232048.282	1.282	1.803	-0.521
SUBGRADE	328997.204	6232082.951	1.332	1.899	-0.567
SUBGRADE	328997.215	6232066.191	1.509	2.128	-0.619
SUBGRADE	328998.985	6232088.598	1.313	1.914	-0.601
SUBGRADE	328999.037	6232100.730	1.245	1.832	-0.587
SUBGRADE	328999.509	6232053.683	1.236	1.778	-0.542
SUBGRADE	328999.577	6232060.070	1.386	1.931	-0.545
SUBGRADE	328999.902	6232071.658	1.576	2.140	-0.564
SUBGRADE	329000.071	6232075.670	1.499	2.082	-0.583
SUBGRADE	329000.920	6232094.469	1.303	1.915	-0.612
SUBGRADE	329001.054	6232064.102	1.351	2.005	-0.654
SUBGRADE	329002.164	6232105.826	1.300	1.819	-0.519
SUBGRADE	329002.179	6232105.829	1.295	1.819	-0.524
SUBGRADE	329002.731	6232069.440	1.570	2.111	-0.541
SUBGRADE	329003.096	6232098.651	1.363	1.921	-0.558
SUBGRADE	329003.356	6232079.974	1.531	2.092	-0.561
SUBGRADE	329003.758	6232057.589	1.211	1.793	-0.582
SUBGRADE	329003.845	6232111.929	1.243	1.760	-0.517
SUBGRADE	329003.886	6232086.167	1.457	2.039	-0.582
SUBGRADE	329005.207	6232073.715	1.546	2.161	-0.615

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Point Desc	Point Easting	Point Northing	Point Level	FSL Level	Pavement Thickness
SUBGRADE	329006.068	6232091.592	1.442	2.046	-0.604
SUBGRADE	329007.382	6232077.542	1.588	2.207	-0.619
SUBGRADE	329007.386	6232067.167	1.416	2.004	-0.588
SUBGRADE	329007.733	6232061.614	1.243	1.865	-0.622
SUBGRADE	329008.241	6232096.086	1.473	2.043	-0.570
SUBGRADE	329009.173	6232082.954	1.626	2.186	-0.560
SUBGRADE	329009.857	6232071.485	1.510	2.067	-0.557
SUBGRADE	329010.013	6232102.028	1.423	1.975	-0.552
SUBGRADE	329010.207	6232062.885	1.338	1.867	-0.529
SUBGRADE	329010.495	6232104.657	1.411	1.939	-0.528
SUBGRADE	329011.560	6232109.411	1.348	1.877	-0.529
SUBGRADE	329011.634	6232087.753	1.642	2.191	-0.549
SUBGRADE	329011.818	6232074.947	1.584	2.124	-0.540
SUBGRADE	329012.314	6232061.136	1.264	1.779	-0.515
SUBGRADE	329012.573	6232112.228	1.295	1.822	-0.527
SUBGRADE	329013.411	6232116.241	1.189	1.725	-0.536
SUBGRADE	329013.796	6232068.728	1.400	1.967	-0.567
SUBGRADE	329013.876	6232092.700	1.621	2.167	-0.546
SUBGRADE	329014.167	6232079.926	1.660	2.196	-0.536
SUBGRADE	329015.147	6232101.069	1.509	2.061	-0.552
SUBGRADE	329015.576	6232062.046	1.267	1.785	-0.518
SUBGRADE	329015.785	6232104.144	1.457	2.025	-0.568
SUBGRADE	329016.091	6232072.256	1.475	2.021	-0.546
SUBGRADE	329016.516	6232084.372	1.716	2.254	-0.538
SUBGRADE	329016.517	6232108.413	1.415	1.963	-0.548
SUBGRADE	329016.805	6232111.847	1.380	1.881	-0.501
SUBGRADE	329017.566	6232066.072	1.345	1.882	-0.537
SUBGRADE	329018.991	6232076.616	1.520	2.096	-0.576
SUBGRADE	329019.463	6232089.498	1.698	2.253	-0.555
SUBGRADE	329019.739	6232069.883	1.387	1.947	-0.560
SUBGRADE	329020.264	6232100.075	1.607	2.135	-0.528
SUBGRADE	329021.098	6232103.709	1.543	2.096	-0.553
SUBGRADE	329021.381	6232063.181	1.216	1.789	-0.573
SUBGRADE	329021.408	6232081.367	1.569	2.168	-0.599
SUBGRADE	329021.663	6232108.029	1.472	2.024	-0.552
SUBGRADE	329021.819	6232111.822	1.409	1.941	-0.532
SUBGRADE	329023.425	6232074.042	1.406	2.016	-0.610
SUBGRADE	329023.445	6232093.757	1.649	2.185	-0.536
SUBGRADE	329023.571	6232067.395	1.341	1.874	-0.533
SUBGRADE	329023.885	6232099.629	1.628	2.172	-0.544
SUBGRADE	329024.711	6232086.025	1.620	2.123	-0.503
SUBGRADE	329024.856	6232103.086	1.621	2.151	-0.530
SUBGRADE	329025.007	6232107.801	1.524	2.072	-0.548
SUBGRADE	329025.903	6232078.458	1.400	2.032	-0.632
SUBGRADE	329026.227	6232111.661	1.445	1.989	-0.544
SUBGRADE	329027.499	6232090.391	1.544	2.090	-0.546
SUBGRADE	329027.833	6232098.955	1.605	2.110	-0.505
SUBGRADE	329027.933	6232094.454	1.519	2.092	-0.573
SUBGRADE	329028.628	6232102.696	1.577	2.103	-0.526
SUBGRADE	329028.628	6232107.649	1.551	2.097	-0.546
SUBGRADE	329028.807	6232111.778	1.465	1.983	-0.518
SUBGRADE	329028.987	6232071.611	1.345	1.875	-0.530
SUBGRADE	329030.298	6232075.726	1.352	1.910	-0.558
SUBGRADE	329030.724	6232065.239	1.265	1.766	-0.501
SUBGRADE	329030.895	6232069.980	1.294	1.849	-0.555
SUBGRADE	329031.783	6232081.744	1.387	1.961	-0.574
SUBGRADE	329032.011	6232086.334	1.422	1.989	-0.567
SUBGRADE	329032.286	6232091.809	1.420	2.004	-0.584
SUBGRADE	329033.018	6232097.669	1.458	1.995	-0.537
SUBGRADE	329033.625	6232102.649	1.494	1.999	-0.505
SUBGRADE	329033.937	6232107.276	1.474	1.980	-0.506

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Point Desc	Point Easting	Point Northing	Point Level	FSL Level	Pavement Thickness
SUBGRADE	329034.247	6232111.937	1.389	1.928	-0.539
SUBGRADE	329034.579	6232116.120	1.349	1.862	-0.513
SUBGRADE	329034.825	6232065.058	1.254	1.769	-0.515
SUBGRADE	329034.838	6232070.118	1.272	1.799	-0.527
SUBGRADE	329035.888	6232081.479	1.349	1.877	-0.528
SUBGRADE	329036.544	6232086.358	1.386	1.904	-0.518
SUBGRADE	329037.080	6232091.715	1.352	1.900	-0.548
SUBGRADE	329038.223	6232096.815	1.303	1.867	-0.564
SUBGRADE	329038.640	6232115.681	1.267	1.796	-0.529
SUBGRADE	329038.857	6232102.094	1.350	1.889	-0.539
SUBGRADE	329039.244	6232106.067	1.360	1.897	-0.537
SUBGRADE	329039.579	6232065.648	1.240	1.749	-0.509
SUBGRADE	329039.827	6232069.616	1.242	1.782	-0.540
SUBGRADE	329039.854	6232111.355	1.308	1.829	-0.521
SUBGRADE	329040.037	6232081.291	1.277	1.792	-0.515
SUBGRADE	329041.487	6232085.912	1.275	1.804	-0.529
SUBGRADE	329041.544	6232075.124	1.212	1.772	-0.560
SUBGRADE	329041.757	6232091.335	1.249	1.802	-0.553
SUBGRADE	329043.418	6232105.804	1.245	1.787	-0.542
SUBGRADE	329044.476	6232114.602	1.192	1.752	-0.560
SUBGRADE	329004.059	6232117.964	1.232	1.758	-0.526
SUBGRADE	329023.985	6232116.811	1.298	1.820	-0.522
SUBGRADE	329029.170	6232116.753	1.358	1.862	-0.504
SUBGRADE	329035.543	6232119.664	1.273	1.792	-0.519
SUBGRADE	329036.077	6232125.390	1.227	1.762	-0.535
SUBGRADE	329037.197	6232131.304	1.275	1.776	-0.501
SUBGRADE	329040.015	6232119.078	1.231	1.739	-0.508
SUBGRADE	329041.510	6232123.914	1.214	1.720	-0.506
SUBGRADE	329042.498	6232130.757	1.287	1.790	-0.503
SUBGRADE	329044.829	6232118.219	1.191	1.699	-0.508
SUBGRADE	329045.812	6232122.592	1.207	1.713	-0.506
SUBGRADE	329047.123	6232129.304	1.259	1.760	-0.501

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POINTS PROCESSED : 195

VERTICAL SUMMARY

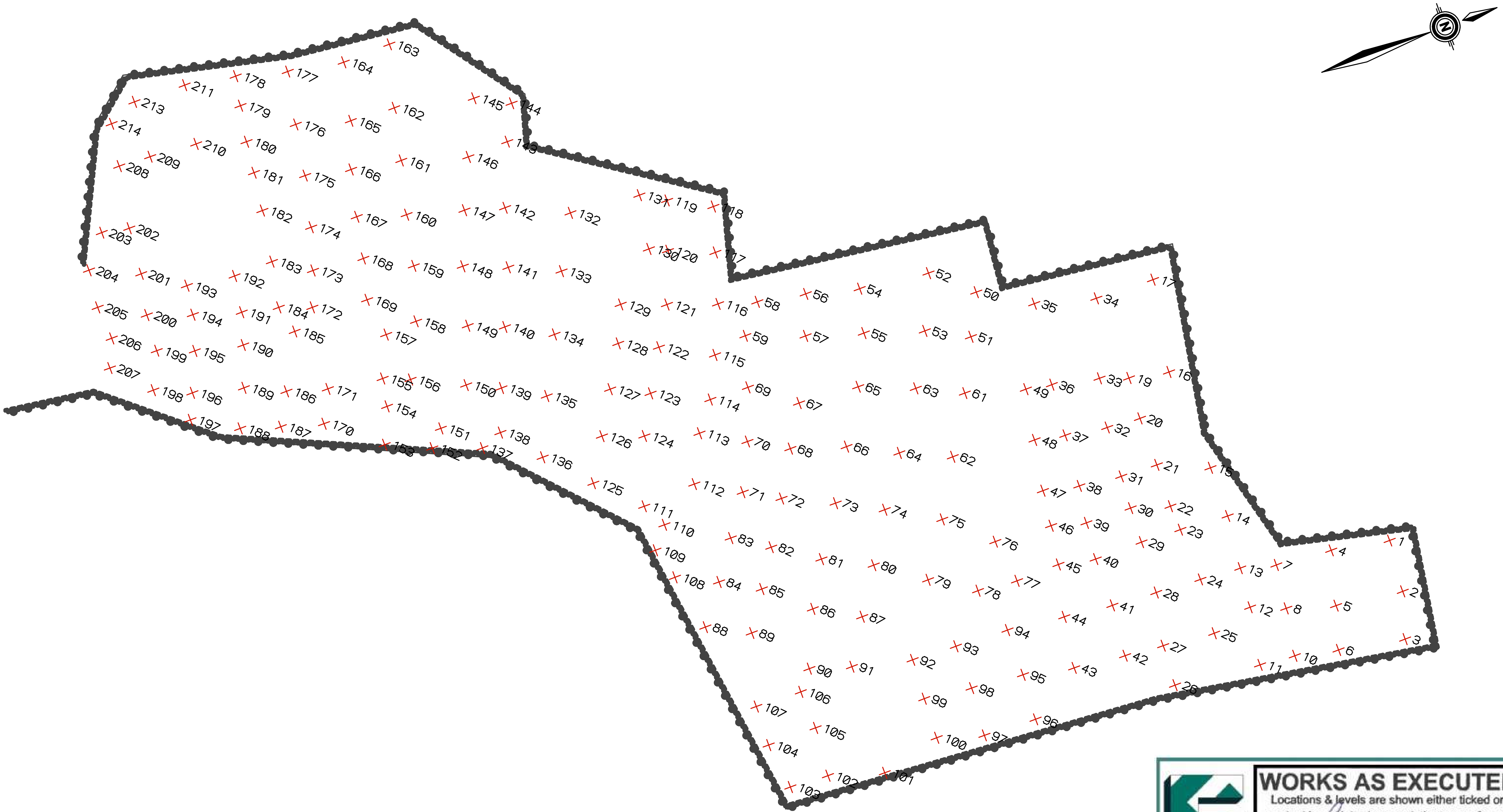
Points Tested :	195	
Within Tolerance :	195	(100.0%)
Too High :	0	(0.0%)
Too Low :	0	(0.0%)
Maximum Conformance:	-0.500	
Minimum Conformance:	-0.695	
Average Conformance:	-0.548	
Standard Deviation :	0.034	

THICKNESS SUMMARY

Points Tested :	195	
Within Tolerance :	195	(100.0%)
Too Thick :	0	(0.0%)
Too Thin :	0	(0.0%)
Average Thickness :	-0.548	
Standard Deviation :	0.034	

Signed:

Robert Friend
Robert Friend Surveys Pty Limited
Registered Land Surveyor NSW #SU003841
Thu 3-Jun-2021 09:32:20



WORKS AS EXECUTED

Locations & levels are shown either ticked or marked in red ink where variations were found.

22/06/2021

Rod Donoso- Engineering Surveyor
Ford Civil 02 9597 4122

Date

FORD CIVIL

Rev.	Issues & Amendments	By	Check'd	App'd	Date
H					
G					
F					
E					
D					
C					
B					
A	Survey and volume	RD	RK	RK	22.06.2021

FORD CIVIL

BULK EARTHWORKS
INFRASTRUCTURE
ENVIRONMENTAL
ROADWORKS
LANDSCAPING
REMEDIATION

Project: CCD Remediation

Client: Transport NSW

Item / Section: SURVEY

Drawing Title: Oyster Farm Marker Layer WAEX

Drawn: RD

Design: AK

Checked: AK

Approved: AK

FORD CIVIL CONTRACTING
9 HATTERSLEY ST ARNCLIFFE , NSW 2205 PO BOX 26
PH: 02 9597 4122 MOB : 0408 278 073
EMAIL: INFO@FORDCIVIL.COM.AU

Scale: 400

Date: 22.06.2021

Cad File: Oyster Farm 200804

Drawing No: 210622_1

Issue: A

Point	Easting	Northing	RL	Description
182	328966.173	6232035.705	1.432	Subgrade/Marker Layer
213	328951.344	6232027.366	1.243	Subgrade/Marker Layer
214	328952.623	6232024.424	1.254	Subgrade/Marker Layer
163	328954.827	6232053.623	1.245	Subgrade/Marker Layer
164	328954.929	6232048.659	1.231	Subgrade/Marker Layer
179	328955.432	6232037.313	1.343	Subgrade/Marker Layer
208	328956.92	6232023.657	1.286	Subgrade/Marker Layer
209	328957.11	6232026.926	1.347	Subgrade/Marker Layer
210	328957.513	6232031.751	1.37	Subgrade/Marker Layer
180	328959.072	6232036.618	1.387	Subgrade/Marker Layer
176	328959.161	6232041.912	1.358	Subgrade/Marker Layer
165	328960.75	6232047.277	1.342	Subgrade/Marker Layer
162	328961.049	6232051.861	1.321	Subgrade/Marker Layer
181	328962.284	6232036.248	1.398	Subgrade/Marker Layer
203	328962.633	6232019.663	1.335	Subgrade/Marker Layer
145	328962.932	6232059.767	1.258	Subgrade/Marker Layer
202	328963.18	6232022.422	1.352	Subgrade/Marker Layer
175	328964.356	6232041.01	1.445	Subgrade/Marker Layer
144	328964.735	6232063.181	1.187	Subgrade/Marker Layer
166	328965.388	6232045.587	1.394	Subgrade/Marker Layer
204	328965.76	6232017.121	1.347	Subgrade/Marker Layer
161	328966.293	6232050.681	1.362	Subgrade/Marker Layer
201	328967.937	6232021.962	1.389	Subgrade/Marker Layer
143	328968.236	6232061.421	1.271	Subgrade/Marker Layer
146	328968.315	6232057.185	1.315	Subgrade/Marker Layer
174	328969.477	6232039.761	1.492	Subgrade/Marker Layer
205	328969.607	6232016.646	1.367	Subgrade/Marker Layer
167	328970.086	6232044.46	1.46	Subgrade/Marker Layer
193	328970.673	6232025.891	1.452	Subgrade/Marker Layer
183	328971.369	6232034.818	1.451	Subgrade/Marker Layer
192	328971.431	6232030.762	1.491	Subgrade/Marker Layer
160	328971.642	6232049.279	1.457	Subgrade/Marker Layer
200	328972.056	6232021.043	1.423	Subgrade/Marker Layer
147	328973.249	6232054.943	1.443	Subgrade/Marker Layer
194	328973.64	6232025.443	1.469	Subgrade/Marker Layer
173	328973.66	6232038.421	1.508	Subgrade/Marker Layer
168	328974.283	6232043.628	1.539	Subgrade/Marker Layer
142	328974.444	6232058.886	1.418	Subgrade/Marker Layer
191	328975.123	6232030.171	1.531	Subgrade/Marker Layer
184	328975.963	6232033.866	1.533	Subgrade/Marker Layer
159	328976.765	6232048.16	1.546	Subgrade/Marker Layer
172	328977.145	6232037.052	1.518	Subgrade/Marker Layer
132	328977.228	6232064.921	1.357	Subgrade/Marker Layer
131	328977.964	6232072.099	1.215	Subgrade/Marker Layer
169	328978.353	6232042.531	1.568	Subgrade/Marker Layer
148	328978.523	6232052.808	1.554	Subgrade/Marker Layer
119	328979.447	6232074.551	1.225	Subgrade/Marker Layer
141	328980.229	6232057.099	1.475	Subgrade/Marker Layer
118	328981.65	6232078.736	1.218	Subgrade/Marker Layer
158	328982.118	6232046.421	1.577	Subgrade/Marker Layer
157	328982.33	6232043.119	1.467	Subgrade/Marker Layer
133	328982.451	6232062.022	1.444	Subgrade/Marker Layer
130	328983.421	6232071.112	1.302	Subgrade/Marker Layer
120	328984.252	6232072.858	1.286	Subgrade/Marker Layer
149	328984.355	6232051.187	1.553	Subgrade/Marker Layer
171	328985.449	6232035.668	1.326	Subgrade/Marker Layer
140	328985.778	6232054.67	1.564	Subgrade/Marker Layer
117	328986.094	6232077.311	1.259	Subgrade/Marker Layer
155	328986.378	6232041.239	1.408	Subgrade/Marker Layer
156	328987.461	6232043.859	1.434	Subgrade/Marker Layer
129	328987.704	6232066.48	1.424	Subgrade/Marker Layer
134	328988.231	6232059.128	1.5	Subgrade/Marker Layer
170	328988.622	6232034.073	1.254	Subgrade/Marker Layer
154	328989.194	6232040.68	1.335	Subgrade/Marker Layer
121	328989.345	6232070.871	1.378	Subgrade/Marker Layer
150	328989.944	6232048.948	1.467	Subgrade/Marker Layer
116	328991.08	6232075.753	1.352	Subgrade/Marker Layer
128	328991.33	6232064.875	1.479	Subgrade/Marker Layer
139	328991.468	6232052.205	1.471	Subgrade/Marker Layer

Point	Easting	Northing	RL	Description
58	328992.267	6232079.563	1.28	Subgrade/Marker Layer
153	328992.751	6232039.101	1.122	Subgrade/Marker Layer
122	328993.12	6232068.613	1.478	Subgrade/Marker Layer
151	328993.173	6232045.021	1.291	Subgrade/Marker Layer
56	328993.211	6232084.447	1.288	Subgrade/Marker Layer
135	328993.819	6232056.227	1.452	Subgrade/Marker Layer
54	328994.613	6232089.76	1.263	Subgrade/Marker Layer
152	328994.749	6232043.51	1.198	Subgrade/Marker Layer
59	328995.074	6232077.231	1.349	Subgrade/Marker Layer
127	328995.401	6232062.493	1.506	Subgrade/Marker Layer
52	328995.542	6232096.848	1.251	Subgrade/Marker Layer
138	328995.669	6232050.532	1.342	Subgrade/Marker Layer
115	328995.826	6232073.669	1.466	Subgrade/Marker Layer
137	328996.504	6232048.282	1.282	Subgrade/Marker Layer
57	328997.204	6232082.951	1.332	Subgrade/Marker Layer
123	328997.215	6232066.191	1.509	Subgrade/Marker Layer
55	328998.985	6232088.598	1.313	Subgrade/Marker Layer
50	328999.037	6232100.73	1.245	Subgrade/Marker Layer
136	328999.509	6232053.683	1.236	Subgrade/Marker Layer
126	328999.577	6232060.07	1.386	Subgrade/Marker Layer
114	328999.902	6232071.658	1.576	Subgrade/Marker Layer
69	329000.071	6232075.67	1.499	Subgrade/Marker Layer
53	329000.92	6232094.469	1.303	Subgrade/Marker Layer
124	329001.054	6232064.102	1.351	Subgrade/Marker Layer
35	329002.179	6232105.829	1.295	Subgrade/Marker Layer
113	329002.731	6232069.44	1.57	Subgrade/Marker Layer
51	329003.096	6232098.651	1.363	Subgrade/Marker Layer
67	329003.356	6232079.974	1.531	Subgrade/Marker Layer
125	329003.758	6232057.589	1.211	Subgrade/Marker Layer
34	329003.845	6232111.929	1.243	Subgrade/Marker Layer
65	329003.886	6232086.167	1.457	Subgrade/Marker Layer
70	329005.207	6232073.715	1.546	Subgrade/Marker Layer
63	329006.068	6232091.592	1.442	Subgrade/Marker Layer
68	329007.382	6232077.542	1.588	Subgrade/Marker Layer
112	329007.386	6232067.167	1.416	Subgrade/Marker Layer
111	329007.733	6232061.614	1.243	Subgrade/Marker Layer
61	329008.241	6232096.086	1.473	Subgrade/Marker Layer
66	329009.173	6232082.954	1.626	Subgrade/Marker Layer
71	329009.857	6232071.485	1.51	Subgrade/Marker Layer
49	329010.013	6232102.028	1.423	Subgrade/Marker Layer
110	329010.207	6232062.885	1.338	Subgrade/Marker Layer
36	329010.495	6232104.657	1.411	Subgrade/Marker Layer
33	329011.56	6232109.411	1.348	Subgrade/Marker Layer
64	329011.634	6232087.753	1.642	Subgrade/Marker Layer
72	329011.818	6232074.947	1.584	Subgrade/Marker Layer
109	329012.314	6232061.136	1.264	Subgrade/Marker Layer
19	329012.573	6232112.228	1.295	Subgrade/Marker Layer
16	329013.411	6232116.241	1.189	Subgrade/Marker Layer
83	329013.796	6232068.728	1.4	Subgrade/Marker Layer
62	329013.876	6232092.7	1.621	Subgrade/Marker Layer
73	329014.167	6232079.926	1.66	Subgrade/Marker Layer
48	329015.147	6232101.069	1.509	Subgrade/Marker Layer
108	329015.576	6232062.046	1.267	Subgrade/Marker Layer
37	329015.785	6232104.144	1.457	Subgrade/Marker Layer
82	329016.091	6232072.256	1.475	Subgrade/Marker Layer
74	329016.516	6232084.372	1.716	Subgrade/Marker Layer
32	329016.517	6232108.413	1.415	Subgrade/Marker Layer
20	329016.805	6232111.847	1.38	Subgrade/Marker Layer
84	329017.566	6232066.072	1.345	Subgrade/Marker Layer
81	329018.991	6232076.616	1.52	Subgrade/Marker Layer
75	329019.463	6232089.498	1.698	Subgrade/Marker Layer
85	329019.739	6232069.883	1.387	Subgrade/Marker Layer
47	329020.264	6232100.075	1.607	Subgrade/Marker Layer
38	329021.098	6232103.709	1.543	Subgrade/Marker Layer
88	329021.381	6232063.181	1.216	Subgrade/Marker Layer
80	329021.408	6232081.367	1.569	Subgrade/Marker Layer
31	329021.663	6232108.029	1.472	Subgrade/Marker Layer
21	329021.819	6232111.822	1.409	Subgrade/Marker Layer
86	329023.425	6232074.042	1.406	Subgrade/Marker Layer

Point	Easting	Northing	RL	Description
76	329023.445	6232093.757	1.649	Subgrade/Marker Layer
89	329023.571	6232067.395	1.341	Subgrade/Marker Layer
46	329023.885	6232099.629	1.628	Subgrade/Marker Layer
79	329024.711	6232086.025	1.62	Subgrade/Marker Layer
39	329024.856	6232103.086	1.621	Subgrade/Marker Layer
30	329025.007	6232107.801	1.524	Subgrade/Marker Layer
87	329025.903	6232078.458	1.4	Subgrade/Marker Layer
22	329026.227	6232111.661	1.445	Subgrade/Marker Layer
78	329027.499	6232090.391	1.544	Subgrade/Marker Layer
45	329027.833	6232098.955	1.605	Subgrade/Marker Layer
77	329027.933	6232094.454	1.519	Subgrade/Marker Layer
40	329028.628	6232102.696	1.577	Subgrade/Marker Layer
29	329028.628	6232107.649	1.551	Subgrade/Marker Layer
23	329028.807	6232111.778	1.465	Subgrade/Marker Layer
90	329028.987	6232071.611	1.345	Subgrade/Marker Layer
91	329030.298	6232075.726	1.352	Subgrade/Marker Layer
107	329030.724	6232065.239	1.265	Subgrade/Marker Layer
106	329030.895	6232069.98	1.294	Subgrade/Marker Layer
92	329031.783	6232081.744	1.387	Subgrade/Marker Layer
93	329032.011	6232086.334	1.422	Subgrade/Marker Layer
94	329032.286	6232091.809	1.42	Subgrade/Marker Layer
44	329033.018	6232097.669	1.458	Subgrade/Marker Layer
41	329033.625	6232102.649	1.494	Subgrade/Marker Layer
28	329033.937	6232107.276	1.474	Subgrade/Marker Layer
24	329034.247	6232111.937	1.389	Subgrade/Marker Layer
13	329034.579	6232116.12	1.349	Subgrade/Marker Layer
104	329034.825	6232065.058	1.254	Subgrade/Marker Layer
105	329034.838	6232070.118	1.272	Subgrade/Marker Layer
99	329035.888	6232081.479	1.349	Subgrade/Marker Layer
98	329036.544	6232086.358	1.386	Subgrade/Marker Layer
95	329037.08	6232091.715	1.352	Subgrade/Marker Layer
43	329038.223	6232096.815	1.303	Subgrade/Marker Layer
12	329038.64	6232115.681	1.267	Subgrade/Marker Layer
42	329038.857	6232102.094	1.35	Subgrade/Marker Layer
27	329039.244	6232106.067	1.36	Subgrade/Marker Layer
103	329039.579	6232065.648	1.24	Subgrade/Marker Layer
102	329039.827	6232069.616	1.242	Subgrade/Marker Layer
25	329039.854	6232111.355	1.308	Subgrade/Marker Layer
100	329040.037	6232081.291	1.277	Subgrade/Marker Layer
97	329041.487	6232085.912	1.275	Subgrade/Marker Layer
101	329041.544	6232075.124	1.212	Subgrade/Marker Layer
96	329041.757	6232091.335	1.249	Subgrade/Marker Layer
26	329043.418	6232105.804	1.245	Subgrade/Marker Layer
11	329044.476	6232114.602	1.192	Subgrade/Marker Layer
17	329004.059	6232117.964	1.232	Subgrade/Marker Layer
15	329023.985	6232116.811	1.298	Subgrade/Marker Layer
14	329029.17	6232116.753	1.358	Subgrade/Marker Layer
7	329035.543	6232119.664	1.273	Subgrade/Marker Layer
4	329036.077	6232125.39	1.227	Subgrade/Marker Layer
1	329037.097	6232131.304	1.275	Subgrade/Marker Layer
8	329040.015	6232119.078	1.231	Subgrade/Marker Layer
5	329041.51	6232123.914	1.214	Subgrade/Marker Layer
2	329042.498	6232130.757	1.287	Subgrade/Marker Layer
10	329044.829	6232118.219	1.191	Subgrade/Marker Layer
6	329045.812	6232122.592	1.207	Subgrade/Marker Layer
3	329047.123	6232129.304	1.259	Subgrade/Marker Layer
177	328953.843	6232043.009	1.229	Subgrade/Marker Layer
178	328952.456	6232037.894	1.29	Subgrade/Marker Layer
211	328951.516	6232032.725	1.242	Subgrade/Marker Layer
206	328973.038	6232016.886	1.357	Subgrade/Marker Layer
207	328975.802	6232015.668	1.306	Subgrade/Marker Layer
198	328979.431	6232019.021	1.339	Subgrade/Marker Layer
199	328975.798	6232020.735	1.405	Subgrade/Marker Layer
195	328977.156	6232024.35	1.438	Subgrade/Marker Layer
196	328981.062	6232022.643	1.317	Subgrade/Marker Layer
197	328983.559	6232021.504	1.293	Subgrade/Marker Layer
188	328986.129	6232025.935	1.258	Subgrade/Marker Layer
189	328982.396	6232027.719	1.407	Subgrade/Marker Layer
186	328984.227	6232031.637	1.34	Subgrade/Marker Layer
187	328987.397	6232029.86	1.207	Subgrade/Marker Layer
190	328978.299	6232029.164	1.446	Subgrade/Marker Layer
185	328978.818	6232034.532	1.476	Subgrade/Marker Layer

FORD CIVIL

WORKS AS EXECUTED

Locations & levels are shown either ticked or marked in red ink where variations were found.

22/06/2021

Rod Donoso- Engineering Surveyor
Ford Civil 02 9597 4122

Date

Rev.	Issues & Amendments	By	Check'd	App'd	Date
H					
G					
F					
E					
D					
C					
B					
A	Survey and volume	RD	RK	RK	22.06.2021

FORD CIVIL

BULK EARTHWORKS
INFRASTRUCTURE
ENVIRONMENTAL
ROADWORKS
LANDSCAPING
REMEDIATION

Project: CCD Remediation

Client: Transport NSW

Drawn: RD | Design: AK
Checked: AK | Approved: AK

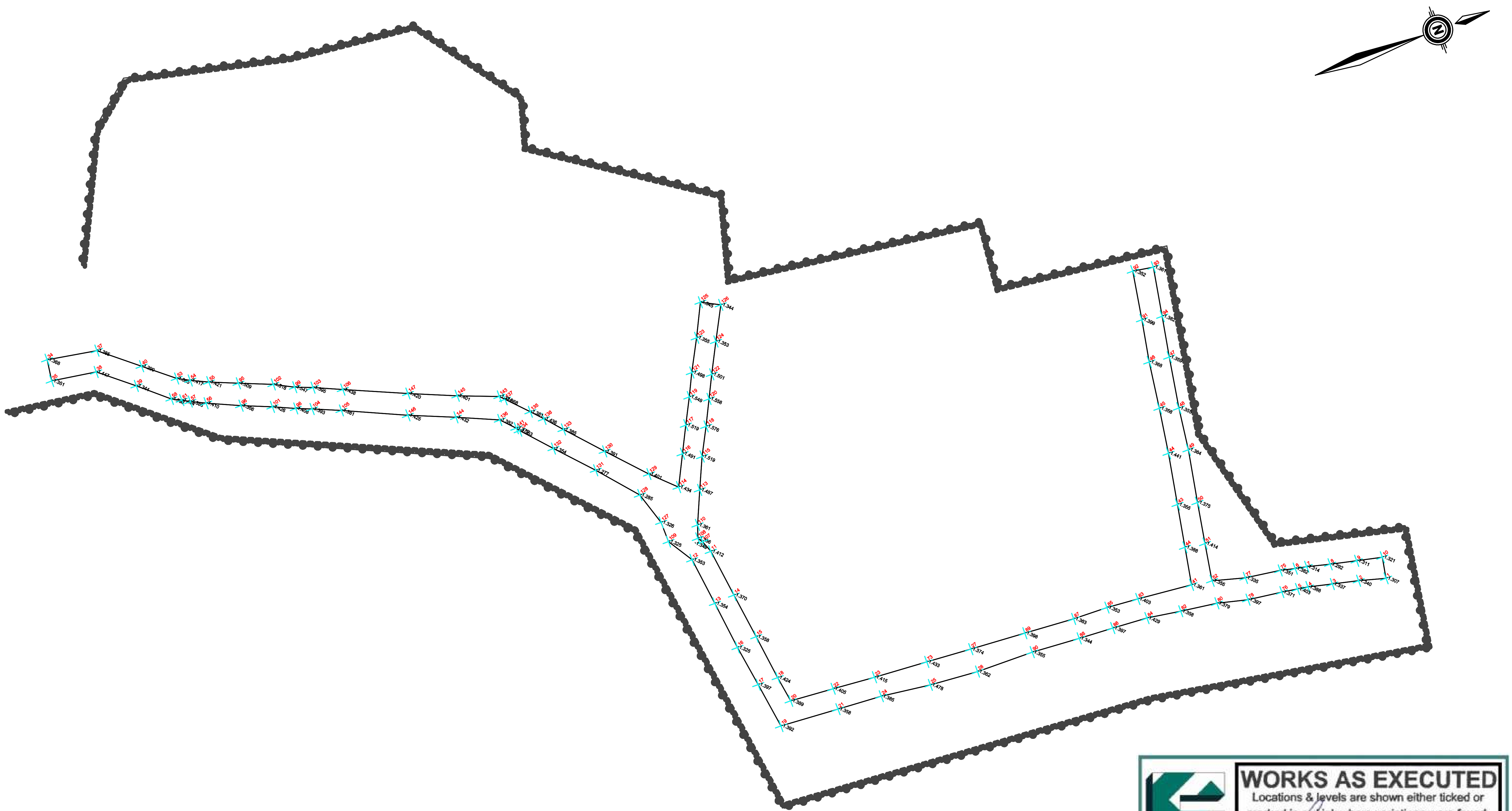
FORD CIVIL CONTRACTING
9 HATTERSLEY ST ARNCLIFFE , NSW 2205 PO BOX 26
PH: 02 9597 4122 MOB : 0408 278 073
EMAIL: INFO@FORDCIVIL.COM.AU

Item / Section: SURVEY

Drawing Title: Oyster Farm Marker Layer WAEX
Co Ordinate table

Scale: 400 | Date: 22.06.2021 | Cad File: Oyster Farm 200804

Drawing No: 210622_2 | Issue: A



WORKS AS EXECUTED

Locations & levels are shown either ticked or marked in red ink where variations were found.

12/05/2021

Rod Donoso- Engineering Surveyor
Ford Civil 02 9597 4122

Date

FORD CIVIL

Rev.	Issues & Amendments	By	Check'd	App'd	Date
H					
G					
F					
E					
D					
C					
B					
A	Survey as built	RD	RK	RK	12.05.2021

FORD CIVIL

BULK EARTHWORKS
INFRASTRUCTURE
ENVIRONMENTAL
ROADWORKS
LANDSCAPING
REMEDIATION

Project: Oyster Lease – CCD Remediation

Client: Transport NSW

Drawn: RD
Design: AK
Checked: AK
Approved: AK

FORD CIVIL CONTRACTING
9 HATTERSLEY ST ARNCLIFFE , NSW 2205 PO BOX 26
PH: 02 9597 4122 MOB : 0408 278 073
EMAIL: INFO@FORDCIVIL.COM.AU

Item / Section: SURVEY

Drawing Title: Service Corridor Works As Executed

Scale: 400
Date: 12.05.2021
Cad File: Oyster Farm 200804
Drawing No: 210512_1
Issue: A

Point	Easting	Northing	Level (RL)	TIN FSL	Depth from FSL	Description
1	329040.889	6232130.296	0.474	1.781	-1.307	Bottom of Trench
2	329040.149	6232127.585	0.423	1.763	-1.34	Bottom of Trench
3	329039.534	6232124.955	0.426	1.763	-1.337	Bottom of Trench
4	329038.959	6232122.516	0.374	1.762	-1.388	Bottom of Trench
5	329038.783	6232121.457	0.359	1.762	-1.403	Bottom of Trench
6	329036.742	6232121.951	0.396	1.778	-1.382	Bottom of Trench
7	329036.969	6232123.118	0.464	1.778	-1.314	Bottom of Trench
8	329037.566	6232125.444	0.486	1.778	-1.292	Bottom of Trench
9	329038.176	6232128.106	0.467	1.778	-1.311	Bottom of Trench
10	329038.738	6232130.685	0.46	1.781	-1.321	Bottom of Trench
11	329014.427	6232066.656	0.488	1.9	-1.412	Bottom of Trench
12	329014.572	6232064.565	0.505	1.858	-1.353	Bottom of Trench
13	329019.558	6232065.206	0.483	1.837	-1.354	Bottom of Trench
14	329019.431	6232067.324	0.51	1.88	-1.37	Bottom of Trench
15	329024.2	6232067.977	0.503	1.861	-1.358	Bottom of Trench
16	329024.562	6232065.809	0.491	1.816	-1.325	Bottom of Trench
17	329028.855	6232066.478	0.392	1.789	-1.397	Bottom of Trench
18	329028.872	6232068.591	0.393	1.817	-1.424	Bottom of Trench
19	329033.615	6232067.192	0.374	1.766	-1.392	Bottom of Trench
20	329031.546	6232069.014	0.384	1.773	-1.389	Bottom of Trench
21	329034.017	6232073.241	0.425	1.783	-1.358	Bottom of Trench
22	329031.896	6232073.501	0.421	1.826	-1.405	Bottom of Trench
23	329032.257	6232077.863	0.462	1.877	-1.415	Bottom of Trench
24	329034.316	6232077.84	0.453	1.838	-1.385	Bottom of Trench
25	329034.971	6232082.937	0.415	1.893	-1.478	Bottom of Trench
27	329032.976	6232088.075	0.613	1.987	-1.374	Bottom of Trench
28	329035.362	6232087.918	0.581	1.943	-1.362	Bottom of Trench
34	328972.633	6232009.945	0.499	1.867	-1.368	Bottom of Trench
35	328974.821	6232009.63	0.523	1.874	-1.351	Bottom of Trench
37	328973.52	6232015.027	0.444	1.829	-1.385	Bottom of Trench
38	328975.538	6232014.203	0.369	1.816	-1.447	Bottom of Trench
39	328978.29	6232017.561	0.498	1.842	-1.344	Bottom of Trench
40	328976.594	6232018.752	0.59	1.88	-1.29	Bottom of Trench
41	329034.638	6232111.458	0.538	1.899	-1.361	Bottom of Trench
43	329026.451	6232112.957	0.566	1.921	-1.355	Bottom of Trench
44	329021.243	6232113.909	0.402	1.843	-1.441	Bottom of Trench
44	329030.808	6232112.155	0.582	1.97	-1.388	Bottom of Trench
45	329016.612	6232114.628	0.43	1.788	-1.358	Bottom of Trench
46	329011.827	6232115.294	0.363	1.731	-1.368	Bottom of Trench
47	329012.066	6232117.378	0.356	1.715	-1.359	Bottom of Trench
48	329017.284	6232116.496	0.386	1.741	-1.355	Bottom of Trench
49	329021.599	6232115.936	0.424	1.788	-1.364	Bottom of Trench
50	329026.976	6232114.935	0.502	1.877	-1.375	Bottom of Trench
51	329031.16	6232114.205	0.523	1.937	-1.414	Bottom of Trench
52	329034.965	6232113.563	0.51	1.865	-1.355	Bottom of Trench
53	328979.002	6232021.679	0.515	1.88	-1.365	Bottom of Trench
54	328979.669	6232022.906	0.468	1.885	-1.417	Bottom of Trench
55	328980.492	6232024.628	0.473	1.894	-1.421	Bottom of Trench
56	328982.41	6232023.62	0.445	1.855	-1.41	Bottom of Trench
57	328981.695	6232022.164	0.462	1.848	-1.386	Bottom of Trench
58	328980.772	6232020.446	0.443	1.841	-1.398	Bottom of Trench
61	328981.258	6232021.4	0.441	1.845	-1.404	Bottom of Trench
73	329032.64	6232083.407	0.51	1.943	-1.433	Bottom of Trench
75	329036.39	6232120.454	0.427	1.778	-1.351	Bottom of Trench
76	329038.521	6232119.844	0.39	1.761	-1.371	Bottom of Trench
77	329035.874	6232116.857	0.469	1.804	-1.335	Bottom of Trench
78	329038.049	6232116.338	0.387	1.784	-1.397	Bottom of Trench
80	329037.294	6232113.237	0.442	1.821	-1.379	Bottom of Trench

Point	Easting	Northing	Level (RL)	TIN FSL	Depth from FSL	Description
82	329036.772	6232109.492	0.522	1.88	-1.358	Bottom of Trench
83	329034.084	6232105.828	0.58	1.983	-1.403	Bottom of Trench
84	329036.239	6232106.025	0.507	1.936	-1.429	Bottom of Trench
85	329033.813	6232102.566	0.607	1.96	-1.353	Bottom of Trench
86	329035.979	6232102.39	0.526	1.923	-1.397	Bottom of Trench
87	329033.722	6232098.979	0.588	1.951	-1.363	Bottom of Trench
88	329035.782	6232098.82	0.561	1.905	-1.344	Bottom of Trench
89	329033.362	6232093.802	0.545	1.943	-1.398	Bottom of Trench
90	329035.44	6232093.842	0.542	1.897	-1.355	Bottom of Trench
91	329007.525	6232116.083	0.34	1.739	-1.399	Bottom of Trench
92	329002.551	6232116.935	0.407	1.759	-1.352	Bottom of Trench
93	329002.896	6232119.039	0.419	1.78	-1.361	Bottom of Trench
94	329007.91	6232118.15	0.363	1.745	-1.382	Bottom of Trench
95	328981.646	6232027.418	0.401	1.91	-1.509	Bottom of Trench
96	328983.881	6232026.868	0.499	1.865	-1.366	Bottom of Trench
98	328986.084	6232032.007	0.405	1.813	-1.408	Bottom of Trench
99	328984.014	6232032.665	0.316	1.863	-1.547	Bottom of Trench
101	328985.103	6232029.832	0.41	1.836	-1.426	Bottom of Trench
102	328982.993	6232030.712	0.369	1.887	-1.518	Bottom of Trench
103	328984.7	6232034.394	0.451	1.846	-1.395	Bottom of Trench
104	328986.715	6232033.553	0.405	1.798	-1.393	Bottom of Trench
105	328987.89	6232036.306	0.389	1.77	-1.381	Bottom of Trench
106	328985.941	6232037.18	0.388	1.826	-1.438	Bottom of Trench
107	329013.228	6232066.207	0.55	1.899	-1.349	Bottom of Trench
108	329012.729	6232065.877	0.56	1.896	-1.336	Bottom of Trench
109	329012.002	6232062.958	0.519	1.844	-1.325	Bottom of Trench
110	329011.438	6232066.319	0.553	1.914	-1.361	Bottom of Trench
113	329008.155	6232067.769	0.501	1.988	-1.487	Bottom of Trench
114	329007.144	6232065.845	0.527	1.961	-1.434	Bottom of Trench
115	329005.056	6232069.179	0.54	2.059	-1.519	Bottom of Trench
116	329004.094	6232067.405	0.543	2.034	-1.491	Bottom of Trench
117	329001.476	6232068.732	0.578	2.097	-1.519	Bottom of Trench
118	329002.311	6232070.625	0.55	2.126	-1.576	Bottom of Trench
119	328998.903	6232070.056	0.585	2.134	-1.549	Bottom of Trench
120	328999.783	6232071.88	0.564	2.122	-1.558	Bottom of Trench
121	328996.649	6232071.165	0.563	2.061	-1.498	Bottom of Trench
122	328997.535	6232073.007	0.548	2.049	-1.501	Bottom of Trench
123	328993.505	6232072.848	0.606	1.961	-1.355	Bottom of Trench
124	328994.537	6232074.563	0.598	1.951	-1.353	Bottom of Trench
125	328990.229	6232074.471	0.513	1.858	-1.345	Bottom of Trench
126	328991.205	6232076.328	0.502	1.846	-1.344	Bottom of Trench
127	329009.904	6232062.925	0.536	1.862	-1.326	Bottom of Trench
128	329006.539	6232061.863	0.595	1.88	-1.285	Bottom of Trench
129	329004.845	6232063.473	0.538	1.939	-1.401	Bottom of Trench
130	329001.111	6232060.044	0.485	1.876	-1.391	Bottom of Trench
131	329002.602	6232058.521	0.544	1.821	-1.277	Bottom of Trench
132	328999.031	6232055.24	0.445	1.799	-1.354	Bottom of Trench
133	328997.561	6232056.876	0.496	1.881	-1.385	Bottom of Trench
134	328996.12	6232052.642	0.509	1.862	-1.353	Bottom of Trench
135	328994.698	6232054.335	0.532	1.913	-1.381	Bottom of Trench
136	328994.406	6232051.122	0.529	1.911	-1.382	Bottom of Trench
137	328992.605	6232052.353	0.605	1.973	-1.368	Bottom of Trench
138	328995.849	6232055.378	0.46	1.896	-1.436	Bottom of Trench
141	328995.774	6232052.413	0.501	1.873	-1.372	Bottom of Trench
143	328992.134	6232051.906	0.65	1.974	-1.324	Bottom of Trench
144	328992.596	6232047.018	0.435	1.867	-1.432	Bottom of Trench
145	328990.584	6232047.906	0.525	1.926	-1.401	Bottom of Trench
146	328990.709	6232042.49	0.39	1.815	-1.425	Bottom of Trench
147	328988.624	6232043.27	0.459	1.879	-1.42	

FORD CIVIL

WORKS AS EXECUTED

Locations & levels are shown either ticked or marked in red ink where variations were found.

12/05/2021

Rod Donoso- Engineering Surveyor
Ford Civil 02 9597 4122

Date

Rev.	Issues & Amendments	By	Check'd	App'd	Date
H					
G					
F					
E					
D					
C					
B					
A	Survey as built	RD	RK	RK	12.05.2021

FORD CIVIL

BULK EARTHWORKS
INFRASTRUCTURE
ENVIRONMENTAL
ROADWORKS
LANDSCAPING
REMEDIATION

Project: Oyster Lease – CCD Remediation

Client: Transport NSW

Drawn: RD

Design: AK

Checked: AK

Approved: AK

FORD CIVIL CONTRACTING
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EMAIL: INFO@FORDCIVIL.COM.AU

Item / Section: SURVEY

Drawing Title: Service Corridor Works As Executed
Table of co ordinates

Scale: 400

Date: 12.05.2021

Cad File: Oyster Farm 200804

Drawing No: 210512_2

Issue: A

Appendix B LTEMP Record of Induction Form

Date	Name	Signature

Date	Name	Signature

Appendix C Capping Layer Reinspection Register

DATE	AREA INSPECTED	COMMENTS	INSPECTING COMPANY AND PERSONNEL DETAILS	SITE LTEAMP MANAGER SIGNATURE

DATE	AREA INSPECTED	COMMENTS	INSPECTING COMPANY AND PERSONNEL DETAILS	SITE LTEAMP MANAGER SIGNATURE

Appendix D Asbestos Related Works Record

DATE	LOCATION OF WORKS	WORKS COMPLETED	ASBESTOS RELATED WORKS COMPLETED BY	CLEARANCE INSPECTION AND CERTIFICATE ISSUED?	ISSUER OF CLEARANCE CERTIFICATE	SITE LTEAMP MANAGER SIGNATURE

DATE	LOCATION OF WORKS	WORKS COMPLETED	ASBESTOS RELATED WORKS COMPLETED BY	CLEARANCE INSPECTION AND CERTIFICATE ISSUED?	ISSUER OF CLEARANCE CERTIFICATE	SITE LTEAMP MANAGER SIGNATURE

Appendix E Environmental Management Controls and Monitoring Procedures

E1. Minor Surface Works / Maintenance Procedure

No specific environmental controls are required for works that do not penetrate the cap including general maintenance and day to day activities of site surfaces and above ground structures when developed, as these should not result in penetration the underlying capping and marker layers. It is noted that during minor surface works/maintenance the following is required:

- All workers and external contractors should be inducted into the LTEMP prior to commencing works at the site; and
- Any unexpected finds/conditions observed during minor works should be reported and documented in accordance with the Unexpected Finds Protocol as included in **Appendix I** of this LTEMP.

E2. Shallow Intrusive Works Procedure (Above Marker Layer)

Due to the presence of soil contamination and hazardous ground gas identified at the site, during all intrusive works, the following environmental management measures apply prior to any intrusive work commencing:

- Approval for the works must be sought from the person/s with management or control of the workplace who will assess whether the works are necessary or if there is an alternative that will not result in exposure of potentially impacted materials and whether the works are required to be carried out by a specialist contractor;
- The person/s with management or control of the workplace must review the information available for the site to determine if contamination is likely or known to be present in the relevant work area as presented in **Section 2.3**;
- The person/s with management or control of the workplace must review and approve the specific job risk assessment (JRA) and/or safe work method statements (SWMS) for the works and ensure that site personnel and/or contractors who will undertake the works are inducted into the LTEMP;
- Site personnel or contractors required to conduct intrusive works at the site must be inducted into the LTEMP and must be aware of their responsibilities with regard to health and safety;
- The marker layer shall not be disturbed, and any capping layer materials disturbed must be reinstated consistent with the description in **Section 2** of this LTEMP. Where disturbed, the different capping layer materials should be separately stockpiled, managed and reinstated consistent with this LTEMP;
- Any repairs to the capping layer shall be recorded and changes should be detailed in an updated survey plan, if required;
- Workers are not required to wear additional personal protective equipment (PPE) beyond normal site requirements for shallow intrusive works; and
- Air monitoring is not required provided the environmentally impacted material beneath the marker layer is not disturbed.

E3. Deep Intrusive Works Procedure (Below Marker Layer)

These provisions for deep intrusive works apply to all activities that extend below the marker layer (i.e. within encapsulated environmentally impacted materials).

Where deep intrusive works are required, the following management measures will apply:

- A copy of this LTEMP is to be supplied to all persons proposing to conduct deep intrusive works on the site;
- Prior to any deep intrusive work commencing, approval for the works must be sought from the person/s with management or control of the workplace who is responsible for the enforcement of the LTEMP (**Section 3**). This person will assess whether the works are necessary or if there is an alternative that will not result in exposure of environmentally impacted soil and will assess whether the works are required to be carried out by a specialist contractor;
- The person/s with management or control of the workplace must also review and approve the JRAs and SWMS for the works and ensure that site personnel and/or contractors who will undertake the works understand the requirements of the LTEMP;
- Site personnel or contractors required to conduct deep intrusive works at the site must be inducted into the LTEMP and must be aware of their responsibilities with regard to health and safety;
- The works area must be isolated from casual entry using temporary barriers and only personnel inducted in the requirements of the site LTEMP will be permitted to enter the works area;
- Sufficient room must be provided within the works area to allow stockpiling of spoil from excavations, if required, in accordance with **Procedure E6.3**;
- Stockpiles of excavated spoil must be managed in accordance with **Procedure E6.3**;
- Hazardous ground gas monitoring must be conducted to monitor the potential generation of hazardous ground gas in any excavations and to monitor the explosive limits of methane in accordance with **Procedure E4** and **E5**;
- In the event that materials from beneath the marker layer must be excavated, a water supply must be provided to the works area for the purpose of maintaining potential environmentally impacted soil in the excavations and stockpiles in a moist state;
- Personnel entering the works area must wear appropriate PPE in accordance with **Section 4.2;**
- Decontamination procedures must be undertaken in accordance with **Procedure E6.7;**
- Air monitoring is to be undertaken in accordance with **Procedure E6.3;**
- Once the works are complete, the marker and capping layers shall be reinstated with materials of similar nature as were originally present, as described in this LTEMP; and
- Any repairs to the capping layer shall be recorded and changes should be detailed in an updated survey plan, if required.

E3.1 Reinstatement of Capping

Following potential works completed as per **Procedure E1** and **E2**, there may be a requirement to supply new 'capping material' to the site to replace existing capping material as consumed by the works. Capping material is to consist of a 2 coat seal (or similar), consistent with the thickness of the existing 2 coat seal on the site, with subsurface virgin excavated natural material (VENM) or excavated natural material (ENM). Where VENM or ENM are used, then appropriate validation assessment, inclusive sampling and analysis must be available as consistent with relevant NSW EPA guidelines or otherwise resource recovery exemptions. The person responsible for the implementation of the LTEMP must be provided with all relevant copies of documentation certifying the suitability of capping material.

E4. Hazardous Ground Gas Controls

Should hazardous ground gas, particularly methane concentrations be reported at levels at or above the exposure standards during intrusive works (detailed in **Table E1** below), as stated in SafeWork Australia 2019, *Workplace Exposure Standard for Airborne Contaminants* (SWA 2019), then all works in the vicinity are to cease, until gas concentrations reduce or mitigation measures can be implemented to make the work area safe. Should hazardous ground gas remain at concentrations above the adopted guidelines values presented below, notification to the emergency services (NSW Police and NSW Fire and Rescue) may be required.

Hazardous ground gas thresholds applicable to intrusive works at the site are detailed in Table E1 below.

Table E1 - Monitoring Parameters and Adopted Thresholds

Ground gas parameter	Unit of measurement	Adopted Threshold Values			
		Internal Buildings	Monitoring Wells	Service pits	Surface Gas Emissions
Methane (CH_4)	%v/v	0.25 % v/v[14] 2,500 (ppm)	1.0	< 1.25	0.05 %v/v (500 ppm[15])
Carbon Dioxide (CO_2)	%v/v	0.5[16] (5, 000ppm) or above established background concentrations*	1.5 or above established background concentrations*	1.5 or above established background concentrations*	5,000 ppm
Oxygen (O_2)[4]	%v/v	>19.5% v/v[17]	For reference	>19.5% v/v	>19.5% v/v
Carbon Monoxide[1] (CO)	ppm	30	30	30	30
Hydrogen Sulphide[2] (H_2S)	ppm	10	10	10	10
VOCs	ppm	10 ppm (above background)	Above background outside air	Above background outside air	Above background outside air

SafeWork Australia 2020, *Code of Practice Confined Spaces* (SWA 2020c) states that air normally contains 21% v/v air by volume however oxygen levels between 19.5 % v/v and 23.5 % v/v are considered to be safe.

The source of hazardous ground gas identified at this site is characterised by a combination of residual historical imported fill material and natural organic rich mangrove sediments encountered underneath the fill material.

As such, hazardous ground gas monitoring data should be compared against SafeWork Australia 2019, *Workplace Exposure Standard for Airborne Contaminants* (SWA 2019), SafeWork Australia 2020, *Code of Practice Confined Spaces* (SWA 2020c) and WHS Regulation assessment criteria.

[14] 5% of LEL in Confined Spaces – NSW WHS Regulation (2017)
[15] *Environmental Guidelines – Solid Waste Landfills*. NSW EPA 2016. EPA (2016).
[16] Time Weighted Average – SafeWork Australia 'Workplace Exposure Standards for Airborne Contaminants' (December 2019)
[17] SafeWork Australia Code of Practice – Confined Spaces (July 2020)

E5. Enclosed Structure and Confined Space Maintenance Procedure

The site currently does not comprise buildings however it is anticipated structures will be developed on the site. Following implementation of gas mitigation measures and associated verification, maintenance works conducted on the ground floor or above in buildings at the site may be conducted with the normal level of PPE for that task as outlined in **Section 4.2.**

Additional procedures are required where maintenance works are conducted in enclosed structures or confined areas or excavations where hazardous ground gas may accumulate. Smoking is not permitted within operational work zones during intrusive works undertaken at the site, and a designated smoking area should be established.

The following procedures must be implemented during such works:

- All confined spaces[18] shall be tested and cleared for the accumulation of hazardous ground gas, particularly methane concentrations and associated hazardous gases with a calibrated landfill gas meter capable of measuring lower (5% v/v) and upper (15% v/v) explosive limit (LEL/UEL) based on methane concentrations, and concentrations of carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide. All works in a confined space or enclosed structure shall be undertaken in accordance with relevant sections of the WHS Regulation, SafeWork Australia 2019, *Workplace Exposure Standards for Airborne Contaminants* and SafeWork Australia 2020 (SWA 2019), *Code of Practice Confined Spaces* (SWA 2020c); and
- Monitoring continues to indicate normal atmospheric conditions with no elevated gases prior to re-entering the work area.

If an acute or explosive risk from hazardous ground gas is suspected as outlined in **Procedure E4,** immediate action should be taken to address the risk, including contacting relevant emergency services (NSW Police, Fire and Rescue).

E6. Soil Contamination and Asbestos Management Plan

E6.1 Works Involving Soil Disturbance and Maintenance Procedure

Soil contaminants including TRHs, PAHs, BTs and asbestos has been identified within the underlying fill material across the site. Furthermore, acid sulfate soils have been identified at depth below the fill material. It is considered unlikely that disturbance of fill materials or untreated ASS/PASS would occur regularly as part of ongoing day to day operations of the site.

The process relating to soil disturbance where works involving known or unexpected asbestos are likely is as follows, and should be recorded on the Asbestos Related Works Record provided in **Appendix D**:

- All site workers shall be inducted to the site and made aware of the procedures outlined in this LTEMP;
- Workers and visitors to the site area will be made aware of the friable asbestos contamination during site inductions and tool box meetings and only authorised people shall enter the work area, which must contain a perimeter barrier to restrict entry;
- An asbestos work area shall be defined and clearly marked;

[18] *SafeWork Australia 2020, Code of Practice Confined Space* defines a Confined Space as being an enclosed or partially enclosed space that is not designed or intended to be occupied by a person, is or is designed or intended to be, at normal atmospheric pressure while any person is in the space; and is or is likely to be a risk to health and safety from an atmosphere that does not have a safe oxygen level, or contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or harmful concentrations of any airborne contaminants, or engulfment (SWA 2020c)

- All personnel working within the asbestos work area shall wear P2 (or higher) class half face respirators, disposable gloves and coveralls made from materials which provide adequate protection against fibre penetration whilst completing works and whilst within the asbestos work area;
- A 10 m wide exclusion zone shall be established around the perimeter of the asbestos work area. The dimensions of the exclusion zone may be varied by the person/s with management or control of the workplace, or by the Class A licensed asbestos contractor, if necessary, or as otherwise caused to be necessary by the east-west extent of the rail corridor in the proximity of the works area;
- Asbestos warning signs shall be placed surrounding the asbestos work area and at entry/egress points;
- A decontamination area shall be marked out within the asbestos work area for the removal and disposal of PPE before site workers leave the asbestos work area. Personal decontamination must be undertaken each time a site worker leaves the asbestos works area and at the completion of the works. All disposable PPE shall be disposed of as asbestos waste;
- Static air monitoring at a minimum of four locations surrounding each asbestos work area and with consideration to neighbouring receptors shall be undertaken in accordance with **Procedure E6.2** for the duration of the work. The monitoring locations shall be assigned by a Licensed Asbestos Assessor (LAA); and
- At the completion of the works the capping and marker layer are to be re-instated in accordance with the requirements of this LTEMP. The changes should be detailed in an updated register of site works as included as **Appendix C.**

E6.2 Airborne Asbestos Fibre Monitoring Procedure

All airborne asbestos fibre monitoring shall be completed in accordance with the National Occupational Health and Safety Commission's Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres – 2nd Edition [NOHSC: 3003(2005)].

The LAA shall undertake the air monitoring for the duration of all asbestos removal works. Safe Work Australia's *Workplace Exposure Standards for Airborne Contaminants* (SWA 2019) identifies the current exposure standard for a standard 8 hour shift as:

- Chrysotile Asbestos – 0.1 fibres/mL;
- Amosite Asbestos – 0.1 fibres/mL;
- Crocidolite Asbestos – 0.1 fibres/mL; and
- Other forms of asbestos or a mixture of any forms of asbestos – 0.1 fibres/mL.

Conservative trigger action levels for daily concentrations of airborne fibres have been outlined in Safe Work Australia's 2019 *Workplace Exposure Standards for Airborne Contaminants* (SWA 2019) to identify potential fibre releases prior to an exceedance of the national exposure standard. These trigger action levels are shown below.

Table E2: Airborne Fibre Trigger Values

Trigger Action Level	Action
< 0.01 fibres/mL	Works are suitable to continue without any additional control measures
0.01 - 0.02 fibres/mL	Review control measures currently in place
> 0.02 fibres/mL	Cease work, notify the regulator and identify the cause of fibre release

Any exceedance of the trigger value 0.01 fibres/mL presented in **Table E2** will result in a stop work direction, until such time as a field assessment by the LAA is undertaken to identify the potential source of fibres within the works zone and establish appropriate additional management procedures to appropriately manage the risk of worker exposure and/or asbestos fibre migration to other areas of the site.

E6.3 Spoil Stockpile Management Procedure

During any soil excavation works below the marker layer on site:

- Any contaminated soil, potential/actual acid sulfate soils (PASS/ASS) or asbestos that is excavated during onsite works, such as maintenance of underground services and utilities, must be securely stockpiled;
- Where possible, stockpiles should be placed on a sealed or hardstand surface or on 200 µm plastic sheeting to prevent cross contamination of unsealed surfaces;
- Where saturated ASS are excavated, appropriate sediment controls are required to minimise potential acidic groundwater/rainwater run off from stockpiled soils. If immediate neutralisation is not possible, the stockpile should be kept wet and covered until such time that the stockpile can be appropriately managed;
- If it is not possible to stockpile on a sealed or plastic covered surface, if above the marker layer the unsealed surface within the footprint of the stockpiles must be visually inspected by a person who is appropriately qualified to recognise ACM, and samples collected across the footprint on a 1/10 m^2 frequency and analysed for the contaminant of potential concern (COPC) i.e. TRHs, PAHs, BTs or asbestos to confirm that cross contamination has not occurred;
- Stockpiles must be placed in a secure location onsite and covered in geofabric if to remain for more than 24 hours; and
- All excavation works and stockpiling of soil should be kept damp to prevent the generation of dust. Care should be taken to not over wet excavations and/or stockpiles that excess runoff is generated and appropriate sediment and erosion controls must be implemented and maintained for the duration of soil management works, consistent with Landcom (2004) *Managing Urban Stormwater: Soils and Construction Guide* and other relevant guidelines/standards.

E6.4 Dust Management Procedure

During intrusive works that will disturb contaminated soils:

- Exposed impacted fill / soils in the walls and floors of excavations and stockpiles of spoil should be kept moist to prevent the generation of dust from these sources;
- Care should be taken to not over-wet excavations and/or stockpiles such that excess surface runoff is generated;
- Works should cease should visible dust be migrating from the work site area, until such time as dust is controlled or conditions causing dust migration (e.g. excessive wind, storms etc.) improve;
- For substantial soil disturbance works, appropriate dust controls should be applied at work site boundaries; and
- Any non-compliances or migration of dust from site boundaries should be reported to the Site Operator and appropriate information recorded in the Environmental Incidents Register in **Appendix H.**

E6.5 Waste Management Procedure

Where waste materials including excess soil are required to be removed from site:

- Any material to be disposed offsite should be classified in accordance with *Waste Classification Guidelines* (EPA 2014) or guidelines that may be in current at that time;
- Materials removed from site for waste disposal should be classified prior to removal, and tracked during transportation with both transport and disposal documentation maintained consistent with relevant regulatory requirements; and
- Any special (asbestos) waste must be removed, transported and disposed in accordance with relevant guidelines and legislative requirements using Waste Locate**.**

E6.6 Asbestos Clearance Certification and Validation Procedure

Following the completion of asbestos removal works, a clearance inspection and potential soil validation sampling (if above the marker layer) will be required to demonstrate the identified asbestos hazards have been removed to a level that enables ongoing works without asbestos controls.

Upon successful completion of the visual clearance inspection and satisfactory results of collected validation samples (if required), the LAA will issue a clearance certificate for the asbestos work area detailing the results of the clearance inspection, validation sampling (if required to be completed) and air monitoring, and will also include a statement for areas that can be re-occupied under non-asbestos or otherwise appropriately controlled conditions.

E6.7 Personnel, Plant and Vehicle Decontamination Procedure

All personnel undertaking works within the contamination / asbestos work area must exit the contaminated zone via the decontamination area and/or unit at the site.

Personal decontamination procedure is as follows:

- Personnel shall remove any sediment or dust from the outer layers of PPE via wet wiping with disposable wipes or damp cloths. All used wipes/cloths shall be disposed as asbestos waste into appropriately labelled asbestos waste bags;
- Disposable coveralls shall be rolled down into themselves and removed and placed into asbestos waste bags;
- Footwear shall be wiped down via wet wiping with disposable wipes or damp cloths. All used wipes/cloths shall be disposed as asbestos waste and placed into asbestos waste bags. Decontaminated footwear shall be placed into a designated clean area in preparation for subsequent shifts and shall not leave the decontamination area;
- Gloves shall be removed and placed into asbestos waste bags;
- Finally, respirators shall be removed and disposed as asbestos waste for single use respirators or wiped down via wet wiping with disposable wipes or damp cloths for non-disposable respirators. All used wipes/cloths shall be disposed as asbestos waste and placed into asbestos waste bags. Decontaminated non-disposable respirators shall be placed into a designated clean area in preparation for subsequent shifts and shall not leave the decontamination area;
- Appropriate personal hygiene shall be adhered to and all workers must wash hands and face thoroughly at the completion of each shift and prior to eating, drinking or smoking; and

- All asbestos waste bags shall be sealed by the Class A contractor and placed into a designated asbestos waste bin for storage prior to offsite disposal at the completion of each shift.

Any plant or vehicles that enter an asbestos works area must be decontaminated prior to exiting the contaminated zone to minimise the tracking of sediment and potentially contaminated soil from entering a clean area.

Decontamination procedures comprise:

- Establish a designated plant decontamination zone;
- Install appropriate sediment controls around the boundary of the plant decontamination zone to minimise the potential for migration of asbestos impacted material from the site and/or entering storm water services or any natural waterways during the decontamination process;
- The decontamination area shall be large enough to accommodate all vehicle and plant that is used on site during asbestos removal works and hold all wastewater and sediment generated from the decontamination process;
- All personnel within the decontamination must wear appropriate PPE as outlined in **Section 4.2;**
- Prior to a vehicle leaving the asbestos works area, all visible sediment, dust and soil shall be removed from the external surfaces with low pressure water and hand brushing, targeting the wheels and underbody of the vehicle;
- Prior to any plant leaving the asbestos works area, all visible sediment, dust and soil shall be removed from the external surfaces, targeting the tracks, underbody, buckets and/or other attachments, and cabin. More extensive decontamination procedures may need to be utilised and include, but not limited to, the use of low-pressure water, shovels and scrapers;
- Following completion of each decontamination, the supervising LAA shall undertake a visual clearance and inspect the plant or vehicle for the presence of sediment, dust, soil and ACM before the plant or vehicle can leave the decontamination area;
- If any sediment, dust, soil or ACM is observed during the visual clearance, additional decontamination of the plant or vehicle will be required;
- All wastewater and soils collected within the decontamination area must be removed and disposed of in accordance with NSW EPA 2014; and
- It is recommended that all plant and vehicles are clean prior to entering the asbestos works area to reduce extensive decontamination timeframes removing existing accumulations of sediment and soil.

E7. Unexpected Finds Procedure

There is potential for unexpected contamination or aesthetic issues to be encountered during general maintenance or subsurface intrusive works at the site.

Unexpected finds, such as previously unreported potentially impacted (e.g. stained, odorous) fill/soil, asbestos or other unexpected contamination, should be managed with consideration to the unexpected finds protocol provided in **Appendix I.**

E8. Groundwater Management Procedure

In the event groundwater is encountered during excavations and requires extraction, extraction requirements should be assessed by suitably qualified and experienced persons to ensure appropriate approvals are obtained and management controls (e.g. treatment, discharge or disposal) planned and implemented.

Appendix F Gas Risk Mitigation System Management and Procedures

F1. Gas Risk Mitigation System Inspection Procedure

Should buildings be constructed at the site, a detailed inspection of the gas mitigation systems shall be conducted by the appointed Site Manager at quarterly intervals throughout the occupation of the site to ensure the systems are performing adequately and no damages or blockages i.e. rips, tears, waste debris, flooding, soil or new slab penetrations have occurred.

F2. Hazardous Ground Gas Required Corrective Actions / Contingency Plan Procedure

In the event an inspection identifies a possible defect to the gas mitigation measures by identification of changes/modifications to existing infrastructure/buildings that may result in accumulation of hazardous gas within the building, that may pose an acute or explosive risk, a combination of the following corrective actions / contingency plans should be implemented appropriate to the event:

- Site Manager to restrict access to the areas of concern (i.e. fencing off) or temporary evacuate the building in accordance with the applied building evacuation procedures;
- Site Manager to arrange an inspection by a qualified Environmental Consultant;
- Environmental Consultant to conduct further investigation and/or monitoring to assess the identified defect and any immediate risk to the building and site users;
- If a risk is identified, report to relevant emergency services (NSW Fire and Rescue / Police Force); and
- Introduce additional ventilation to the area of exceedance to passively ventilate accumulated hazardous concentrations i.e. initially, fans installed to passively vent any excess accumulation of hazardous ground gas (depending on location).

If methane (or other bulk hazardous ground gases) above explosive or harmful concentrations within the building is identified by the Environmental Consultant, with concentrations present that cannot be reduced, the following actions should be undertaken:

- Immediately evacuate the building in accordance with the building evacuation procedures/plan;
- Report to the site users and the emergency services (Fire and Rescue NSW / NSW Police Force); and
- Consideration should also be given to utilise continuous gas monitoring equipment to provide assurance in the long-term operation of the building.

Where a pollution incident occurs that may cause material harm to the environment as defined in Sections 147 and 148 of POEO Act 1997, immediate verbal notification to the NSW EPA (and others, as required by applicable legislation) must take place using the contact numbers provided in **Table 4.3**.

Appendix G Work Health and Safety Management

G1. Specific Requirements for Working in Confined Spaces Procedure

Due to the presence of hazardous ground gas at the site, there is potential for methane and/or carbon dioxide to accumulate in future subsurface excavations at the site. If excavations are to be entered, then entry must be undertaken in accordance with the requirements of the SafeWork Australia 2020, *Code of Practice Confined Spaces*.

A separate risk assessment should be undertaken by a qualified and/or appropriately licensed person before carrying out any confined space work. This will assess the following:

- Nature of the confined space;
- Work that is required;
- Range of methods by which the work can be done;
- The hazards involved;
- The method selected;
- The appropriate control measures; and
- Emergency and rescue procedures.

Monitoring of atmospheric conditions should also be undertaken to assess whether entry of a potential confined space will require suitable PPE/RPE, including the supply of ventilation and/or fresh air.

Monitoring throughout the works will be required to record potential explosive limits of methane present at the site (lower explosive limit of 5 % v/v and upper explosive limit of 15 % v/v). Any area classified as a confined space shall be monitored for the accumulation of hazardous ground gas and verified as safe to enter with a calibrated landfill gas meter capable of measuring low level and explosives limits for methane gas, including bulk concentrations of carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide.

All works within a confined space shall be undertaken in accordance with relevant sections of SafeWork Australia 2020, *Code of Practice Confined Spaces* (SWA 2020c) and WHS Regulation.

G2. Specific Requirements for Working with Asbestos Procedure

It is the responsibility of Site Operator with management or control of the facility to ensure that comprehensive health and safety programmes that comply with the requirements of the WHS Regulation and are appropriate for the activities undertaken at the site are implemented. Given the presence of asbestos at the site, additional protocols and procedures that address the specific hazards posed by the asbestos must be included in the overall health and safety plans implemented.

The only significant exposure pathway that can lead to health effects from asbestos fibres is inhalation of respirable fibres. Consequently, site users / workers who may be exposed to dust that has the potential to contain asbestos fibres must wear appropriate asbestos personal protection equipment, including respiratory protection. Furthermore, measures must be taken to ensure that dust or other material that may contain asbestos fibres is not carried out of the work zone to areas where breathing protection would not ordinarily be considered a requirement.

In areas where intrusive works are required that are deemed to be 'asbestos related works', work should be supervised by a suitably experienced person with training in the safe handling of asbestos and the requirements of working with asbestos. The supervising personnel shall prepare or review existing JRAs and SWMS relating to the potential for asbestos to be present and shall ensure that the intrusive works are carried out in accordance with the JRA and SWMS and requirements identified in **Procedure E6**. All asbestos related works shall be undertaken in accordance with SafeWork Australia 2020, *Code of Practice How to Safely Remove Asbestos (SWA 2020a)*.

Appendix H Environmental Incidents Register

COMPLAINTS AND ENVIRONMENTAL INCIDENT REGISTER

The purpose of the Complaints and Environmental Incident Register is to maintain a register of complaints from local residents or concerned parties, which will include a record of any action taken with respect to the complaints.

The Complaints and Environmental Incident Register is required to be completed immediately following the receipt of any complaints associated with works undertaken at the site.

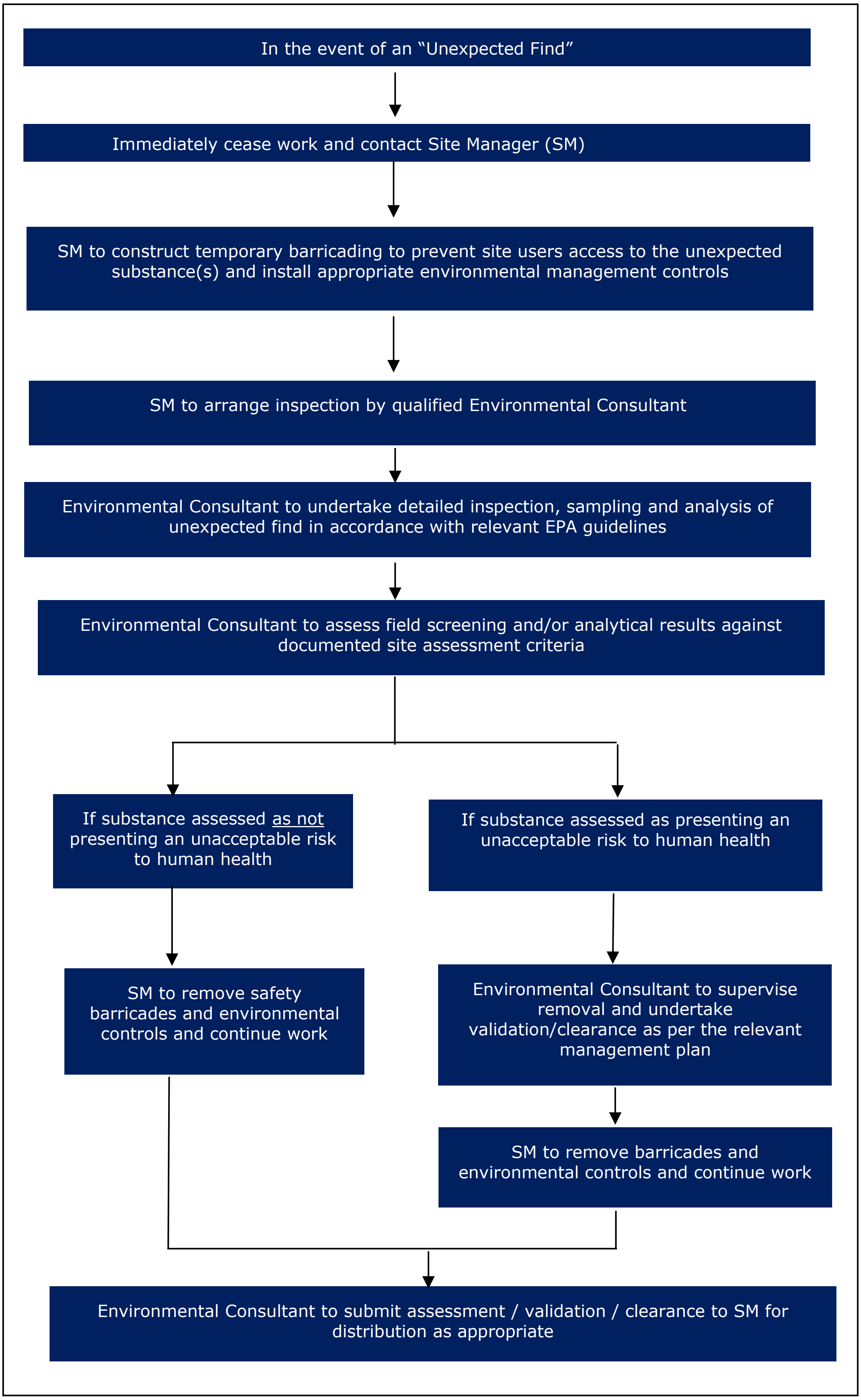
Date	Time	Type of Communication	Name, address and phone number of complainant	Nature of Complaint	Corrective Action	Dates of Response	Signature

DUST MANAGEMENT CHECKLIST

During intrusive works that will disturb asbestos or other impacted soils, the following checklist should be completed on a daily basis.

<table>
<tr><th>Compliance Questions</th><th>Yes (√/x)</th><th>No (√/x)</th><th>Outcome</th></tr>
<tr><td colspan="4">Dust Management Date:</td></tr>
<tr><td rowspan="2">Has all exposed soil/fill in stockpiles and walls and floors of excavations been kept moist?</td><td rowspan="2"></td><td rowspan="2"></td><td>If no, corrective actions such as wetting down the area with a hose must be taken.</td></tr>
<tr><td>If yes, no further action is required.</td></tr>
<tr><td rowspan="2">Is excess run-off being caused by over wetting?</td><td rowspan="2"></td><td rowspan="2"></td><td>If no, no further action is required.</td></tr>
<tr><td>If yes, stop wetting and ensure appropriate sediment controls are in place.</td></tr>
<tr><td rowspan="2">Is visible dust migrating from the work site area?</td><td rowspan="2"></td><td rowspan="2"></td><td>If no, no further action is required.</td></tr>
<tr><td>If yes, work should cease until such time as dust is controlled or conditions causing dust migration (e.g. excessive wind) improves.</td></tr>
<tr><td colspan="4">Any non-compliances or migration of dust from site boundaries should be reported to the Site Environmental Manager and appropriate information recorded in the Environmental Incidents Register.</td></tr>
</table>

Appendix I Unexpected Finds Protocol


In the event of an "Unexpected Find"
Immediately cease work and contact Site Manager (SM)
SM to construct temporary barricading to prevent site users access to the unexpected substance(s) and install appropriate environmental management controls
SM to arrange inspection by qualified Environmental Consultant
Environmental Consultant to undertake detailed inspection, sampling and analysis of unexpected find in accordance with relevant EPA guidelines
Environmental Consultant to assess field screening and/or analytical results against documented site assessment criteria
If substance assessed as not presenting an unacceptable risk to human health
If substance assessed as presenting an unacceptable risk to human health
SM to remove safety barricades and environmental controls and continue work
Environmental Consultant to supervise removal and undertake validation/clearance as per the relevant management plan
SM to remove barricades and environmental controls and continue work
Environmental Consultant to submit assessment / validation / clearance to SM for distribution as appropriate

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A	Jessica Staehli	Aidan Marsh/ Greg Dasey	Aidan Marsh/ Greg Dasey	Draft for client/auditor review	10/12/2021
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1	Jessica Staehli	Aidan Marsh/Greg Dasey	Greg Dasey		17/3/2022

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Appendix H

Off-site Ecological Risk Assessment

Off-site Ecological Risk Assessment

APP Corporation Pty Ltd

Captain Cook Drive Remediation
Woolooware, NSW

15 November 2019

54083/120579 (Revision 1)

JBS&G Australia Pty Ltd

www.jbsg.com.au

Off-site Ecological Risk Assessment

APP Corporation Pty Ltd

Captain Cook Drive Remediation
Woolooware, NSW

15 November 2019

54083/120579 (Revision 1)
JBS&G Australia Pty Ltd

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Abbreviations

ACM	Asbestos Containing Material
AHD	Australian Height Datum
As	Arsenic
bgs	below ground surface
Cd	Cadmium
CSM	Conceptual site model
Cr	Chromium
Cu	Copper
BTEX	Benzene, toluene, ethylbenzene and xylenes
B(a)P	Benzo(a)pyrene
DEC	NSW Department of Environment and Conservation
DECCW	NSW Department of Environment, Climate Change and Water
DP	Deposited Plan
DQI	Data quality indicator
DQOs	Data Quality Objectives
EPA	NSW Environment Protection Authority
GME	Groundwater monitoring event
ha	Hectare
Hg	Mercury
HIL	Health based investigation level
JBS&G	JBS&G Australia Pty Ltd
LOR	Limit of Reporting
MAH	Monocyclic Aromatic Hydrocarbon
NEPC 2013	National Environment Protection (Assessment of Site Contamination) Measure, 1999 Amendment No 1, National Environment Protection Council (NEPC 2013)
Ni	Nickel
OCP	Organochlorine Pesticide
OEH	Office of Environment and Heritage
PAHs	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAQP	Sampling, Analysis and Quality Plan
TPH	Total Petroleum Hydrocarbons
TPH	Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
Zn	Zinc

1. Introduction

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) has been engaged by APP Corporation Pty Ltd (APP) on behalf of Roads and Maritime Services (RMS) to provide environmental consulting services related to the assessment and remediation of contamination at the property known as the 'Captain Cook Drive Remediation' located on Captain Cook Drive, Woolooware NSW (the site). The site location is shown on **Figure 1**.

Previous investigations have identified that soils and groundwater at the site are impacted with polycyclic aromatic hydrocarbons (PAHs) and total recoverable hydrocarbons (TRH) (C>10 fractions). These contaminants are associated with the historical use of tars on the site to treat timbers associated with oyster farming. An assessment conducted in 2016 (JBS&G 2018a[1]) recommended that tar-based contamination (acting as potential source material) within the extent of the site be removed, with an Environmental Management Plan (EMP) prepared for the site.

Remediation works have subsequently been undertaken in accordance with a Remedial Action Plan (RAP) (JBS&G 2018b[2]). The primary objectives of the remedial works are to remove or manage the risks associated with the identified contamination on site with respect to future commercial occupants and to the surrounding environment (off-site ecological receptors). The scope of remedial works includes the removal of tar-based contamination acting as potential source material within the extent of the site, as well as validation to confirm that remaining soils do not pose a risk to groundwater or a potential on-going risk to off-site receptors.

A preliminary off-site ecological risk assessment conducted in 2016 within areas adjacent to the site concluded that while there were exceedances of sediment quality guidelines, the "likelihood of actual adverse effects from the contaminants of concern at these levels is low" (Geochemical Assessments 2016[3]) in the areas that were not proposed to be remediated (via removal of readily accessible sediments) as p

er the RAP (JBS&G 2018b). Additional sampling and a revised ecological risk assessment were proposed for the area adjacent to the site to further refine and support the conclusions of the preliminary assessment. This report details the results and conclusions from the revised off-site ecological risk assessment as completed in accordance with the Sampling, Analysis and Quality Plan (SAQP) (JBS&G 2018c[4]) and the Additional Offsite Investigation, Sampling and Analysis Quality Plan (JBS&G 2019a[5]).

This report has been prepared in accordance with the requirements of the NSW Environment Protection Authority (EPA) published and endorsed guidelines.

1.2 Objectives

The primary objective of the off-site ecological risk assessment is to assess the significance of contamination migrating from the site to off-site ecological receptors. The findings of this objective will inform the required scope of remedial works such that upon completion of works, the site will not pose an on-going risk to the surrounding environment. A secondary objective of the assessment

[1] *Additional Contamination Assessment*, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 4 June 2018 (JBS&G 2018a).

[2] *Remedial Action Plan*, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 4 June 2018 (JBS&G 2018b).

[3] Screening Level Ecological Risk Assessment; 'The Oyster Farm', Captain Cook Drive, Woolooware Bay, Geochemical Assessments, July 2016 (Geochemical Assessments 2016).

[4] *Offsite Investigation, Sampling Analysis and Quality Plan,* 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 4 June 2018 (JBS&G 2018c).

[5] *Additional Offsite Investigation, Sampling, Analysis and Quality Plan, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware NSW*, JBS&G Australia Pty Ltd, 10 July 2019 (JBS&G 2019a).

is to assess the ecological significance of contaminants in off-site sediments related to historical Oyster Farming operations.

1.3 Scope of Works

The following scope of work has been undertaken for the off-site investigation:

- Review of previous site contamination assessments/investigation reports as available to JBS&G;
- A targeted sediment investigation comprising the collection of cores at 18 locations (located east and north of the site) to adequately characterise and delineate potential impacts from the identified contaminants of potential concern (COPCs) within sediments;
- The collection and analysis of pore and surface water samples at 15 locations to further assess the potential environmental mobility of site-related contaminants;
- Additional direct assessment of uptake of site related contaminants by biota. Sampling comprised deploying live oysters at 15 locations (including background reference sites) for one month. Composited oyster tissue samples were then analysed to assess the potential for bioaccumulation of site-related contaminants;
- Laboratory analyses of representative sediment, pore, surface water and biota samples with subsequent data assessed referencing NSW EPA endorsed guideline values; and
- Preparation of this report documenting the methods, results and conclusions of the investigation. The assessment of risks to off-site ecological receptors was completed in accordance with the framework provided in Schedule B5a (NEPC 2013) as follows:
    - **Problem Identification**. Previous investigations have identified that site soils and groundwater are impacted with PAHs and TRH (C>10 fractions) originating from the historical use of tars to treat timbers associated with oyster farming. These impacts were considered to have the potential to migrate from the site primarily through the discharge of impacted groundwater. A screening level off-site ecological risk assessment conducted in areas adjacent to the site identified the presence of site related contaminants at levels exceeding relevant sediment quality guidelines. It was concluded that despite the reported exceedances, the "likelihood of actual adverse effects from the contaminants of concern at these levels is low" at areas generally not proposed to be subject to remediation. Further assessment was required to confirm the preliminary findings and conclusions of the screening level off-site assessment in order to determine the type/extent of any future management requirements.
    - **Receptor Identification.** The identification of the off-site ecological receptors potentially exposed to contaminants migrating from the site is presented in **Section 3** with additional information provided within **Section 5**.
    - **Exposure Assessment.** Sediment, surface and pore water sampling was conducted in order to assess the potential exposures of site related contaminants within ecological receptors in the investigation area. In addition, tissue samples were collected to assess the potential bioaccumulation of site related contaminants within biota in the environment. **Sections 6-7** provide discussion of these elements of the assessment.
    - **Toxicity Assessment.** Tier 1 guideline values as presented in **Section 5** were used to assess potential toxicity of sediments, surface and pore water as discussed in **Sections 6-7**.

- **Risk Characterisation.** A Weight of Evidence (WOE) assessment of the potential for environmental effects at the site was undertaken following the methodology described by Simpson, et al. (2013) and presented in **Section 7**.

2. Site Identification and Setting

The site location is shown on **Figure 1**. Site details of the site are summarised in **Table 2.1** following.

Table 2.1: Site Details

Lot/DP	Part Lot 3 DP1165618
Address	'Oyster Farm' Captain Cook Drive, Woolooware, NSW
Local Government Authority	Sutherland Shire Council
Easting **Northing**	329000.83 (MGA56) 6232074.42 (MGA56)
Site Zoning	W1 Natural Waterways
Current Use	Oyster farming (commercial/industrial)
Proposed Use	Ongoing commercial/industrial use

The assessment was limited to Woolooware Bay within proximity of the Oyster Farming processing site as shown on **Figure 3**. Previous site assessments, as summarised in JBS&G (2018b) have reported that the most significant off-site impacts are located within the boat channel adjacent to the site.

2.1 Woolooware Bay

Woolooware Bay is part of Botany Bay which is typical of a NSW drowned river valley type estuary (AGSO 1998)[6]. Tidal range in the bay is 1 m on neap and 1.9 m on spring tides. Across Botany Bay, sediments are a mixture of three different types:

- Quartz sand;
- Calcareous sand-gravel; and
- Mud derived from fluvial supply of fine terrigenous grains and organic material.

The central portion of Botany Bay is dominated by sand and gravel while mud is the dominant sediment type in the natural basins at Ramsgate and Woolooware.

Woolooware Bay is located at the southern side of Botany Bay and is enclosed to the east by Towra Point (nature reserve), to the west by Taren Point (commercial industrial area) and the south by Woolooware (golf courses and schools). The Bay is fringed by mangroves/wetlands that are considered to be of national importance. Towra Point Nature Reserve (http://www.nationalparks.nsw.gov.au/visit-a-park/parks/towra-point-nature-reserve) incorporates a Ramsar Wetland (http://www.environment.gov.au/cgi-bin/wetlands/ramsardetails.pl?refcode=23#) that includes a wide variety of habitats including seagrass meadows, mangroves and salt marsh.

2.2 Local Geology

Review of the regional geologic map (DMR 1993) [7] indicated the site is underlain by organic-rich, muddy, marine sand.

Review of the regional soil map (DCLM 1993) [8] indicated that the local area is located on tidal mudflats with a relief of less than 3 m and a slope of less than 3%. The local soils consist of water-logged calcareous sands and siliceous sands.

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6 *Australia Port Environmental Data & Risk Analysis Phase 1: Literature Review* Petroleum & Marine Division Australian Geological Survey Organisation December 1998 (AGSO 1998).

7 *Wollongong – Port Hacking Geological Series Sheet 9029 (Edition 1) 1993*. Geological Survey of NSW Department of Mineral Resources, (DMR 1993).

8 *Soil Landscape Series Sheet 9029*. Department of Conservation and Land Management of NSW, 1993 (DCLM 1993).

During previous investigations conducted at the site, the soils encountered generally comprised:

- Fill to a depth of greater than 2.2 m, comprising gravelly silty sand with inclusions of shell fragments and igneous gravels; and
- Underlying natural material generally consisted of dark grey silty clays with some organic material inclusions.

2.3 Local Hydrogeology

JBS (2012 [9]) provides a review of the potential hydrogeological conditions underlying the site based on a review of the registered bores in proximity to the site. A number of representative wells were identified to surround the site within a 2 km radius. Where information was available from records, a shallow groundwater aquifer was identified in bores installed for the purposes of groundwater monitoring (located 2 km west of site) and had a reported standing water level at 1.4 m bgs in sandy clay. A review of current registered bores (accessed from NSW DPI 2017 [10]) in proximity of the site identified several additional irrigation bores located approximately 400-700 m south-west of the site. The additional bores were reported as used for industrial purposes within Cronulla Golf course and were installed to a depth of 19 m within fractured rock (water bearing zone was reported at a depth of 10-19 m). All other bore information was consistent with JBS (2012).

JBS&G 2016 provides further detail on the groundwater conditions at the site. In summary, shallow groundwater was encountered from a depth of 0.8-1.2 m bgs and was found to be tidally influenced. Review of the field parameters recorded for the samples indicate that the groundwater has a relatively neutral pH, is saline and relatively low in oxygen.

2.4 Previous Assessments

JBS&G has been provided with the following previous contamination assessments relating to the site:

- Environmental Site Assessment, 'Oyster Farm', Captain Cook Drive, Woolooware NSW, JBS Environmental (JBS 2012);
- Additional Contamination Assessment, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW, (JBS&G 2018a);
- Screening Level Ecological Risk Assessment, 'Oyster Farm', Woolooware, NSW (Geochemical Assessments 2016);
- Remedial Action Plan, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW, 4 June 2018 (JBS&G 2018b);
- Offsite Investigation, Sampling Analysis and Quality Plan, 'Oyster Farm', Captain Cook Drive, Woolooware, NSW, 19 April 2018 (JBS&G 2018c); and
- Additional Offsite Investigation, Sampling and Analysis Quality Plan, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware, NSW, 11 July 2019 (JBS&G 2019a).

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[9] *Environmental Site Assessment, 'Oyster Farm' Captain Cook Drive, Woolooware, NSW*. JBS Environmental Pty Ltd, September 2016 (JBS 2012)

[10] NSW Department of Primary Industries, 2015. Groundwater Monitoring Overview Map. Http://allwaterdata.water.nsw.gov.au/water.stm. Accessed 16 April 2018

3. Conceptual Site Model

A conceptual site model (CSM) based on the results presented in Geochemical Assessments (2016) is presented in **Table 3.1** following. **Figure 3** presents the historical sampling locations and analytical results. It is noted that the historical sample results have been compared to the revised assessment criteria (**Section 5**) within **Appendix A**.

Table 3.1: Conceptual Site Model

CSM Aspect	Summary of Available Information
Current Extent of Known Impacts	**Sediments** Concentrations of PAHs in surficial (0-0.1 m) sediment in proximity of the site are elevated in comparison to those reported in sediment collected at background reference locations. Sediments at the seaward end of the boat channel and in one location in mangroves along the northern foreshore of the site contained concentrations of individual, low and high molecular weight, and total PAHs that exceeded the now superseded ISQG-Low values. Concentrations of pyrene, benzo(a)anthracene and high molecular weight PAHs also exceeded their respective ISQG-High values in samples collected in the boat channel to the east of the site. A review of the historical sediment dataset with the current adopted assessment criteria (**Table A3** in **Appendix A**) identified total PAHs exceeded the D-GV criterion at location SS03 0.0-0.1 and SS04 0.1-0.5 and mercury at SS10 0.1-0.5 as presented in **Figure 3**. **Pore Water** Concentrations of individual and high molecular weight PAHs in pore water extracted from surficial sediments in proximity of the site were higher than those reported in pore water collected from reference locations. However, the reported concentrations of contaminants in pore water were considered to indicate a low potential for adverse ecological effects. A review of the historical pore water dataset with the current adopted assessment criteria (**Table B3** in **Appendix A**) identified that anthracene marginally exceeded the 99% protection levels in sample locations to the west of the site and within the southern and northern portions the boat channel. In addition, B(a)P exceeded the 99% protection levels in sample locations to the north of the site as well the 95% protection levels at PW05 (to the west of the site). The historical sampling locations and exceedances (with respect to current adopted criteria) are presented in **Figure 3**. **Surface Water** Concentrations of PAHs in grab samples collected from surface water surrounding the site (and at reference locations) did not exceed the adopted guideline values. Concentrations of TRH in surface waters were, with the exception of a single sample analysed for Toluene, below the laboratory limit of reporting (LOR). The reported concentrations of contaminants in surface water therefore indicated a low potential for adverse ecological effects. The historical surface water data is presented in **Table D3** with comparison to the current adopted criteria. A review of the dataset with comparison to the current adopted criteria identified that anthracene and/or B(a)P marginally exceeded the criteria protective of 99% of species at locations SW01, SW02 and SW05. Historical sampling locations are presented in **Figure 3**. **Biota** Concentrations of PAHs in tissues of wild oysters were assessed at five locations in close proximity of the site. The highest concentrations of individual PAHs in oyster tissue were reported for fluoranthene (80 µg/kg), pyrene (88 µg/kg) and benzo(b)&(k)fluoranthene (90 µg/kg) in which the relative concentrations were considered to be low compared to locations in Sydney Harbour (Birch and Taylor, 2002[11]) that were grossly contaminated by PAHs, however, baseline data for PAH concentrations of oyster tissues in Botany Bay or Woolooware Bay was not available. Therefore, the significance of the reported concentrations of PAHs in oysters could not be assessed without data for oysters collected

[11] Birch, G, Taylor, S.E. (2002). Application of Sediment Quality Guidelines in the Assessment and Management of Contaminated Surficial Sediments in Port Jackson (Sydney Harbour), Australia. Environmental Management, 29 (6):860-870.

CSM Aspect	Summary of Available Information
	from suitable reference locations. The historical biota analytical results are presented in **Table E2** and sampling locations shown on **Figure 3**. **Source Material (tar impacted soils)** Onsite contamination sources are associated with the historical use of tars on the site to treat timbers associated with oyster farming. It is understood that the tars were applied by hand to timber racks at a number of potential locations around the site. Substantial spillages of tar are thought to have occurred during these treatment works. On-site remedial excavations and the findings of the test pit investigation works in the southern portion of the site identified tar impacts in fill material at depths extending to 2.0 m bgs (as free flowing tar and tar impacted timbers) in proximity to the site boundaries to the north, west and south of the site.
Contaminants of Concern	Historical investigations (JBS 2012 and JBS&G 2018a) completed within the extent of the Oyster Farm site included sampling and analysis (including soils and groundwater) for a variety of identified contaminants of potential concern (COPCs) that included heavy metals (As, CD, Cr, Cu, PB, Ni, Zn and Hg), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), phenols, organochlorine pesticides (OCPs), organotin compounds and asbestos. The principal contaminants identified on the site were reported to be PAHs and TRH (C>10 fractions). These contaminants were reported to be associated with the historical use of tars on the site to treat timbers associated with oyster farming where their elevated concentrations in site groundwater were considered to pose a potentially unacceptable risk to off-site ecological receptors. All other COPCs were below the adopted site assessment criteria and therefore not considered to pose an unacceptable risk to off-site receptors. The preliminary off-site ERA (Geochemical Assessments (2016)) included laboratory analysis of heavy metals (within sediment samples only), TRH/BTEX and PAHs within sediment, surface water and pore samples collected in the investigation. In addition, biota samples were analysed for PAHs. With the exception of mercury in a single sediment sample (SS10 0.1-0.5 m) which marginally exceeded the adopted criteria (**Table A3**), all heavy metal concentrations were below the adopted criteria. It is noted that the mercury exceedance was reported within sediments collected at depth (out of the biologically active zone) and given that it was relatively isolated (in the context of the complete dataset) it is not considered to pose an unacceptable risk to off-site ecological receptors and is therefore not required to be further assessed – this is further supported by historical investigations not identifying elevated levels of heavy metals within site soils. During recent remedial works on-site, butyltin (BT) compounds (monobutyltin, dibutyltin and tributyltin) were reported within fill based soils in which approximately 6,515 m^3 of impacted on-site fill materials has been excavated for off-site disposal in accordance with the RAP (JBS&G 2018b). Of these materials, approximately 495 m^3 (representing 7.5% of impacted fill materials requiring off-site disposal) reported concentrations of TBT above the sediment guideline value (high) of 70 µg/kg. These materials were excavated at depths ranging from 0.2-1.8 m bgs in the central-northern portion of the site over a limited period (<3 days) in May 2018. Given that these materials were excavated from a small area over a short period, it is considered unlikely that significant runoff from these materials to the surrounding environment could have occurred during remediation works (given the sediment/erosion controls implemented). Of the remaining excavated fill materials, approximately 981 m^3 (representing 15% of impacted fill materials requiring off-site disposal) exceeded the TBT default sediment guideline value of 9 µg/kg. These materials were excavated from the extent of the on-site remediation areas at depths ranging from >0.2-2.5 m bgs. Noting that approximately 22% of fill materials exceeded the TBT sediment guideline values, and that these materials were previously covered in sea shells and were excavated at depths from 0.2-2.5 m bgs - it is considered unlikely that significant surface water runoff from these materials could have occurred historically during previous site operations.

CSM Aspect	Summary of Available Information
	JBS&G also completed an additional groundwater assessment of BT compounds (JBS&G 2018d[12]) to assess the potential for BT impacts within site groundwater in order to assess potential off-site ecological risks posed by BTs present in groundwater discharging from the site. The report concluded that there were no identified BT impacts within site groundwater. It was therefore considered that the identified TBT impacts within on-site soils soil are not acting as source material to TBT in groundwater and therefore present a low risk to off-site receptors. As such, no additional assessment of BTs is considered necessary for the off-site ERA. Consistent with the historical investigations (both on and off-site) reported herein, it is considered that the primary COPCs that require further assessment with respect to posing an unacceptable risk to off-site receptors is limited to TRH and PAHs.
Ecological Receptors	The off-site investigation area is located within the Towra Point Nature site. Information with respect to the ecological character of the Towra Point Nature site is provided in DECCW (2010[13]), in which the habitats within the nature reserve were identified as sand spits, estuarine waters, intertidal mudflats, intertidal marshes, intertidal forested wetlands and sea grass meadows. Based on observations during the investigation works - the primary habitats within the investigation area is considered to comprise estuarine waters and intertidal mudflats and forests. Flora present within these habitats is reported to comprise phytoplankton, seagrass and mangroves. In addition, the fauna is expected to comprise macroinvertebrates, fish, amphibians, reptiles, mammals, birds and rare, endemic & threatened species (of which, further discussion is provided below). With respect to rare and threatened species, DECCW (2010) reports that the greater area of Towra Point supports three nationally threatened species that includes the magenta lilly pilly, green and golden bell frog and grey-headed flying fox. Given the environmental setting (primarily comprising estuarine mudflats) of the investigation area, it is not anticipated to support primary habitat for these species. A review of Table 6 in DECCW (2010) also identifies 16 NSW threatened species of fauna within the greater Towra Point reserve. These include the green and golden bell frog, dugong, masked owl, grey-headed flying fox, greater broad-nosed bat – of which none are expected, or have been reported to be located within the investigation area (DECCW 2010). Table 6 also identifies 12 threatened species of local and migratory birds that have not been reported to have been found within the investigation area, but may temporarily forage for food within the investigation area. In these instances, the birds could potentially be exposed to site related impacts primarily through predation of impacted organisms in which bioaccumulation could potentially occur. It is noted that the investigation area (and corresponding area of site related environmental impacts) relative to the greater Towra Point reserve area is small - in which these threatened species of bird are expected to require a large area for feeding/foraging. Therefore, it is expected that these species of birds will predate on organisms over a wider area (i.e. throughout Woolooware Bay) such that their diet will be balanced which will in turn, minimise the potential for bioaccumulation. Hedge *et al.,* (2014[14]) provides a detailed review of the variety of organisms that are found in mudflats in the nearby Sydney Harbour estuary. The underlying biological structure of mudflats was identified to be provided by bacteria, which occur in high densities, where the surface sediments are often densely coated by mats of filamentous plants. These form the basis of an important food chain, providing habitat and resources for a diverse range of juvenile and adult invertebrates, fishes and birds. Macrophytes present within these environments include mangroves and sea grasses which support a wide variety of fauna. The variety of fauna that has been reported within these

[12] *Additional Groundwater Assessment of Butyltin Compounds (BTs*), 'The Oyster Farm', Captain Cook Drive, Woolooware, NSW, JBS&G Australia Pty Ltd, 7 November 2018 (JBS&G 2018d).

[13] *Towra Point Nature Reserve Ramsar Site: Ecological character description*, Department of Environment, Climate Change and Water NSW (DECCW 2010)

[14] Hedge, L.H., Johnston, E.L., Ahyong, S.T., Birch G.F., Booth, D.J., Creese, R.G., Doblin, M.A., Figueira, W.F., Gribben, P.E., Hutchings, P.A., Mayer-Pinto, M, Marzinelli, E.M., Pritchard, T.R., Roughan, M., Steinberg, P.D., (2014). Sydney Harbour: A systematic review of the science, *Sydney Institute of Marine Science, Sydney, Australia. Prepared for the NSW Department of Primary Industries.*

CSM Aspect	Summary of Available Information
	habitats in Sydney Harbour includes polychaetes (e.g. worms), molluscs (e.g. snails, mussels, octopus), crustaceans (e.g. crabs, shrimps, amphipods and barnacles), bony fish (e.g. bream and mullet) and shore birds (e.g. pelicans, cormorants and herons) as detailed in *Hutchings et al.*, (2013[15]) and similar to that reported in DECCW (2010).
Potential and Complete Exposure Pathways	Organisms living within estuarine systems have the ability to bioaccumulate contaminants from both pore waters and overlying surface waters, as well as via ingestion of sediment particles and food. To date, the reported concentrations of COPCs within pore and surface water samples were considered to indicate a low potential for adverse ecological effects. The concentrations of total PAHs within surficial sediment samples exceed default guideline values, which indicates a potentially complete exposure pathway for ecological receptors via the ingestion or uptake of contaminants through sediment particles. To date, the bioaccumulation of these constituents could not be assessed without data from biota samples collected from suitable reference locations.
Potential for Off-Site Migration	The potential for off-site migration of contaminants is primarily limited to site contaminants migrating via groundwater and their discharge to the environment within pore waters. Noting that the on-site remedial works currently being completed in accordance with the RAP (JBS&G 2018b) will remove any on-going source of impacts to site groundwater, it is considered that any future off-site migration of contaminants in groundwater will be acceptable. Surface water runoff is not considered to be as significant (when compared to groundwater) with respect to off-site migration of contaminants. Prior to the recent remedial works on-site, the site ground surface primarily comprised of crushed oysters (acting as road base) with limited areas of hardstand/building footprints. As such, surface water would largely have infiltrated the ground surface (through the relatively permeable crushed oyster surface) and percolated through the soil profile where the majority of contaminant source material (tar impacts within site soils) was identified at a depth of greater than 0.3 m bgs. In addition, during recent remedial works, sediment and erosion controls were implemented to control surface water run-off from the site when impacted soils were exposed, thereby limiting this migration pathway. Once the remedial works are completed, it is proposed to seal the ground surface with a 2-coat spray seal (in accordance with the RAP (JBS&G 2018c) that will limit sediment laden run-off migrating from the site in the future.
Data Gaps	The key data gaps that are required to be addressed include the following: • Further delineation of contamination in sediments in proximity of the site; • Further assessment of the potential environmental mobility of site-related contaminants and the subsequent risks to off-site receptors via the collection of additional pore water and surface water samples; and • Additional direct assessment of potential ecological exposures to site related contaminants via biota sampling. Representative tissue samples (from oysters) from background reference sites is required to allow for tissue sample results to be included in the WOE conclusions of the assessment.

[15] Hutchings PA, Ahyong ST, Ashcroft MB, McGrouther MA, Reid AL (2013). Sydney Harbour: Its diverse biodiversity, Australian Zoologist, 36: 255-320.

4. Sampling and Analysis Plan

4.1 Data Quality Objectives

Data Quality Objectives (DQOs) established for the off-site sampling program are discussed in the following sections.

4.1.1 State the Problem

Section 3 has identified a series of data gaps that are required to be addressed in order to satisfy the objectives of the ecological risk assessment including:

- Assessment of the significance of contamination migrating from the site to off-site ecological receptors to inform the required scope of remedial works; and
- Assessment of the ecological significance of contaminants in off-site sediments related to historical Oyster Farming operations.

4.1.2 Identify the Decisions

The decision required to be made for the revised assessment:

- Have the identified data gaps been sufficiently addressed in order to assess the significance of contamination migrating from the site and the associated risks to off-site ecological receptors?

4.1.3 Identify Inputs to the Decision

The following inputs are required in order to make the stated decisions:

- Previous environmental data for the site and off-site areas;
- Sampling and analysis of sediments, pore water, surface water and biota in proximity to the site and at reference locations;
- Site assessment criteria for potentially impacted media for COPCs; and
- Confirmation that data generated by sampling and analysis are of an acceptable quality to allow reliable comparison to assessment criteria.

4.1.4 Define the Study Boundary

The study boundary comprises the extent of identified site-related contamination in sediments in proximity to the site, as shown in **Figures 4A and 4B**. It is noted that reference locations were selected from within the greater area of Woolooware Bay.

The temporal study boundaries were limited to the period of assessment works. Due to the nature of the potential contamination identified, seasonality is not considered to be significant with respect to assessing risks to off-site receptors.

4.1.5 Develop a Decision Rule

A summary of the decision rules to be adopted for each of the environmental issues required to be addressed are outlined in **Table 4.1** below.

Table 4.1: Summary of Decision Rules

Decision Required to be Made	Decision Rule
1. Have the identified data gaps been sufficiently addressed in order to assess the significance of contamination migrating from the	Was data collected at the proposed sample locations in accordance with the SAQP (JBS&G 2018c and 2019a)? Has the environmental mobility of site-related contaminants been appropriately and sufficiently assessed in off-site areas?

Decision Required to be Made	Decision Rule
site and the associated risks to off-site ecological receptors?	Has sufficient data been collected to support a weight of evidence (WOE) assessment using multiple lines of evidence to assess the potential for adverse ecological effects as related to site related contaminants such that the remaining scope of remediation can be refined? If Yes to all, the decision is Yes. Otherwise the decision is No.

4.1.6 Specific Limits on Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013), appropriate indicators of data quality (DQIs used to assess quality assurance / quality control as outlined in **Section 4.7**) and standard JBS&G procedures for field sampling and handling.

In standard environmental investigations, there are two types of decision errors including:

A. Deciding that the site is acceptable when it actually is not; and

B. Deciding that the site is unacceptable when it is.

It is nominated in AS4482.1 that limits should be set on these, with a 5% probability set for A type errors and 20% probability set for B type errors. The application for determining the probability of these type errors is dependent on a grid based sampling pattern conducted across an area in order to detect contaminant hotspots of a given size. As the assessment is a targeted investigation in order to delineate known impacts, it is not possible to determine the probability of these type errors. Therefore, a qualitative judgement must be made in order to consider the potential for these decision errors within the investigation.

Data Reliability

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined Data Quality Indicators (DQIs) established for the project as discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters).

The DQIs and data assessment criteria are summarised as presented in **Table 4.2**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** – expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to

collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.

- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.

Table 4.2: Summary of DQIs

Data Quality Indicators	Frequency	Data Quality Criteria
Precision		
Split duplicates (intra laboratory)	1 / 20 samples	<50% RPD[1]
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD[1]
Laboratory Duplicates	1 / 20 samples	<50% RPD[1]
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes	All samples	All samples[2]
Samples extracted and analysed within holding times.	-	sVOCs (PAHs, TRH>C10 – 7 days), VOCs/TRH<C10 – 14 days).
Laboratory Blanks	1 per lab batch	<LOR
Trip spike	1 per lab batch (soil/water only)	70-130% recovery
Trip blank	1 per lab batch	<LOR
Rinsate sample	1 per sampling event/media	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All Samples
Standard analytical methods used for all analyses	All Samples	NATA accreditation
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples[2]
Limits of reporting appropriate and consistent	All Samples	All samples[2]
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples[2]
Appropriate documentation	All Samples	All samples[2]
Satisfactory frequency and result for QC samples	All Samples	95% compliance
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		
Analytical methods and limits of recovery appropriate for media and adopted Site assessment criteria	All samples	LOR<= Site assessment criteria

1 If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.
2 A qualitative assessment of compliance with standard procedures and appropriate sample collection methods will be completed during the DQI compliance assessment.

4.1.7 Optimise the Design for Obtaining the Data

The purpose of this step is to identify a resource-effective field investigation sampling design that generates data that are expected to satisfy the criteria specified in the preceding steps of the DQO process. This step provides a general description of the activities necessary to generate and select data collection designs that satisfy decision performance criteria. Based on the objectives of the assessment, the investigation approach broadly comprised the sampling of:

- Sediments;
- Pore water;
- Surface water; and
- Biota.

The sampling with respect to the different media listed above is discussed in the following sections. It is noted that all sampling was undertaken from a small boat / vessel and was undertaken over multiple mobilisations (required for deployment of oysters and passive surface water samplers and their subsequent collection) over a period of several weeks as described in greater detail in the following sections.

4.2 Background / Reference Location Selection

In order to differentiate the risks posed by contaminants migrating from the site to those posed by natural and anthropogenic sources in the environment, background / reference sample locations were completed (for each media). The background sample locations were labelled as locations 7-10 and are shown on **Figure 4A**. Noting that the background reference sites are located approximately 150-300 m to the north-west and north-east of the site respectively, it is considered that these locations would have no / minimal influence from contamination potentially migrating from the site. In addition, the locations were selected within the same environment (mudflats within Woolooware Bay) as the test locations and therefore present similar physical conditions with the same expected ecological receptors. On this basis, the reference locations were considered appropriate to differentiate the risks posed by contaminants migrating from the site to those posed by natural and anthropogenic sources. The potential sources of background contaminants within Woolooware Bay include urban stormwater runoff and various industries to the north-west of the site. It is noted that surficial sediments collected within background / reference locations (S08 and S09) from Geochemical Assessments (2016) had reported total PAH concentrations of 0.83-0.85 mg/kg respectively, indicating at least some level of background PAH impacts within Woolooware Bay. It is further noted in DECCW (2010) that oyster cultivation had historically occurred throughout Woolooware Bay at a much higher production rate until 1994 when Qx disease halted the industry – the historical cultivation practice along with discarded oyster farming materials (further reported to still line the foreshores of Woolooware Bay in areas outside the investigation area) would likely have produced some additional environmental impacts (contributing to background levels) within the greater Woolooware Bay area.

4.3 Sediment Sampling

Additional sediment sampling was required to further delineate the extent of sediment impacts in proximity to the site. Specifically, it was required to allow for the identification of the lateral and vertical extent of contaminants in the stratigraphic profile of sediments surrounding the site. The locations are shown on **Figures 4A and 4B.**

The sampling of sediments was undertaken via the following method:

- A manually-operated piston coring device (stainless steel barrels, 50.8 mm OD) was used to collect sediment to a maximum depth of 1.15 m during the 2018 investigation works.

Penetration depth at each location was dependent on the nature of the substrate encountered;

- A surficial sample was collected to the depth of the biologically active zone, i.e. 0-0.2 m and further samples were collected to the maximum depth of coring, based on the stratigraphy and visual or olfactory presence of contaminants in the core. It is noted that deeper cores (to a maximum depth of 1 m) were completed on 15 November 2018 in order to vertically delineate the extent of impacts at locations where elevated PAHs were reported from the first round of surficial sampling completed on 17 October 2018 in the north-eastern portion of the investigation area. In addition, deeper cores were collected at locations (up to a maximum depth of 1.9 m) using a manually operated vibrocorer (stainless steel barrels, 50.8 mm OD) at locations adjacent to where source material (tar based impacts) were identified on-site;

- All sediments were described and recorded (appearance and grain size, texture, inorganic and organic component) at the time of sampling; and

- Samples were analysed for PAHs and TRHs in accordance with the laboratory schedule in **Section 4.6**. Since the grain size and organic content of sediments influence contaminant concentrations, particle size distribution and total organic carbon (TOC) contents of sediment were also determined via reference to results from Geochemical Assessments (2016) and additional laboratory analysis (TOC only).

4.4 Pore Water Sampling

Additional pore water data was required to allow for an assessment of the potential mobility of contaminants identified. The locations were generally to the north and east of the previous sample locations from 2016 as well as in proximity to the southern boundaries of the site as shown on **Figures 4A and 4B.** Pore water sampling was undertaken by:

- Collection of multiple cores of surficial (0-0.1 m) sediments at each location to provide sufficient material to extract the required volume of pore water;

- The pore waters were extracted by centrifugation;

- The separated pore water samples were then immediately transferred to laboratory-supplied sample bottles and were then transferred to a chilled iced box for sample preservation prior to and during shipment to the testing laboratory; and

- Samples were analysed at a NATA accredited laboratory for PAHs and TRH.

4.5 Surface Water Sampling

Additional surface water sampling was conducted to assess the presence and potential mobility of site related contaminants and the subsequent risks to receptors. The sample locations are shown on **Figure 4A and 4B** and were selected to target areas of identified impact, as well as background reference locations adjacent to the site**.** The sampling of surface water was undertaken by both passive and grab water sampling as detailed following:

- Passive water samplers were installed from 17-18 October 2018 until 15-16 November 2018 at the selected surface water sampling locations limited to subtidal areas through a method developed by Professor Jochen Mueller of the University of Queensland (UQ). The passive samplers comprised of polydimethylsiloxane (PMDS) passive samplers in which the PDMS strips were co-deployed with Passive flow monitors (PFMs) at each site (at a depth below the low tide level) to estimate water flow conditions over the passive sampler devices. These types of samplers provide time-averaged water concentrations that are suitable for assessing against the toxicant trigger values presented in Australian and New Zealand

Guidelines for Water Quality (ANZAST, 2018[16]). The use of these samplers allows a robust time-integrated dataset to be collected that is less influenced by concentration changes induced by tides and stormwater flows and therefore well suited for comparison to guideline values;

- Field sampling procedures incorporated field (method) blanks and sample duplicates. Water samples were preserved for the specific analyses, including cooling during transportation. Analytical methods were capable of detection at an order of magnitude below default guideline trigger value concentrations;
- Surface water samplers were analysed by a laboratory within the University of Queensland utilising gas-chromatography mass spectrometry (GC-MS) for PAHs; and
- In addition, during deploying and collection of the passive water samplers, a grab sample was collected at multiple locations during the period of a falling tide (that is potentially representative of worst-case conditions relating to off-site migration of site related contaminants) for comparison to results from the passive samplers. The grab samples were collected directly into laboratory supplied bottles from a depth of approximately 10-20 cm and were immediately transferred to a chilled iced box for sample preservation prior to and during shipment to the testing laboratory.

4.6 Biota Sampling

To directly assess potential ecological exposures (via bioaccumulation) to site contaminants, additional biota samples (comprising live oysters) were deployed for a period of 4 weeks. The sample locations are shown on **Figure 4A** and were situated to target areas of identified impact adjacent to the site as well as background reference sites within Woolooware bay. The investigation was undertaken by the following:

- Three representative composite samples of 12 individual oysters (Sydney rock oysters) per sample were submitted for chemical analyses prior to deployment for use as blanks. It is noted that the oysters were reported to be harvested from the lower reaches of Woolooware Bay and sourced from the same farmers that supplied the test samples detailed below. The individual oysters used in each blank were shucked, and the oyster tissue composited to provide a sufficient mass of sample for analysis of each blank;
- Deployment of oysters (at least 12 oysters per location) within appropriate plastic growing baskets at 15 locations surrounding the site from 17-18 October 2018 until 15-16 November 2018. The oysters were deployed at a depth that slightly exceeded the low-tide mark that was generally 0-10 cm above the underlying sediments;
- Following the deployment period, the individual oysters were shucked, and the oyster tissue composited to provide a sufficient mass of sample for analysis. Samples were transferred to a chilled iced box for preservation prior to and during shipment to the testing laboratory; and
- Samples were analysed at a NATA accredited laboratory for PAHs.

Bivalve molluscs are among the most well-established biomonitors of contaminants in marine environments in which it is noted that Sydney Rock Oysters have previously been used to monitor the bioaccumulation of organic contaminants in a number of studies (Edge *et al*, 2014[17]). Oysters

[16] Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, August 2018)

[17] Edge, K.J., Dafforn, K.A, Simpson, S.L, Roach, A.C., Johnston, E. L, 2014. A biomarker of contaminant exposure is effective in large scale assessment of ten estuaries. Chemosphere, 100, 16-26.

were selected as the preferred biomonitor organism for this investigation for the following broad reasons:

- they are sedentary and therefore representative of the test location;
- they are hardy and tolerant of high concentrations of contaminants;
- they are widespread and abundant in the environment being studied;
- they can accumulate higher concentrations of COPCs within their tissues; and
- They are filter feeders and thereby ingest sediments.

The final point is important with respect to this investigation as the primary COPCs are PAHs, which are hydrophobic organic compounds and therefore less likely to be found in pore/surface waters as opposed to sediments. This was supported by the historical results from Geochemical Assessments (2016) as presented in the preliminary CSM (**Section 3**), where PAHs were mainly reported in sediments. Noting that the oysters were deployed at a depth that slightly exceeded the low-tide mark (0-10 cm above the underlying sediment), it is considered that the adopted approach sufficiently addresses the contaminant exposure mechanisms, where the filter feeders were exposed to sediments through uptake via direct contact (on the sediment surface) and resuspension of sediment particles in the water column (as further supported by the observation of turbid waters at the sampling locations). The duration for the deployment of oysters was consistent with the recommendations in ASTM (2010[18] and 2013[19]) in which bioaccumulation studies require to be conducted for 28 days, as this time is believed to be sufficient for most model organisms and contaminants to reach steady-state tissue concentrations.

4.7 Deviations from SAQP

There were a few minor deviations from the SAQPs (JBS&G 2018c and 2019a) as listed following:

- An additional 3 locations (total of 18 locations) to the north of the site were sampled for sediments to provide additional lateral delineation of identified PAH/TRH impacts;
- An additional 3 locations (OSA2-13, OSA2-14 and OSA2-14-2, totalling 20 locations) to the south-west of the site were sampled for sediments to provide a visual lateral delineation of sheen impacted sediments observed within the core collected at location 2-12.
- Pore water samples were only collected from surficial sediments (0.0-0.1 m) due to the presence of low permeability sediments present at depth that precluded the extraction of the required volume of pore water for laboratory analysis;
- Additional surface water samples (grab samples) were collected during a falling tide when the passive surface water samplers were deployed and retrieved; and
- One proposed location directly south of the power lines was unable to be conducted due to the proximity of the protected Coastal Wetland Zone. Samples to the south-east of the site required shifting further north and south as they were also located within the Coastal Wetland Zone.

4.8 Analytical Schedule

JBS&G contracted Eurofins MGT (Eurofins) as the primary laboratory and Envirolab Services (Envirolab) as the secondary laboratory for sediment, pore water and surface water (grab samples) analysis. Both laboratories are NATA registered for the required analyses. In addition, all biota

[18] ASTM (2010) Standard guide for determination of the bioaccumulation of sediment-associated contaminants by benthic invertebrates, E1688-10. American Society for Testing and Materials, West Conshohocken, PA, USA.

[19] ASTM (2013) Standard guide for conducting in-situ field bioassays with caged bivalves, E2122-02. American Society for Testing and Materials, West Conshohocken, PA, USA.

samples were submitted to National Measurement Institute (NMI) which is NATA accredited for the required analysis noting that there are no other Australian laboratories that are NATA accredited for this analysis (thus precluding inter-laboratory duplicates).

Analysis of passive samplers (of surface water) is specialised and only undertaken by the suppliers of the devices (in this case by UQ). The UQ laboratory is not NATA registered for the required analysis. Notwithstanding, the laboratory implemented internal quality controls to assess the precision of the analysis. In addition, the techniques employed have been established in peer-reviewed scientific journals and therefore considered sufficiently reliable to meet the objectives of the assessment.

The commercial laboratories were required to meet JBS&G's internal QA/QC requirements.

Table 4.2: Analytical Schedule

Media	Sampling Locations / Numbers	Sample Analyses (excluding QA/QC)
Sediment	38 (0-0.2 m and subsample collected to the maximum depth of coring 1.9 m).	PAHs – 63 sediment samples TRH – 63 sediment samples
Pore Water	32	PAHs (0.0001 mg/L detection limit) – 32 sediment samples TRH – 32 sediment samples
Surface Water	21 locations (grab samples)	PAHs (0.0001 mg/L detection limit) – 24 surface water grab samples TRH – 24 surface water grab samples
	15 locations (passive samplers)	PAHs – 15 passive water samples TRH – 15 passive water samples
Biota	15 locations	PAHs – 15 oyster tissue samples

5. Assessment Criteria

The investigation area is located within a highly sensitive ecological setting, being within the Towra Point Nature Reserve and located in relatively close proximity of the RAMSAR declared wetland associated with Quibray Bay. **Section 3** provides further detail on the potential ecological receptors within this environment, with justification for the adopted criteria (to be protective of those receptors) provided in the sections below.

5.1 Sediment Assessment Criteria

With respect to the assessment of potential ecological risks, sediment data has been assessed within the framework instructed to Australian and New Zealand Guidelines for Sediment Quality (ANZAST, August 2018). Sediment guidelines are provided in ANZAST (2018) as sediment quality guideline (GV) values. These are provided as default (D-GV) and guideline-high (GV-high) values corresponding to the statistical probability of effects. For the relevant constituents assessed, the reported concentrations have been normalised to 1% organic carbon. A summary of the sediment assessment criteria are provided in **Table 5.1** following.

Table 5.1: Chemical Contaminants in Sediment Assessment Criteria (all units in mg/kg)

	Limit of Reporting	Laboratory Method	D-GV ANZAST 2018	GV-high ANZAST 2018
TPH				
TPH (C_6-C_{40})[1]	50	Purge Trap-GCMS (USEPA8260)	280	550
PAHs				
Total PAHs[1]	0.5	GCMS (USEPA8270)	10	50

[1] (mg/kg dry weight normalised to 1% OC within the limits of 0.2 to 10%)

It is noted that the total PAH sediment guideline values provided in ANZAST (2018) is inclusive of 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene.

5.2 Surface and Pore Water Assessment Criteria

Surface and pore water data have been compared to guidelines provided by ANZAST (2018) for marine ecosystems protective of 95% and 99% of species for the protection of marine ecosystems including all the identified ecological receptors discussed in **Section 3**. ANZAST (2018) recommends that in ecosystems with high ecological/conservation value (such as the investigation area) that the highest 99% species protection level is applied – which has been adopted for the assessment. The 99% species protection level has also been applied to evaluate the potential for bioaccumulation.

In slightly to moderately disturbed systems (also applicable to the investigation area owing to its location within an urban environment) that the 95% species protection level is applied. As such, both guideline values (95 and 99% protection levels) have been applied to this assessment as an adequate screening point for assessing water quality in conjunction with other relevant lines of evidence (eight of evidence) in accordance with the framework provided in ANZAST (2018).

Surface and pore water data have also been compared to drinking water guideline values provided in NEPC (2013) adjusted by an order of magnitude as consistent with the approach provided in NHMRC (2011) to assess human recreational exposures in Woolooware Bay.

It is noted that there are several PAH compounds within the laboratory screen that do not have published screening criteria. In these cases, the laboratory LOR will be adopted as an initial screening tool noting that the analytical methods adopted for the passive water samplers produce a detection limit that is orders of magnitude less than traditional (low level) PAH analytical methods. If such compounds are detected above the LOR, then the reported concentrations will be compared to the background / reference locations as consistent with guidance in ANZECC (2000) in which the average background concentrations will be multiplied by a factor of two-three to derive site-specific screening criteria. Where applicable, reference will also be made to the water quality guidelines for the protection of aquatic life published in the Canadian Environmental Quality Guidelines (CEQGs) where available for the PAH compounds of interest. In addition, the potential for bioaccumulation of the compounds will be directly assessed as part of the biota assessment.

There is currently limited guidance regarding threshold concentrations for TRH in receiving waters. ANZAST (2018) instructs that oil and petrochemicals should not be noticeable as a visible film on the water nor should they be detectable by odour. As such, the laboratory detection limit will be used as initial screening level, prior to evaluating the potential for a sheen or odour as attributable to the reported TRH concentration within surface or pore waters.

The adopted surface and pore water assessment criteria are listed in **Table 5.2** following.

Table 5.2: Surface and Pore Water Assessment Criteria (all units are µg/L unless otherwise shown)

	Limit of Reporting	Laboratory Method	Recreational Criteria	Aquatic Ecosystem Criteria (95% protection level)	Aquatic Ecosystem Criteria (99% protection level)
TRH					
F1 C_6-C_{10}	250	P&T GC/MS (USEPA 8020A, 8000)	-	-	-
F2 >C_{10}-C_{16}	250	P&T GC/MS (USEPA 8020A, 8000)	-	-	-
BTEX					
Benzene	1.0	P&T GC/MS (USEPA 8020A)	10	700	500
Toluene	1.0	P&T GC/MS (USEPA 8020A)	8000	180	110
Ethylbenzene	1.0	P&T GC/MS (USEPA 8020A)	3000	80	50
m-Xylene	1.0	P&T GC/MS (USEPA 8020A)	6000 (total Xylene)	75	50
p-Xylene	1.0	P&T GC/MS (USEPA 8020A)		200	140
o-Xylene	1.0	P&T GC/MS (USEPA 8020A)		350	200
PAHs					
Anthracene	0.01	GCMS (USEPA8270)	-	0.4	0.01
Naphthalene	0.01	GCMS (USEPA8270)	-	70	50
Fluoranthene	0.01	GCMS (USEPA8270)	-	1.4	1.0
Phenanthrene	0.01	GCMS (USEPA8270)	-	2.0	0.6
Benzo(a)pyrene	0.01	GCMS (USEPA8270)	0.1	0.2	0.1

5.3 Biota Assessment Criteria

In the absence of EPA endorsed criteria for acceptable levels of site COPCs within tissue samples of living organisms, the laboratory LOR has been adopted as an initial screening tool as part of this assessment. When assessing the potential for bioaccumulation (of PAHs) within tissue samples, a comparison of the concentrations between subject and reference locations was undertaken.

6. Investigation Results

6.1 Data Reliability

Data quality indicators (DQIs) have been calculated as per the requirements of **Table 4.2** and are presented and discussed in detail within **Appendix D**. Laboratory reports and chain of custody documentation are provided as **Appendix C**.

In summary, the field sampling and handling procedures produced QA/QC results which indicate that the sediment, surface/pore water and biota data are of an acceptable quality and suitable for use in site characterisation. The NATA certified laboratory results sheets indicate that the project laboratories were generally achieving levels of performance within its recommended control limits during the period when the samples from this program were analysed. In addition, the QA/QC results from the non-NATA UQ laboratory (for passive sampler analysis) indicate the laboratory was achieving levels of performance generally consistent with the NATA registered laboratories.

On the basis of the results of the field and laboratory QA/QC program, the investigation data is considered to be of an acceptable quality in order to achieve the objectives of the assessment.

6.2 Sediment Assessment

6.2.1 Material Description

Sample locations are shown on **Figures 4A and 4B**. Sediments encountered at the investigation locations during the field works are summarised below, with bore logs included in **Appendix B**. Sediment investigation works were completed at a total of 38 locations using a piston coring device on 17-18 October,15-16 November 2018 and 15-17 October 2019.

Sediments at all locations were composed of gravelly, sandy clay (mud), brown to grey with a gravel fraction consisting of sea shells. No significant odours (with the exception of sulphidic odours attributable to estuarine conditions) or obvious signs of contamination were observed within the sediments with the exception of black anoxic conditions observed within shallow sediments at locations OSA 4, 11, 12, 15 and 16.

Inclusions of mangrove roots/rootlets were observed in the top metre of sample locations to the west and south-east of the site, with sediments observed to compose of gravelly, silty clay (mud). The following was observed:

- Stains were observed on sampling equipment on removal from Locations 4 and 5;
- A very slight sheen was observed within uncentrifuged pore water at Location 10;
- Grey-yellow-red silty clay fill was observed from 0 to 0.7 m bgs at Location 12. Sheen was observed within the water profile extracted with the sediment core at Location 12 from 0-1.2 m bgs, with mangrove roots black in colour. Sheen was not observed within surficial sediments; and
- A very slight PAH odour was observed within surficial sediments at Location 17.

No other significant odours (with the exception of sulphidic odours attributable to estuarine conditions) or obvious signs of contamination including tar impacted materials were observed within the sediments.

6.2.2 Analytical Results

Laboratory analytical results for sediment samples completed for the investigation have been summarised in tables presented in **Table A2, Appendix A**, with comments discussed below for the various analyte groups.

TRH and BTEX

All normalised TRH and BTEX concentrations were below the adopted site assessment criteria with the following exceptions:

- OSA SED 15 (0-0.1) which exceeded the TRH >C_{10}-C_{40} (745 mg/kg) high guideline value of 550 mg/kg;
- OSA SED 16 (0-0.1) which exceeded the TRH >C_{10}-C_{40} (454 mg/kg) default guideline value of 280 mg/kg; and
- QA15102019-SED1 (OSA2 SED 04 (0-0.1)) which exceeded the TRH >C_{10}-C_{40} (386 mg/kg) default guideline value of 280 mg/kg.

TRH and BTEX were not reported above the laboratory LOR in samples collected at the background reference locations 7-10.

PAHs

All normalised total PAH concentrations were below the adopted site assessment criteria with the following exceptions:

- OSA SED 15 (0-0.2) which exceeded the total PAH (45 mg/kg) default guideline value of 10 mg/kg;
- QC16112018-SED01 (OSA-SED13-0-0.1) which marginally exceeded the total PAH (10.9 mg/kg) default guideline value of 10 mg/kg;
- OSA SED 15 (0-0.1) which exceeded the total PAH (54 mg/kg) high guideline value of 50 mg/kg;
- OSA SED 16 (0-0.1) which exceeded the total PAH (97 mg/kg) high guideline value of 50 mg/kg;
- OSA SED 17 (0-0.2) which exceeded the total PAH (24 mg/kg) default guideline value of 10 mg/kg;
- OSA2 SED 01 (0-0.1) which exceeded the total PAH (14.8 mg/kg) default guideline value of 10 mg/kg;
- QA15102019-SED1 (OSA2 SED 04 (0-0.1)) which exceeded the total PAH (101.8 mg/kg) high guideline value of 50 mg/kg; and
- OSA2 SED 15 (0-0.1) which exceeded the total PAH (12 mg/kg) default guideline value of 10 mg/kg.

The reported concentrations of total PAHs in the above listed exceedances were elevated when compared to the concentrations at background reference locations 7-10. It is noted that the total PAH concentrations at the reference locations to the north-west of the site were 0.5 mg/kg (at location 8) and increased to 0.9 mg/kg (location 7) situated approximately 200 m further away from the site. The concentration of total PAHs in reference locations to the north-east of the site were comparable (to those from the north-west) with concentrations of 0.03 mg/kg (location 9) and 0.6 mg/kg (location 10) respectively.

The PAH concentrations within sub-surface samples collected at locations 12, 15, 16 and 17 (at depths from 0.5-0.6 m bgs) and OSA2 01 (0.5-0.6), 04 (0.3-0.4) and 15 (1.0-1.1) were all below the ANZAST 2018 PAH default guideline value for total PAHs.

6.3 Pore Water Assessment

Laboratory analysis results for pore water samples completed for the investigation have been summarised in tables presented in **Tables B1** (2018) and **B2** (2019), **Appendix A**, with comments discussed below for the various analyte groups. It is noted that only filtered results were considered with respect to analysing the 2019 dataset for reasons discussed in **Appendix D**.

TRH and BTEX

All BTEX concentrations were below the laboratory LOR or the adopted site assessment criteria in all samples analysed.

In addition, all TRH concentrations were below the laboratory LOR with the exception of:

- TRH C_{10}-C_{16} Fraction in samples QC15102019-PW1 (primary sample OSA2 PW 01), OSA2 PW 02, OSA2 PW 04, OSA2 PW 06, OSA2 PW 10, OSA2 PW 12 and OSA2 PW 15 with concentrations ranging from 80-180 µg/L;
- TRH >C_{16}-C_{34} Fraction in samples QA15102019-PW1/QC15102019-PW1 (primary sample OSA2 PW 01), OSA2 PW 02, OSA2 PW 06, OSA2 PW 12 and OSA2 PW 15 with concentrations ranging from 100-1500 µg/L; and
- TRH >C_{34}-C_{40} Fraction in samples QC15102019-PW1 (primary sample OSA2 PW 01 with a concentration of 300 µg/L.

Silica gel clean-up was subsequently conducted on each sample in which TRH was reported above the detection limit to confirm if it was likely to be from a petroleum-based source. The subsequent reported concentration of TRH in each sample was below laboratory detection limits with the exception of OSA2 PW 15, in which >C_{13}-C_{34} was reported at the detection limit of 100 µg/L. The results following the silica-gel clean-up indicate the reported TRH in the primary samples are likely to not be from a petroleum-based source.

PAHs

All PAH concentrations were below the adopted site assessment criteria in all samples with the exceptions:

- Anthracene in samples OSA PW04 (0.02 µg/L), OSA2 PW 10 (0.04 µg/L) and OSA2 PW 17 (0.04 µg/L) which exceeded the 99% protection level criterion (0.01 µg/L) but were below the 95% protection level criterion of 0.4 µg/L;
- Anthracene in sample OSA2 PW 15 (0.66 µg/L) which exceeded the 95% protection level criterion of 0.4 µg/L;
- Benzo(a)pyrene in samples OSA2 PW 10 (0.11 µg/L) which marginally exceeded the 99% protection level criterion (0.1 µg/L) but was below the 95% protection level criterion of 0.2 µg/L;
- Benzo(a)pyrene in sample OSA2 PW 15 (1.3 µg/L) and OSA2 PW 17 (0.33 µg/L) which exceeded the 95% protection level criterion of 0.2 µg/L;
- Flouranthene in sample OSA2 PW 15 (5.8 µg/L) which exceeded the 95% protection level criterion of 1.4 µg/L; and
- Phenanthrene in sample OSA2 PW 15 (2.1 µg/L) which exceeded the 95% protection level criterion of 2 µg/L.

It is noted that several PAH compounds (including acenaphthene, benz(a)anthracene, benzo(b,j)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, fluorene, chrysene, indeno(1,2,3-c,d)pyrene and pyrene) were reported at concentrations that slightly exceeded the laboratory LOR in the majority of samples. In the absence of screening criteria for these compounds, a comparison was made to the average reported concentrations for these compounds at the reference sites in accordance with guidance from ANZECC (2000) with the results presented in **Table 6.1**.

Table 6.1: Site Specific Screening Levels for PAHs (with no published criteria) in Pore Water (µg/L)

	Acenaphthene	Acenaphthylene	Benz(a)anthracene	Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluorene	Indeno(1,2,3-c,d)pyrene	Pyrene
Average Reference Site Concentration	0.01	0.01	0.01	0.0375	0.0275	0.0375	0.02	0.01	0.01	0.025	0.0575
Site Specific Screening Criterion (2x average reference)	0.02	0.02	0.02	0.075	0.055	0.075	0.04	0.02	0.02	0.05	0.115
Site Specific Screening Criterion (3x average reference)	0.03	0.03	0.03	0.1125	0.0825	0.1125	0.06	0.03	0.03	0.075	0.1725
OSA PW 01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
OSA PW 02	<0.01	<0.01	<0.01	0.02	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.03
OSA PW 03	<0.01	<0.01	0.02	0.04	0.03	0.04	0.04	<0.01	<0.01	0.03	0.08
OSA PW 04	0.01	0.01	0.04	0.06	0.05	0.06	0.05	<0.01	0.01	0.05	0.1
OSA PW 05	<0.01	<0.01	<0.01	0.03	0.02	0.02	<0.01	<0.01	<0.01	0.03	0.02
OSA PW 06	<0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.01	0.03
OSA PW 11	<0.01	<0.01	<0.01	0.02	0.03	0.02	<0.01	<0.01	<0.01	0.02	0.04
OSA PW 12	<0.01	<0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	0.01	0.02
OSA PW 13	<0.01	<0.01	<0.01	0.01	0.02	0.01	<0.01	<0.01	<0.01	0.01	0.02
OSA PW 14	<0.01	<0.01	<0.01	0.03	0.03	0.03	0.01	<0.01	<0.01	0.02	0.05
OSA PW 15	<0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.03
OSA2 PW 01	0.01	0.01	0.05	0.05	0.02	0.05	0.09	<0.01	<0.01	0.02	0.1
OSA2 PW 02	<0.01	0.01	0.08	0.07	0.04	0.09	0.1	0.01	<0.01	0.06	0.16
OSA2 PW 03	0.02	0.01	0.06	0.05	0.03	0.06	0.06	0.01	0.01	0.05	0.16
OSA2 PW 04	<0.01	<0.01	0.01	0.02	0.02	0.01	0.02	<0.01	<0.01	0.02	0.03
OSA2 PW 05	0.01	<0.01	0.04	0.03	0.02	0.04	0.05	<0.01	<0.01	0.03	0.08
OSA2 PW 06	0.02	<0.01	0.04	0.04	0.03	0.03	0.06	0.01	0.01	0.04	0.08
OSA2 PW 07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OSA2 PW 08	<0.01	0.01	0.09	0.06	0.03	0.09	0.11	0.02	<0.01	0.01	0.13
OSA2 PW 09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
OSA2 PW 10	0.02	0.03	0.15	0.13	0.07	0.17	0.22	0.04	0.01	0.15	0.24
OSA2 PW 11	0.01	0.01	0.07	0.06	0.04	0.07	0.1	0.01	0.01	0.06	0.15
OSA2 PW 12	<0.01	<0.01	0.05	0.05	0.03	0.05	0.07	<0.01	<0.01	0.04	0.09
OSA2 PW 15	0.27	0.31	1.6	1.6	0.65	1.5	2.1	0.22	0.43	1.2	4.4
OSA2 PW 16	0.01	0.01	0.1	0.15	0.07	0.14	0.22	0.06	<0.01	0.15	0.25
OSA2 PW 17	0.02	0.04	0.3	0.46	0.17	0.39	0.48	0.04	0.02	0.37	0.67
OSA2 PW 18	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OSA2 PW 19	<0.01	<0.01	0.02	0.02	0.01	0.02	0.02	0.03	<0.01	0.05	0.02

From a review of **Table 6.1**, the average reported concentrations for PAH compounds (without screening criteria) at the reference sites were comparable to (i.e. within a factor of 2-3) the sampling locations as represented by OSA 1 to 15 - with the exception of chrysene and benzo(a)anthracene at location OSA 4. A freshwater criterion of 0.018 µg/L is provided in CEQG for benzo(a)anthracene in which the pore water sample at OSA 4 exceeds, indicating potentially unacceptable risks. There is no guideline value for chrysene within CEQG.

The majority of reported PAH compounds in samples OSA2 1 to 19 were elevated when compared to the reference locations although with the exception of OSA2 PW15 and OSA2 PW17 the reported concentrations less than the DGVs presented in ANZG (2018) indicating a relatively low environmental risk.

6.4 Surface Water Assessment

Field surface water parameters were not collected during the collection of surface water samples, however, a qualitative assessment of the turbidity levels was noted. The surface water was noted to be moderately to highly turbid at each sampling location (during each sampling event) in which suspended solids were visible within each sample.

6.4.1 Analytical Results

Laboratory analysis results for surface water samples completed for the investigation have been summarised in tables presented in **Tables C1 (**passive samplers 2018**), D1** (2018 grab samples) and **D2 (**2019 grab samples**)**, **Appendix A**, with comments discussed below for the various analyte groups.

TRH and BTEX

All total TRH and BTEX concentrations were below the laboratory LOR in all grab samples collected during the investigation with the exception of OSA2 SW 02 with an exceedance of TRH Fraction C_{10}-C_{16} of 80 µg/L. Silica gel clean-up was subsequently conducted on sample OSA2 SW 02 to confirm if the reported TRH was likely to be from a petroleum-based source. Subsequent silica gel clean up results were all below the laboratory LOR, therefore indicating the reported TRH in the primary samples are likely to not be from a petroleum-based source.

It is noted that TRH was initially reported within each passive water sampler analysed as part of the investigation – however, upon review of the sampling medium utilised within the passive samplers (PMDS strips), it was identified that the medium contained organic polymer compounds that are reported within the TRH screen utilised by the laboratory. In addition, TRH was detected at similar concentrations within the blank sample analysed when compared to the investigation locations. As such, all TRH results reported from the passive samplers have been excluded from the investigation.

PAHs

All PAH concentrations were below the adopted site assessment criteria in all grab samples collected as part of the assessment, with the exception of anthracene and benzo(a)pyrene in duplicate sample QC15102019-SW1 (0.02 µg/L, primary sample OSA2 SW 04) which marginally exceeded the 99% protection level criteria (0.01 µg/L and 0.1 µg/L) but was below the 95% protection level criterion of 0.4 µg/L and 0.2 µg/L for anthracene and benzo(a)pyrene respectively.

All PAH concentrations were below the adopted site assessment criteria (with the exception of the triplicate samples which had elevated LORs) in all passive water samples collected as part of the investigation. It is noted that the highest concentration of PAH compounds (within the passive samplers) were related to fluoranthene and pyrene which were reported at an average concentration of 0.0064 µg/L and 0.011 µg/L respectively. It is further noted that the concentration of PAHs were largely consistent across all sample locations, including those surrounding the site and the reference locations for all compounds. In the absence of screening criteria for certain PAH compounds, a comparison was made to the average reported concentrations for these compounds at the reference sites in accordance with guidance from ANZECC (2000) with the results presented in **Table 6.2**. Noting the extremely low detection limits within the passive samplers, a multiplication factor of 3 has been applied to the average reference concentrations in which fluorene and pyrene were identified to be slightly elevated when compared to the reference sites at locations 14 and 15 respectively. A freshwater criterion of 3 µg/L and 0.025 µg/L is provided in CEQG for fluorene and pyrene respectively, in which the reported surface water concentrations at 14 and 15 for compounds are less than or equal to, indicating a low potential for unacceptable risks to ecological receptors to these compounds within surface water.

Table 6.2: Site Specific Screening Criteria for PAH Results in Passive Samplers (µg/L)

	Acenaphthene	Acenaphthylene	Benz(a)anthracene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluorene	Indeno(1,2,3-c,d)pyrene	Pyrene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Average Reference Site Concentration	0.00176	0.00065	0.00018	0.00004	0.00016	0.00001	0.00102	0.00004	0.00658
Site Specific Screening Criterion (3x average reference)	0.0053	0.0019	0.0005	0.0001202	0.0005	0.000033	0.0031	0.0001	0.01973
OSA 1	0.00242	0.00060	0.00016	0.00005	0.00018	0.00002	0.00110	0.00004	0.00708
OSA 2	0.00429	0.00081	0.00025	0.00005	0.00028	0.00002	0.00194	0.00005	0.014140
OSA 2 (duplicate)	0.00313	0.00056	0.00026	0.00004	0.00031	0.00001	0.00270	0.00003	0.015737
OSA 3	0.00248	0.00048	0.00021	0.00004	0.00022	0.00001	0.00152	0.00004	0.01006
OSA 4	0.00393	0.00083	0.00021	0.00005	0.00022	0.00002	0.00168	0.00005	0.01122
OSA 5	0.00310	0.00070	0.00029	0.00007	0.00030	0.00002	0.00133	0.00007	0.01591
OSA 6	0.00262	0.00051	0.00024	0.00005	0.00022	0.00002	0.00113	0.00005	0.01197
OSA 11	0.00331	0.00070	0.00023	0.00005	0.00022	0.00001	0.00148	0.00005	0.01182
OSA 12	0.00375	0.00094	0.00027	0.00008	0.00026	0.00002	0.00176	0.00007	0.01509
OSA 13	0.00236	0.00081	0.00020	0.00004	0.00019	0.00001	0.00136	0.00004	0.00911
OSA 14	0.00322	0.00111	0.00026	0.00006	0.00024	0.00001	0.00428	0.00005	0.01528
OSA 15	0.00450	0.00118	0.00036	0.00008	0.00034	0.00002	0.00244	0.00008	0.02512

With respect to the surface water data collected in 2019, the laboratory limit of reporting was used as a screening tool for compounds with no screening criteria as a conservative measure, given that the reporting limit was elevated compared to samples collected at background reference locations in which passive sampling devices were implemented.

All reported PAH concentrations within surface water samples were below the adopted criteria protective of human health under a recreational exposure scenario.

6.5 Biota Assessment

Laboratory analysis results for pore water samples completed for the investigation have been summarised in tables presented in **Table E1, Appendix A**, with comments discussed below.

All PAH compounds were below the laboratory LOR in the three blank samples submitted for analysis with the exception of fluoranthene in blank OSA-OYS-01 with a reported concentration of 0.011 mg/kg, which slightly exceeded the LOR (0.01 mg/kg).

All PAH compounds were reported to be below the laboratory LOR in all samples, with the exception of fluoranthene and pyrene which were detected in all samples. Fluoranthene concentrations were reported from <0.01-0.026 mg/kg and the concentrations were largely consistent in all samples. In addition, pyrene concentrations were reported from 0.012-0.027 mg/kg and the concentrations were similarly consistent in all samples. The reported concentration of fluoranthene and pyrene at the subject and reference locations exceeded the reported concentrations within the blank samples.

7. Discussion and Risk Characterisation

7.1 Discussion

Contaminant concentrations reported for sediment, pore water and surface water have been screened against the relevant guideline values presented in *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZAST, August 2018). The concentrations of key contaminants within each media is presented on **Figures 5-8** and tabulated in **Appendix A**. Discussion of the results is provided below.

7.1.1 Sediment Results

Total PAHs were reported at concentrations above the laboratory LOR within each surficial sediment sample collected at each location. This included the background reference locations (OSA 7-10) situated approximately 150-300 m from the site within Woolooware Bay. Within these reference sites, the reported concentrations of normalised total PAHs were in the range 0.04-0.91 mg/kg, thus indicating sediments within Woolooware Bay contain some level of background PAH impact considered likely a result of its current and historical urban industrial setting.

Surficial sediment samples collected from the boat channel (locations OSA 1-6 and 11) reported TRH and BTEX concentrations below the instrument LOR and normalised total PAH concentrations in the range of 0.2-2.7 mg/kg, which is comparable to the concentrations within the reference locations. Underlying sediment samples collected at a depth of 0.5 m (locations 2-5) reported total PAH concentrations from below the laboratory LOR to a maximum concentration of 0.2 mg/kg, thus indicating that impacts are primarily present in the surface sediments.

It is noted that the concentration of all COPCs were below the adopted site assessment criteria at all locations within the boat channel during the current assessment which is largely consistent with the results reported in Geochemical Assessments (2016) – with the exception of historical sample location S03, which slightly exceeded the default guideline value (10 mg/kg) with a normalised concentration of 12.9 mg/kg. However, adjacent sampling locations within the historical investigation (S02 and S04) and the current investigation (locations 3-5) were below the current default guideline values. As such, the identified PAH impact at S03 is considered to be relatively isolated.

The concentration of total PAHs within surficial sediments generally increased at locations situated to the north of the site in proximity to the overwater sheds. In surface sediments collected at locations OSA 13, 15, 16 and 17, the normalised total PAHs were reported in the range of 11-97 mg/kg which exceeded the adopted assessment criteria. It is noted that the identified PAH impacts were found to co-occur with TRH (>C_{10}-C_{40}) impacts at locations 15 and 16. The underlying sediment samples collected at a depth of 0.5 m (at OSA 13 and 15) reported low total PAH concentrations (0.1-0.2 mg/kg) which similarly indicates the greatest sediment impacts are present at the surface at these locations.

The concentration of total PAHs within surficial sediments were further reported to exceed the adopted assessment criteria at OSA2 15 (12 mg/kg), OSA2 1 (14.75 mg/kg) and OSA2 4 (101.75 mg/kg). The PAH impacts at OSA2 4 were reported to co-occur with TRH (>C_{10}-C_{40}) impact in which the reported concentration was 386 mg/kg. These impacts identified within the south-eastern and western portions of the site are relatively isolated as reported concentrations at adjacent sampling locations (within approximately 10-20 m distance) were below the adopted criteria.

7.1.2 Pore Water

Total PAHs were reported at concentrations above the laboratory LOR within all pore water samples collected from surficial sediments at each location. Discussion is provided below as related to the different locations assessed as part of the offsite investigations.

Boat Channel and North of Site

Within the boat channel, all PAH concentrations were below the adopted site assessment criteria, with the exception of anthracene in sample OSA PW04 (0.02 µg/L) which marginally exceeded the 99% protection level criterion (0.01 µg/L) but was below the 95% protection level criterion of 0.4 µg/L. In addition, anthracene and/or benzo(a)pyrene were reported to exceed the 99% protection level at historical locations within the boat channel (PW01 and PW10) but were below the 95% protection level.

In the absence of screening criteria for a number of detected PAH compounds, a comparison was made to the average reported concentrations for these compounds at the reference sites in accordance with guidance from ANZECC (2000) with the results presented in **Table 6.1** in which chrysene and benzo(a)anthracene were found to be elevated in OSA PW04 (in boat channel) and OSA2 PW08 (north of the site). On this basis, pore waters at these locations may pose a potentially unacceptable risk to ecological receptors.

At other sampling locations, contaminant concentrations in pore water samples were less than the adopted site assessment criteria (protective of 99% of species) or individual PAH compounds (without published screening criteria) were comparable to the reference sites. On this basis, potential ecological risks associated with pore water at these locations (all locations with the exception of OSA PW04, OSA PW08 and historical locations PW01, PW06-07 and 10) are considered to be low and acceptable.

South-east and West of Site

At sampling locations to the south-east and west of the site, the reported concentration of PAH compounds were elevated relative to other locations assessed. At two locations (OSA2 15 and 17), benzo(a)pyrene was reported to exceed the 95% protection values. In addition, benzo(a)pyrene was reported to exceed the 99% protection value at OSA2 10. At all other sampling locations, the concentration of PAHs were below published criteria, however in the majority (12 out of 15) of samples, individual PAH compounds (with no screening criteria) were elevated when compared to the background reference locations – indicating a potential for adverse environmental effects within this media at these locations.

7.1.3 Surface Water

Boat Channel and North of Site

All surface water samples collected as grab samples during a falling tide reported TRH/BTEX and PAH concentrations below the laboratory LOR with the exception of OSA 1 (total PAHs were reported at 0.00022 mg/L) in which the.

In addition, the concentration of PAHs in surface water samples collected from passive samplers deployed over a period of 4 weeks were below the adopted site assessment criteria. It is noted that the concentration of PAHs were largely consistent across all sample locations, including those surrounding the site and the reference locations (locations 7-10). The highest concentration of PAH compounds (within the passive samplers) were related to fluoranthene and pyrene which were reported at an average concentration of 6.4 and 11.5 ng/L respectively.

In the absence of screening criteria for a number of detected PAH compounds, a comparison was made to the average reported concentrations for these compounds at the reference sites in accordance with guidance from ANZECC (2000) with the results presented in **Table 6.2**. Fluorene and pyrene were identified to be slightly elevated when compared to the reference sites at locations 14 and 15 respectively. A freshwater criterion of 3 µg/L and 0.025 µg/L is provided in CEQG for fluorene and pyrene respectively, in which the reported surface water concentrations at OSA 14 and 15 for these compounds are less than or equal to, indicating a low potential for unacceptable risks to ecological receptors to these compounds within surface water at these locations.

Given that the concentration of COPCs in surface water samples were below the adopted site assessment criteria and that individual PAH compounds were largely comparable to background reference sites (or below alternate published criteria), ecological risks associated with surface water are considered to be low and acceptable. In addition, the reported surface water results were below the adopted human health criteria applicable for recreational exposures.

South-east and West of Site

All surface water results at these locations were below the adopted criteria with the exception of the duplicate sample at OSA2 SW1, in which anthracene and benzo(a)pyrene marginally exceeded the 99% protection values but were below the 95% criteria. Given the range in reported PAH concentrations between primary and duplicate samples at this location – the single elevated result is considered likely to be associated with suspended solids in the sample. Under these circumstances, PAHs are likely to be less bioavailable and present less risk to off-site ecological receptors. Notwithstanding, surface waters at location OSA2 4 were conservatively scored 2, along with any samples in which PAH compounds (with no screening criteria) were detected above the laboratory LOR.

7.1.4 Biota

All PAH compounds were reported to be below the laboratory LOR, with the exception of fluoranthene and pyrene which were detected in all biota samples (with the exception of the blanks). Fluoranthene concentrations were reported from <0.01-0.026 mg/kg and the concentrations were largely consistent in all samples including the reference locations (OSA 7-10). In addition, pyrene concentrations were reported from 0.012-0.027 mg/kg and the concentrations were similarly consistent in all sample locations. Given that biota results for locations adjacent to areas where sediment concentrations exceeded the guideline values GVs were similar to those at reference sites, it is concluded that the risk of bioaccumulation from site related impacts is low.

Of note, the two PAH compounds (fluoranthene and pyrene) detected in all biota samples were also the two PAH compounds present at the highest reported concentrations in surface water samples. On this basis, it is considered that the primary exposure pathway for biota to these contaminants is through exposure to surface waters. Importantly, it is noted that there is little difference in reported surface water concentrations between the area adjacent to the site and from the reference areas within Woolooware Bay. It is further noted that fluoranthene was reported in a blank sample (OSA-OYS-01) at a concentration of 0.011 mg/kg, which further indicates that this compound is present within the environment in wild oyster populations in Woolooware Bay.

As detailed in **Section 4.6**, the biota sampling approach comprised deploying live oysters for a period of one month at the sample locations. Noting that the oysters were deployed at a depth that slightly exceeded the low-tide mark (0-10 cm above the underlying sediment), where the filter feeders were exposed to sediments through uptake via direct contact (on the sediment surface) and resuspension of sediment particles in the water column (as further supported by the observation of turbid waters at the sampling locations) it is considered that the sampling approach was representative of the potential exposures of a wide range of organisms (including benthic infauna) to impacted media assessed as part of this investigation. Noting that the primary impacts identified during the investigation were within sediments (PAHs and TRH within sediments at locations OSA 13, 15, 16, 17) and that the primary exposure mechanism appears to be the uptake of contaminants through surface waters (where no site related impacts were identified) the potential for bioaccumulation (as attributable to site related impacts migrating off-site) within off-site ecological receptors is considered to be low.

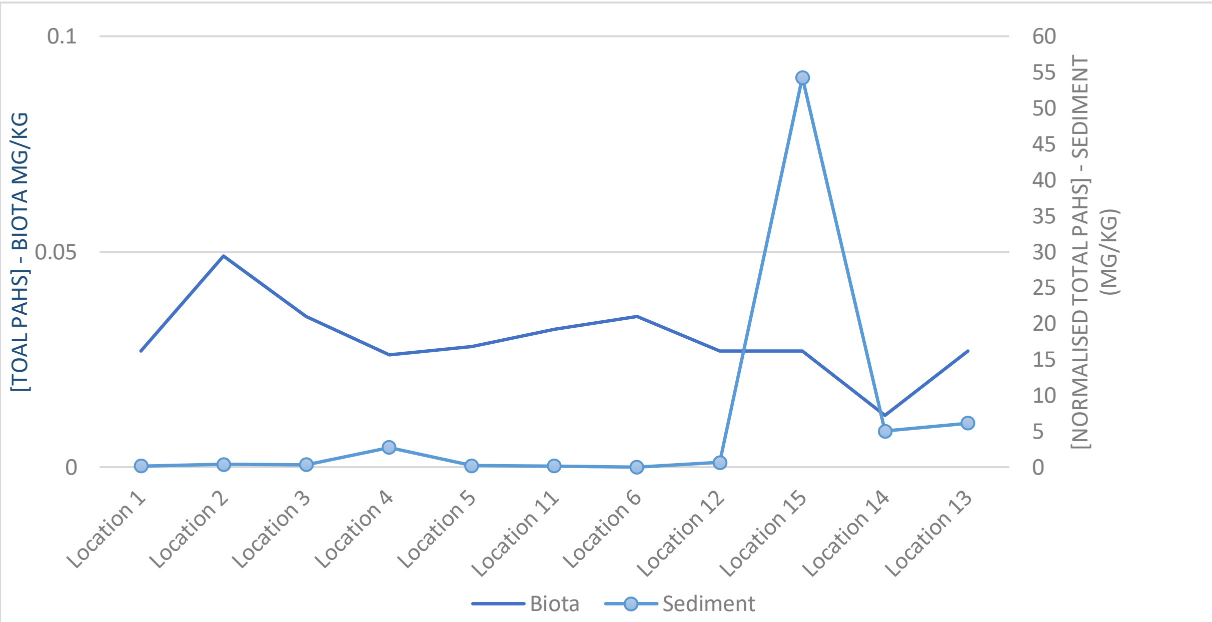
In addition, given the relatively isolated nature of the identified PAH impacts within sediments reported herein – the potential for bioaccumulation (of PAHs) through the food web (starting from polychaetes) is further considered to be low given that higher trophic animals will predate on organisms over a wider area (i.e. throughout Woolooware Bay) such that the diet will be balanced and minimising the potential for bioaccumulation.

It is further noted that the biota results from Geochemical Assessments (2016) were not included as part of this assessment. The significance of the reported PAH concentrations from historical samples, could not be assessed without data from suitable reference locations - which was one of the driving factors for the additional assessment completed herein. In the absence of background PAH concentrations from Woolooware Bay or Botany Bay, reference could only be made to published concentrations in Sydney Harbour - where it was found that the 2016 results were relatively low when compared to the grossly contaminated Sydney Harbour.

7.1.5 PAH Distribution

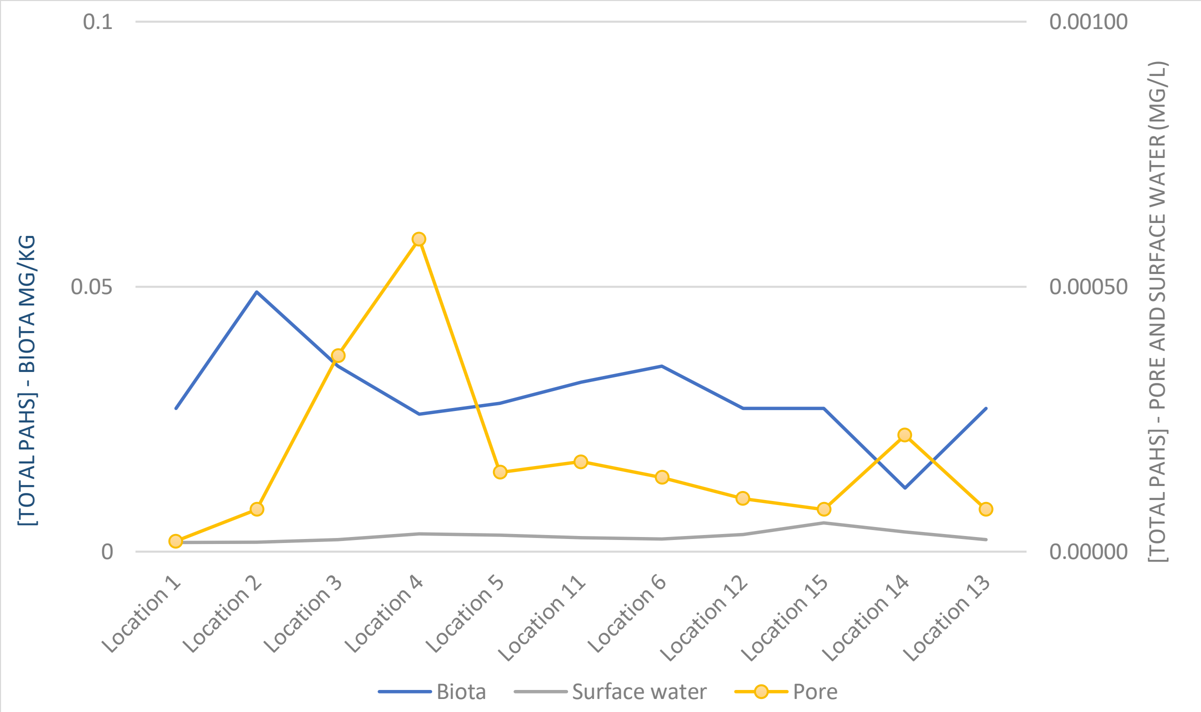
The distribution of total PAH concentrations within sediment and biota samples at locations from the southern portion of the boat channel to the north of the site is presented in **Chart 7.1**. The highest PAH concentrations in sediment were reported to the north of the site, however, this did not correspond with elevated PAHs in tissue samples which were largely comparable at all sample locations.

Chart 7.1: Distribution of PAHs in Biota and Sediments Samples from Locations South to North.



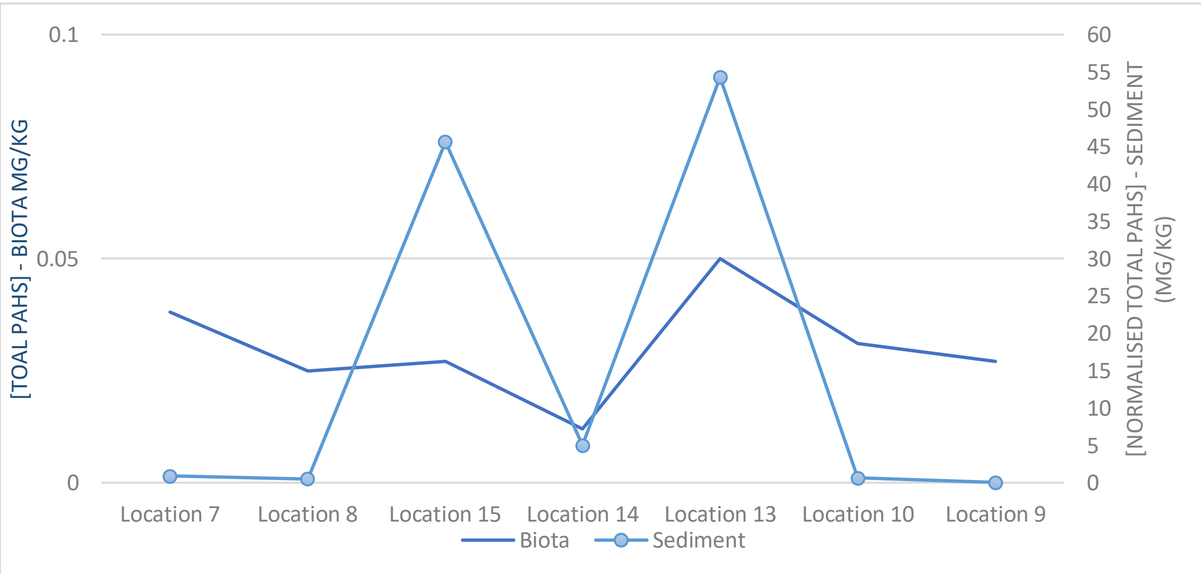
The distribution of total PAH concentrations within biota, surface and pore water samples at locations from the southern portion of the boat channel to the north of the site is presented in **Chart 7.2**. From a review of the chart, there is no direct correlation between the concentration of PAHs in surface or pore water and that within biota tissue samples.

Chart 7.2: Distribution of PAHs in Biota, Surface and Pore Water Samples from Locations South to North.



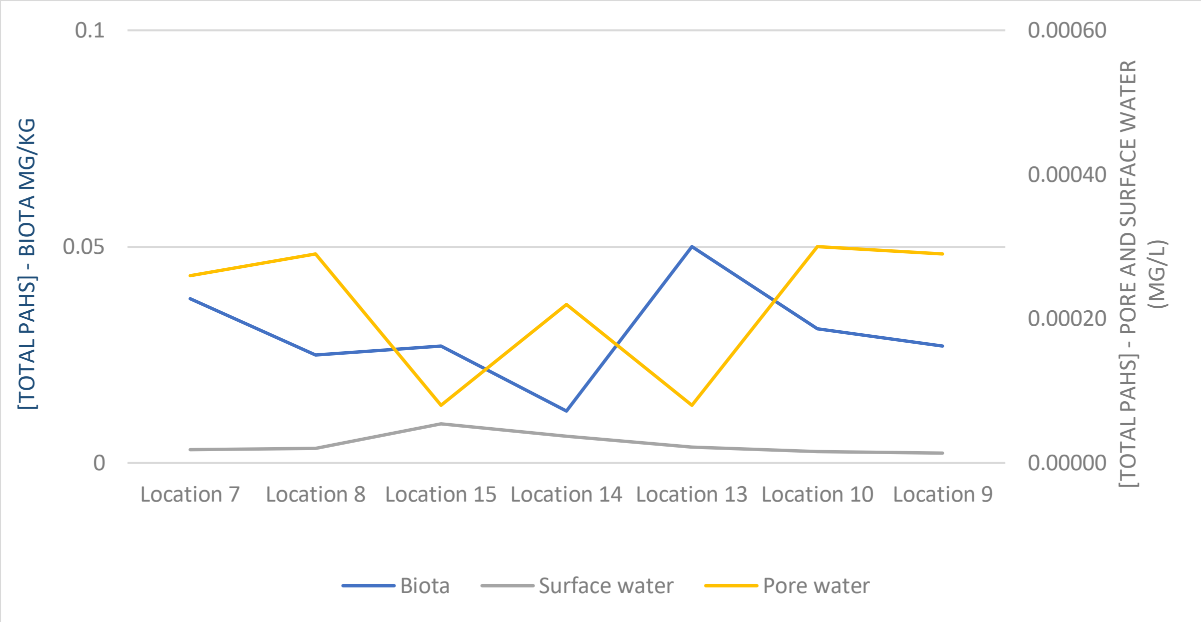
The distribution of total PAH concentrations within sediment and biota samples at locations from the north-west of the site (at reference locations) of the north-east of the site is presented in **Chart 7.3**. The highest PAH concentrations in sediment were reported directly to the north of the site, however this did not correspond with elevated PAHs in biota tissue samples which were largely comparable at all sample locations.

Chart 7.3: Distribution of PAHs in Biota and Sediments Samples from Locations West to East.



The distribution of total PAH concentrations within biota, surface and pore water samples at locations from the north-west of the site (at reference locations) to the north-east of the site is presented in **Chart 7.4**. From a review of the chart, there is no direct correlation between the concentration of PAHs in surface or pore water and that within biota tissue samples.

Chart 7.4: Distribution of PAHs in Biota, Surface and Pore Water Samples from Locations West to East.



7.2 Risk Characterisation

A WOE assessment of the potential for environmental effects at the site was undertaken following the methodology described by Simpson, et al. (2013). The WOE framework allows decisions to be made by tabulating and ranking multiple lines of evidence (LOE). In this assessment, chemical data was compared to sediment and water quality guideline values, but (water or sediment) toxicity was not assessed. In addition, the bioaccumulation of PAHs in tissue (oyster) samples was included as part of the WOE.

It is noted that the benthic diversity data included in Geochemical Assessments (2016) has been excluded from this dataset as there was significant diversity within the limited dataset which precluded conclusions to be made with respect to the effects of the identified impacts on benthic diversity.

7.2.1 Surficial Sediment Chemistry LOE

Only the chemistry of the biologically active surficial sediment (0.0-0.1 m) sediment interval was assessed in this WOE. The following summarises the scoring criteria for surficial sediment chemistry used as part of the WOE:

- LOE Score 1: Contaminant concentrations are less than assessment criteria (default) in which effects are expected to be negligible;
- LOE Score 2: Contaminant concentrations are between assessment criteria default and high values in which effects are possible; and
- LOE Score 3: Contaminant concentrations exceed the high assessment criteria in which effects are expected.

The LOE score for all surficial sediments assessed as part of this investigation is presented in **Table A2** in **Appendix A**. In summary, the majority of surficial sediments were below the assessment criteria (default) and therefore had an LOE score of 1. Surficial sediments at OSA 15 and 16 and OSA2 4 reported an LOE score of 3 owing to the concentrations of PAHs (total) and/or TRH. Surficial sediments at OSA 17, OSA2 1 and OSA2 15 reported an LOE score of 2 due to the concentration of total PAHs.

A review of the historical sediment dataset as reported in Geochemical Assessments (2016) and presented in **Table A3**, identified that the contaminant concentrations within surficial sediments were largely below the current default guideline values and therefore have an LOE score of 1, as consistent with the current dataset. It is noted that total PAHs within surficial sediments at historical sample location S03 slightly exceeded the default guideline value (10 mg/kg) with a normalised concentration of 12.9 mg/kg and was therefore given an LOE score of 2 at this historical sampling location. However, adjacent sampling locations within the historical investigation (S02 and S04) and the current investigation (locations 3-5) were below the current default guideline values. As such, the identified PAH impact at S03 is considered to be relatively isolated.

7.2.2 Surface and Pore Water Chemistry

The following summarises the scoring criteria for surface and pore water chemistry used as part of the WOE:

- LOE Score 1: Contaminant concentrations are less than assessment criteria (99 % protection level);
- LOE Score 2: Contaminant concentrations exceed assessment criteria (99 % protection level), but are less than (95 % protection level) assessment criteria OR contaminant concentrations (for which there are no screening criteria) exceed 3 times the background concentration; and
- LOE Score 3: Contaminant concentrations exceed (95 % protection level) assessment criteria in which effects are expected.

The LOE score for pore and surface waters assessed as part of this investigation is presented in **Tables B1** (2018 Pore Water), **B2** (2019 Pore Water), **C1** (Passive Surface Water), **D1** (Grab Surface Water 201**8)** and **D2** (Grab Surface Water 2019) (respectively) in **Appendix A**.

In summary, the LOE score at all sampled locations within the boat channel and to the north of the site, with the exception of location OSA 4, were 1 for both surface and pore waters in which effects are expected to be negligible. The LOE score at location 4 was 2, based on elevated levels of anthracene, chrysene and benzo(a)anthracene within pore water.

In summary, the LOE score at sample locations to the south-east and west of the site are as follows:

- LOE score of 1 for both surface and pore waters at locations OSA2 1, OSA2 7, OSA2 9, OSA2 18 and OSA2 19;
- LOE score of 2 for both surface and pore waters at locations OSA2 2, OSA2 3, OSA2 5, OSA2 6, OSA2 11, OSA2 12 and OSA2 16 due to elevated PAHs above the 99% screening level criteria or above 3x screening level criteria;
- LOE score of 2 for either surface water or pore water at locations OSA2 4, OSA2 8, OSA2 10 based on elevated levels of PAHs; and
- LOE score of 3 for pore water at locations OSA2 15 (with a LOE score of 2 for surface water) and OSA2 17 due to elevated PAHs above the 95% protection level criteria.

Surface water results from Geochemical Assessments (2016) have been excluded from the current WOE assessment, as the current investigation included a more comprehensive dataset including surface water data from grab samples collected under potentially worst-case conditions (i.e. during falling tides) and over a temporal period of 1 month with the use of passive samplers. As such, the current surface water dataset is considered more robust and representative of average contaminant levels within surface waters in proximity to the site.

7.2.3 Biota (Bioaccumulation) Assessment

The bioaccumulation of the principle contaminants (PAHs) at the site were assessed by the collection of tissue samples (oysters) grown for a period of one month at locations of identified sediment impact as well as background reference sites. The following summarises the scoring criteria used as part of the WOE:

- LOE Score 1: Test samples not significantly different from control (reference sites);
- LOE Score 2: Test samples are significantly different from control ($P < 0.05$ and ≤ x 3 control); and
- LOE Score 3: Test samples significantly different ($P < 0.05$ and > x 3 control).

The LOE score for bioaccumulation assessed as part of this investigation is presented in **Table E** in **Appendix A.** It is noted that the reference sites (background controls) were situated at Locations OSA 7-10. Flouranthene and pyrene were the only PAH compounds detected in all biota samples in which their respective average concentration at the reference sites were 0.014 mg/kg and 0.016 mg/kg. Given that all test samples were not significantly different from the controls, the LOE score with respect to bioaccumulation was 1 at all locations, in which effects are expected to be negligible.

The historical biota results were not included in the WOE assessment, as a lack of control reference sites makes the significance of the reported concentrations of PAHs within the oysters not possible to evaluate. The current biota data has been integrated to the historical results at adjacent sampling locations.

7.2.4 Overall WOE Assessment

The Overall WOE Score is derived from a rounded arithmetic mean of the LOE Scores. The following summarises the scoring criteria used as part of the overall WOE:

- WOE Score 1: No adverse effects;
- A WOE Score 2: Possible adverse effect from contamination; and
- A WOE Score 3: Significant adverse effects from contamination.

Results of the WOE assessment are summarised in **Table 7.1** following.

Table 7.1: Overall WOE Assessment Summary

Location	Surficial Sediment LOE Score	Surface Water LOE Score	Pore Water LOE Score	Bioaccumulation LOE Score (1)	Overall WOE Score
2018 Sample Location Results					
OSA-1	1	1	1	1	1
OSA-2	1	1	1	1	1
OSA-3	1	1	1	1	1
OSA-4	1	1	2	1	1
OSA-5	1	1	1	1	1
OSA-6	1	1	1	1	1
OSA-7	1	1	1	1	1
OSA-8	1	1	1	1	1
OSA-9	1	1	1	1	1
OSA-10	1	1	1	1	1
OSA-11	1	1	1	1	1

Location	Surficial Sediment LOE Score	Surface Water LOE Score	Pore Water LOE Score	Bioaccumulation LOE Score ([1])	Overall WOE Score
OSA-12	1	1	1	1	1
OSA-13	2	1	1	1	1
OSA-14	1	1	1	1	1
OSA-15	3	1	1	1	2
2019 Sample Location Results					
OSA2-1	2	-	1	-	1
OSA2-2	1	2	2	-	2
OSA2-3	1	-	2	-	1[2]
OSA2-4	3	2	1	-	2
OSA2-5	1	-	2	-	1[2]
OSA2-6	1	-	2	-	1[2]
OSA2-7	1	1	1	-	1
OSA2-8	1	1	2	-	1[2]
OSA2-9	1	-	1	-	1
OSA2-10	1	1	2	-	1
OSA2-11	1	2	2	-	2
OSA2-12	1	-	2	-	1[2]
OSA2-15	2	2	3	-	2
OSA2-16	1	-	2	-	1[2]
OSA2-17	1	1	3	-	2
OSA2-18	1	-	1	-	1
OSA2-19	1	1	1	-	1
Geochemical Assessments (2016) Sample Locations					
1	1	1	2	1	1
2	1	1	1	1	1
3	2	1	1	1	1
4	1	1	1	1	1
5	1	-	3	-	2
6	1	-	2	-	2
7	1	-	2	-	2
10	1	1	2	1	1
				OVERALL WOE SCORE	1

1. Bioaccumulation data has only been considered from the current dataset where the values have been applied to the WOE for nearby historical sampling locations as completed in Geochemical Assessment (2016).
2. At locations where the pore water was scored a 2 on the basis of PAH compounds (with no screening criteria) being elevated compared to reference locations and all other PAH compounds (with criteria) were below the 99% protection levels, the overall score was rounded down from 1.5 to 1.

The potential for adverse environmental effects at all sample locations collected as part of the 2018 dataset were low (based on an overall WOE Score 1) with the exception of Locations OSA 4 and OSA 15. It is noted that Locations OSA 16-18 were not included in the WOE score as there was only sediment data available at these locations. Notwithstanding, it is considered that conditions at Locations OSA 16-17 would be similar to Location OSA 15, owing to the comparable sediment surficial chemistry and close proximity. Sediments at Locations OSA 15 caused the WOE Score to be conservatively upgraded to 2 comprising 'Possible adverse effect from contamination'.

The potential for adverse environmental effects at four locations within the 2019 dataset were moderate, based on an overall WOE Score of 2. It is noted that the overall scores for each location within this dataset is likely to be conservative based on the following:

- The surface water data comprised a single grab sample (under worst case falling tide conditions) as opposed to been averaged over a temporal period of 1 month with the use of passive samplers in accordance with the 2019 dataset. In addition, any detection of PAH compounds (in which there are no screening criteria) within each sample resulted in a score of 2;
- There were only 3 out of 13 pore water samples (OSA2 PW10, PW15 and PW17) in which PAH compounds were reported to exceed published criteria. At all other sample locations, in which PAH compounds (with no screening criteria) were elevated compared to background reference locations, the score was conservatively upgraded to 2; and
- The results of the bioaccumulation assessment (from 2018 dataset) were not included as part of the scoring.

The potential for adverse environmental effects within sampling locations included in the historical dataset (Geochemical Assessments 2016) were low when surface water and biota data collected from the current investigation were applied to the overall WOE assessment. It is noted that surface water and /or bioaccumulation data is not available for sampling locations to the west, south-east and immediately north of the site where abundant mangrove growth is present. However, noting the absence of significant or widespread sediment impacts at these locations, it is not considered significant with respect to the outcomes of the assessment.

The average overall WOE score for the entire off-site investigation area (excluding background reference locations), was 1, indicating the potential for adverse environmental effects across the investigation area is low.

7.3 Uncertainty Assessment

Four potential uncertainty factors have been considered in evaluation of the outcomes of the assessment, which are discussed following:

- Spatial distribution of impacts – The sampling program was spatially biased towards areas of greatest inferred impact based on historical data discussed in the CSM (**Section 3**). As such, it is considered that the sampling program is likely to have positively biased the contaminant concentrations within each media assessed. In addition, this is likely to have resulted in the assessment of potential worst-case conditions as associated with site related impacts potentially migrating from the site.
- As detailed in **Appendix D**, the quality assurance / quality control procedures implemented throughout the collection of environmental data has verified that the data is of adequate quality as assessed through PPARCs parameters to be relied upon to meet the objectives of the assessment. As such, any uncertainty with respect to the reliability of the data collected herein, is not considered significant with respect to the outcomes of the assessment.
- A WOE approach was adopted in accordance with the framework developed by Simpson, *et al.* (2013) that included the sampling and analysis of multiple media to assess the ecological significance of contaminants in off-site areas. In this assessment, chemical data was compared to sediment and water quality guideline values and the potential bioaccumulation

of PAHs was assessed in tissue (oyster) samples as part of the WOE. As such, every decision outcome was driven by data collected from multiple media.

- The criteria adopted for the WOE assessment comprised the most conservative (99% protection levels) published trigger values as recommends in ANZAST (2018) for ecosystems with high ecological/conservation value such as the investigation area allowing for a sufficient level of conservatism to be adopted within the assessment. These criteria are additionally noted to be skewed by adoption of numerous simplifying conservative assumptions.

When these factors are considered as a whole, it is considered that there is sufficient conservatism within the adopted assessment approach to make reliable decisions.

8. Conclusions and Recommendations

The primary objective of the off-site ecological risk assessment was to assess the significance of contamination migrating from the site to off-site ecological receptors. This information is required to inform the necessary scope of remedial works to ensure the site will not pose an on-going risk to the environment. The secondary objective of the assessment was to assess the ecological significance of contaminants in off-site sediments related to historical Oyster Farming operations. In order to satisfy the objectives of the assessment, the following decision was required to be made:

- *Has sufficient data been collected to support a weight of evidence (WOE) assessment using multiple lines of evidence to assess the potential for adverse ecological effects as related to site related contaminants such that the remaining scope of remediation can be refined?*

  Based on the results presented herein, it is considered that sufficient information has been gathered to address the key identified data gaps and thus allow for the assessment of the significance of existing offsite contamination and that posed by that migrating from the site to off-site ecological receptors.

  Additional data has demonstrated that sediments impacted with TRH and PAHs at levels that exceed the high probability (of effects) assessment criteria are restricted to locations OSA 15, 16 and 17 to the north of the site and OSA 4 to the west. The impacts are confined to shallow sediments as based on the results from the underlying sediment samples. The source of the identified sediment impacts is likely to be associated with the historical use of tars on the site to treat timbers associated with oyster farming. It is understood that the tars were applied by hand to timber racks at a range of potential locations on and in proximity of the site. There is anticipated to have been substantial spillages of tar during these treatment works that would likely have resulted to the impacts of sediments identified herein. The removal of the potential on-going source of these impacts forms the focus of on-site remedial efforts as detailed in the RAP (JBS&G 2018b).

  Additional surface and pore water data has demonstrated that the concentration of contaminants in these media are largely below the adopted site assessment criteria. A limited number of pore water samples exceeded the adopted criteria in the boat channel (OSA PW4, PW1 and PW10) and at locations to the west (OSA2 PW10) and to the south-east (OSA2 PW15 and PW17) of the site. In addition, the concentration of PAHs compounds (with no screening criteria) at locations west and south-east of the site, were elevated when compared to background reference locations. However, given the relatively isolated impacts identified within these media (when compared to the overall dataset) and the inherent conservatism with the adopted application of the WOE (discussed in **Section 7.2.4**), it is considered that the potential ecological risks associated with pore and surface water are generally considered to be low and acceptable.

  Sampling and analysis of biota samples have demonstrated that the uptake of PAHs in tissue samples is not significantly different (within test samples in areas of identified sediment impact) from background reference sites within Woolooware Bay. On this basis, the risk of bioaccumulation (from potential site related impacts) within biota in proximity of the site, is considered low.

  A Weight of Evidence (WOE) assessment undertaken using the methodology described by Simpson, et al. (2013) found that the average potential for adverse environmental effects across all sampled locations (with the exception of background reference sites) across the off-site investigation area were low as based on an overall WOE Score 1. The average WOE score across each location is considered most appropriate when assessing the potential for adverse environmental effects across the investigation area as a result of the isolated nature of the impacts, the limited potential for bioaccumulation at any given location and noting that higher trophic animals will predate on organisms over an area substantially large than that assessed (refer to **Section 3**). In addition, the sampling locations were spatially biased towards areas of greatest inferred impact based (refer to **Section 7.3**) resulting in potential worst-case conditions being assessed in the investigation.

Subject to the Limitations in **Section 9**, the following conclusions are made with respect to the objectives of the assessment:

- Based on the WOE assessment undertaken herein, it is considered that the risk of contamination (as associated with the site) causing adverse environmental effects to ecological receptors is low. The ecological significance of contaminants in off-site sediments related to historical Oyster Farming operations is also considered to be low.
- Given the above findings, the scope of remedial works currently being undertaken within the extent of the site that includes the removal of tar-based contamination acting as potential source material and validation to confirm that remaining soils do not pose a risk to groundwater and a potential on-going risk to off-site receptors is considered suitable to ensure that the site does not pose an on-going risk to the environment.
- Moreover, the requirement for the remediation of sediments within the boat channel as detailed in the RAP (JBS&G 2018b) is considered to be no longer required based on the findings of the current assessment. As reported in ANZECC/ARMCANZ (2000), sediment remediation is not straightforward and should only be undertaken where absolutely warranted. Consistent with EPA (2017) guidance, in which remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site in its current condition with regard to contamination, it is considered that offsite sediments should not be actively remediated as it will likely result in adverse impacts through requirements for excavation, dewatering, acid sulfate soil treatment and off-site disposal. To this extent, it is recommended that the RAP (2018b) is updated to remove the requirement for remediation of sediments outside the extent of the site.

9. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

10. References

Additional Contamination Assessment, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 4 June 2018 (JBS&G 2018a).

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Additional Offsite Investigation, Sampling, Analysis and Quality Plan, 'Captain Cook Drive Remediation', Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 10 July 2019 (JBS&G 2019a).

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Remedial Action Plan, 'The Oyster Farm' Captain Cook Drive, Woolooware NSW, JBS&G Australia Pty Ltd, 4 June 2018 (JBS&G 2018b).

Screening Level Ecological Risk Assessment; 'The Oyster Farm', Captain Cook Drive, Woolooware Bay, Geochemical Assessments, July 2016 (Geochemical Assessments 2016).

Towra Point Nature Reserve Ramsar Site: Ecological character description, Department of Environment, Climate Change and Water NSW (DECCW 2010)

Figures

Legend:

Approximate Investigation Area

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev0	Date: 31-Jul-2019
Drawn By: RF	Checked By: CB

Scale 1:17,500

0 200 400

metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SITE LOCATION

FIGURE 1

File Name: 54083_01

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2018

Legend:

Approximate Investigation Area

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev0 | Date: 31-Jul-2019

Drawn By: RF | Checked By: CB

Scale 1:6,500

0 75 150

metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SITE LAYOUT

FIGURE 2

File Name: 54083_02

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017

Site ID	Sample	Sample Type
S01	B01	Benthic Community Sample
	PW01	Porewater Sample
	SS01	Sediment Sample
	SW01	Surface Water Sample
S02	B02	Benthic Community Sample
	PW02	Porewater Sample
	SS02	Sediment Sample
	SW02	Surface Water Sample
S03	B03	Benthic Community Sample
	PW03	Porewater Sample
	SS03	Sediment Sample
	SW03	Surface Water Sample
S04	B04	Benthic Community Sample
	PW04	Porewater Sample
	SS04	Sediment Sample
	SW04	Surface Water Sample
S05	B05	Benthic Community Sample
	PW05	Porewater Sample
	SS05	Sediment Sample
	SW05	Surface Water Sample
S06	B06	Benthic Community Sample
	PW06	Porewater Sample
	SS06	Sediment Sample
S07	B07	Benthic Community Sample
	PW07	Porewater Sample
	SS07	Sediment Sample
S08	B08	Benthic Community Sample
	PW08	Porewater Sample
	SS08	Sediment Sample
	SW08	Surface Water Sample
S09	B09	Benthic Community Sample
	PW09	Porewater Sample
	SS09	Sediment Sample
	SW09	Surface Water Sample
S10	B10	Benthic Community Sample
	PW10	Porewater Sample
	SS10	Sediment Sample
	SW10	Surface Water Sample

Site S04 - SS04 0.1-0.5 (SEDIMENT)	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.1-0.5	17.73

Site 7 - PW07 (PORE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.030
B(a)P	0.200

Site 6 - PW06 (PORE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020
B(a)P	0.150

Site 5 - SW05 (SURFACE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.030
B(a)P	0.180

Site 5 - PW05 (PORE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020
B(a)P	0.220

Site S03 - SS03 0.0-0.1 (SEDIMENT)	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	12.917

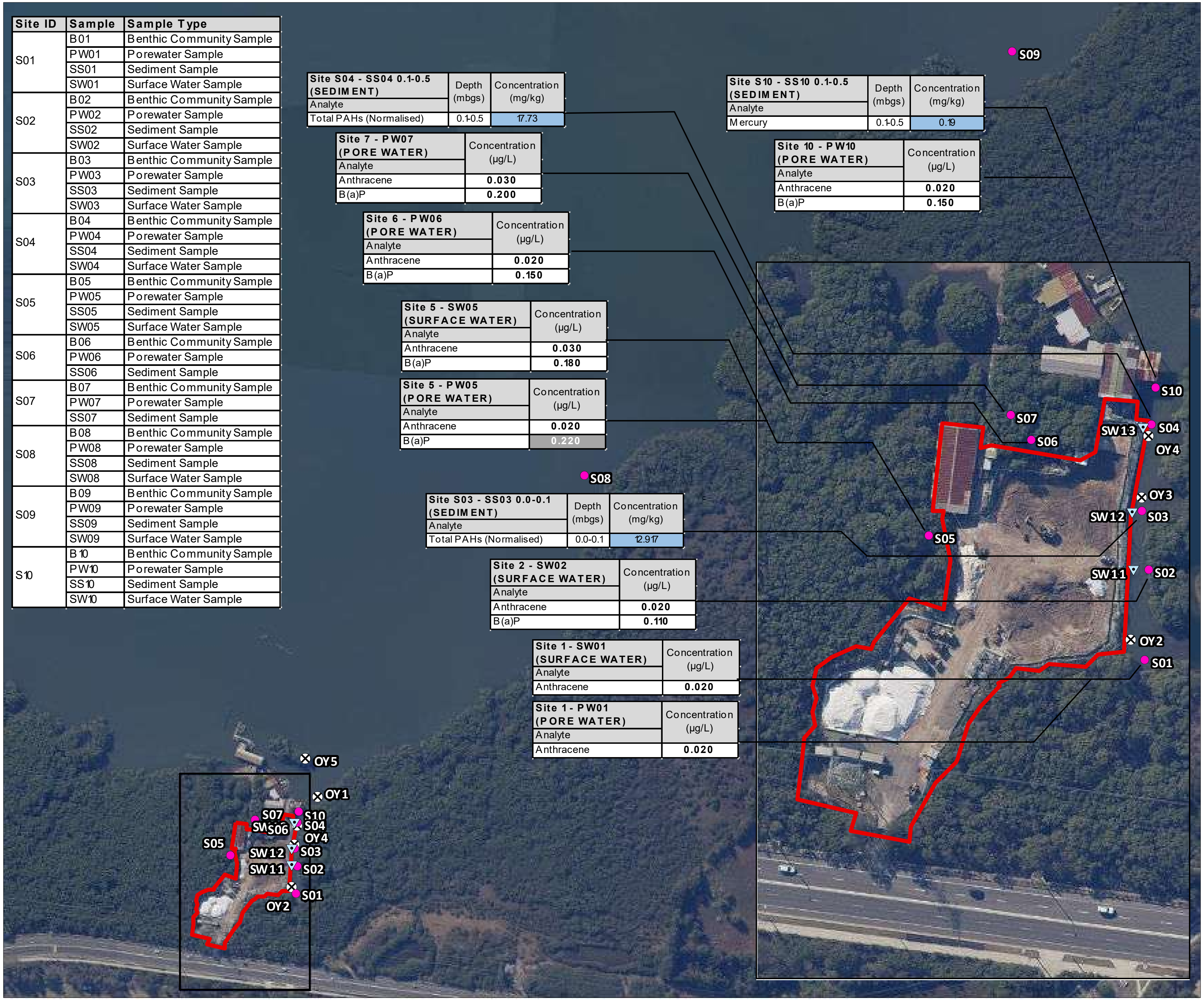
Site 2 - SW02 (SURFACE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020
B(a)P	0.110

Site 1 - SW01 (SURFACE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020

Site 1 - PW01 (PORE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020

Site S10 - SS10 0.1-0.5 (SEDIMENT)	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Mercury	0.1-0.5	0.19

Site 10 - PW10 (PORE WATER)	Concentration (µg/L)
Analyte	
Anthracene	0.020
B(a)P	0.150



Legend:

- Approximate Investigation Area
- Surface Water Sample Location
- Sample Site Location
- Oyster Sample Location

0.020	Recreational
0.220	ANZAST 2018 Marine 95%
0.150	ANZAST 2018 Marine 99%
Result	Highlighted value is equal to or exceeds D-GV (ANZAST 2018)
Result	Highlighted value is equal to or exceeds GV-High (ANZAST 2018)

JBS&G

Job No: 54083

Client: RMS

Version: R02_RevA | Date: 23-Aug-2019

Drawn By: RF | Checked By: CB

Scale 1:5,000

0 50 100
metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

HISTORIC SAMPLING LOCATION SITES

FIGURE 3

File Name: 54083_03
Reference: sixmaps/LPI_Imagery_Best_© Department of Finance, Services & Innovation 2017

Legend:

Approximate Investigation Area

Sample Locations

Sediment/Surface Water/Pore Water/Biota

Sediment

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 31-Jul-2019

Drawn By: RF | Checked By: JS

Scale 1:6,500

0 75 150
metres

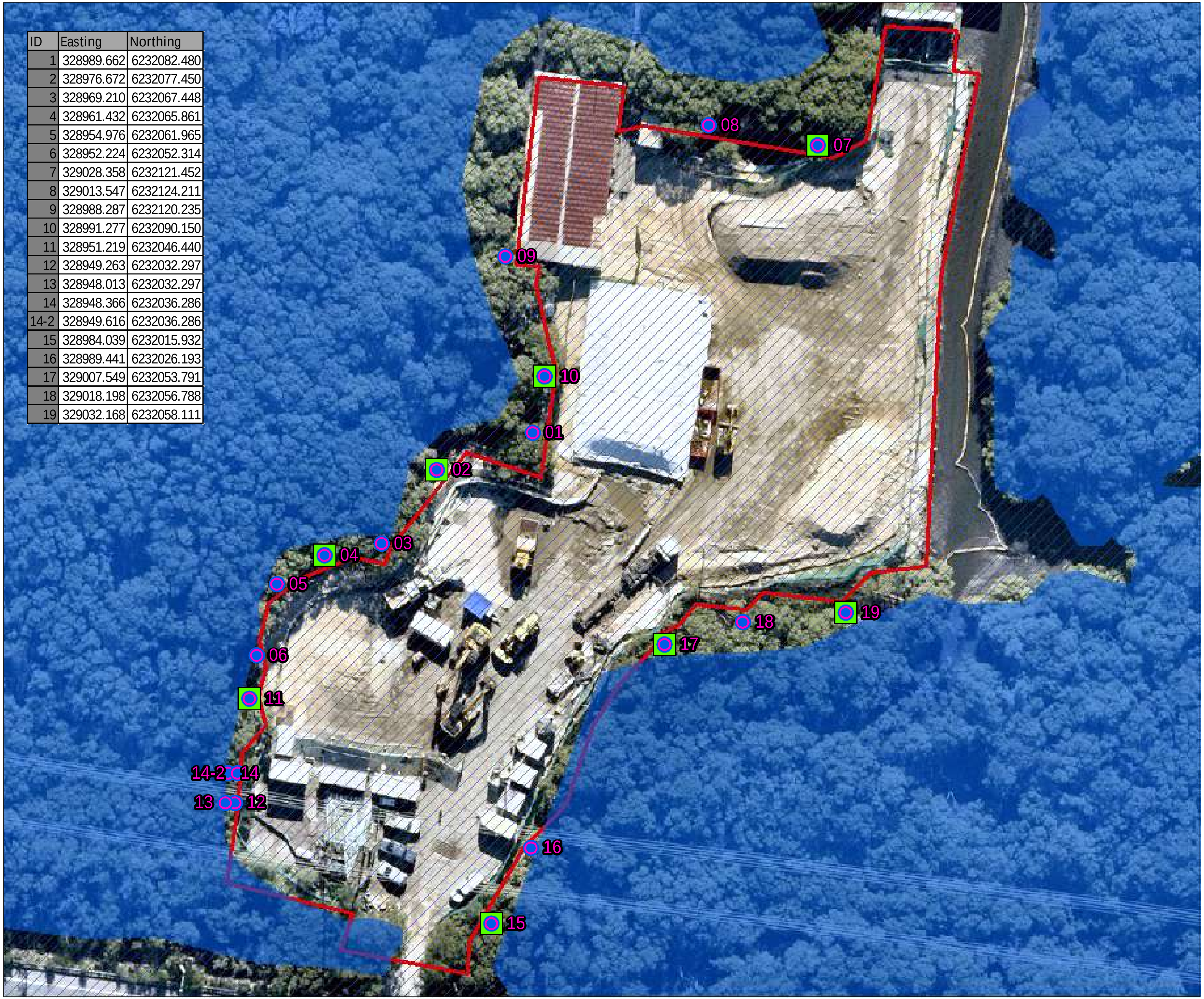
Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

2018 SAMPLE LOCATIONS

FIGURE 4A

File Name: 54083_04
Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



ID	Easting	Northing
1	328989.662	6232082.480
2	328976.672	6232077.450
3	328969.210	6232067.448
4	328961.432	6232065.861
5	328954.976	6232061.965
6	328952.224	6232052.314
7	329028.358	6232121.452
8	329013.547	6232124.211
9	328988.287	6232120.235
10	328991.277	6232090.150
11	328951.219	6232046.440
12	328949.263	6232032.297
13	328948.013	6232032.297
14	328948.366	6232036.286
14-2	328949.616	6232036.286
15	328984.039	6232015.932
16	328989.441	6232026.193
17	329007.549	6232053.791
18	329018.198	6232056.788
19	329032.168	6232058.111

Legend:

Approximate Investigation Area

Pore Water/Surface Water/Sediment Sample Locations

Pore Water/Sediment Sample Locations

Pore Water/Surface Water/Sediment Sample Locations

NSW 2018 Coastal Wetlands SEPP

Coastal Wetlands

Coastal Wetlands Proximity Area

Job No: 54083

Client: RMS

Version: R02 Rev 1	Date: 08-Nov-2019
Drawn By: RF	Checked By: JS

Scale 1:700

0 10 20

metres

Coor. Sys. GDA 1994 MGA Zone 56

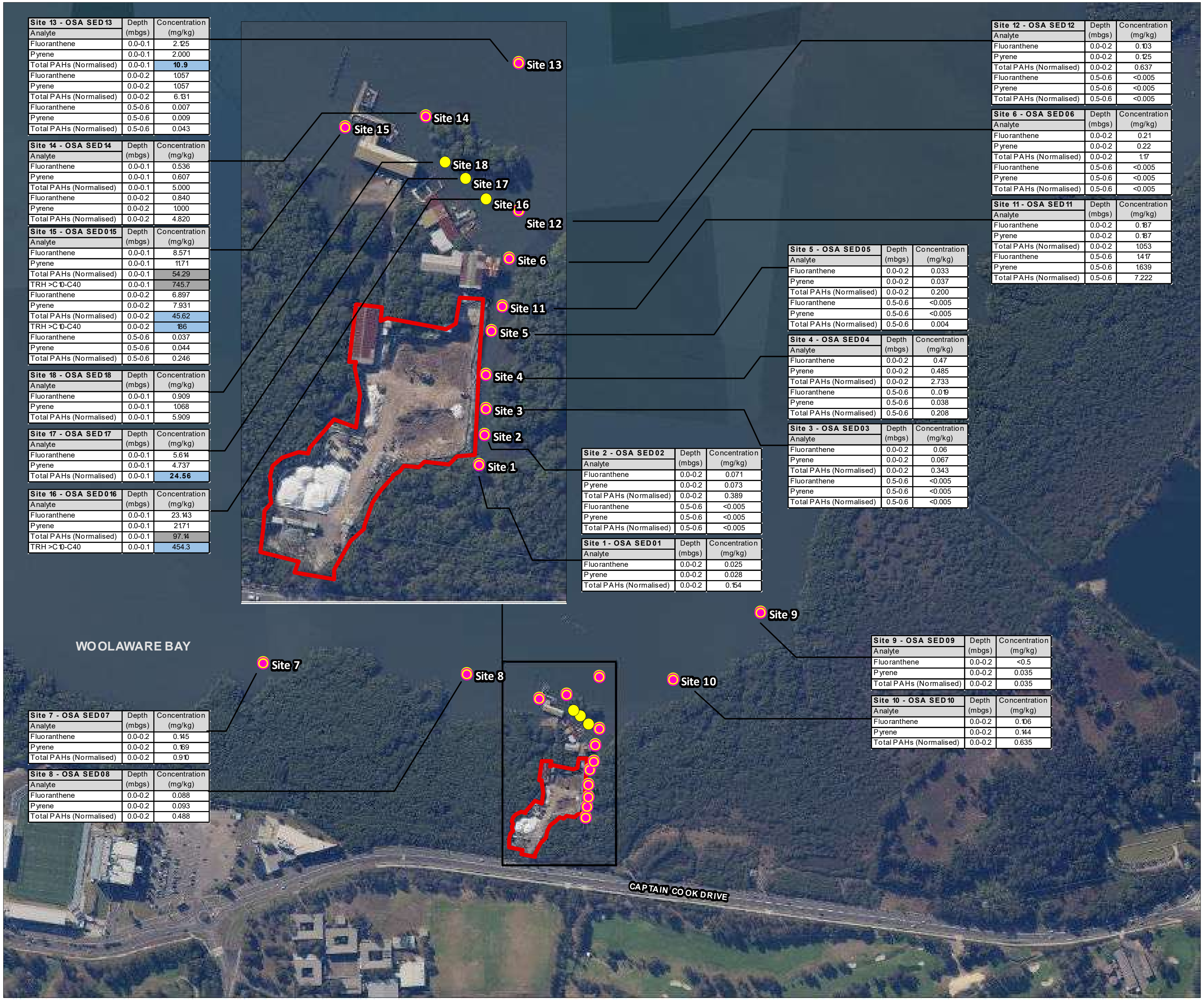
Woolooware Bay, NSW

2019 SAMPLE LOCATIONS

FIGURE 4B

File Name: 51163_04_SampleLocations

Reference: Near Map www.nearmap.com, imagery date 20190701



Site 13 - OSA SED13 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	2.125
Pyrene	0.0-0.1	2.000
Total PAHs (Normalised)	0.0-0.1	**10.9**
Fluoranthene	0.0-0.2	1.057
Pyrene	0.0-0.2	1.057
Total PAHs (Normalised)	0.0-0.2	6.131
Fluoranthene	0.5-0.6	0.007
Pyrene	0.5-0.6	0.009
Total PAHs (Normalised)	0.5-0.6	0.043

Site 14 - OSA SED14 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	0.536
Pyrene	0.0-0.1	0.607
Total PAHs (Normalised)	0.0-0.1	5.000
Fluoranthene	0.0-0.2	0.840
Pyrene	0.0-0.2	1.000
Total PAHs (Normalised)	0.0-0.2	4.820

Site 15 - OSA SED015 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	8.571
Pyrene	0.0-0.1	11.71
Total PAHs (Normalised)	0.0-0.1	54.29
TRH >C10-C40	0.0-0.1	745.7
Fluoranthene	0.0-0.2	6.897
Pyrene	0.0-0.2	7.931
Total PAHs (Normalised)	0.0-0.2	45.62
TRH >C10-C40	0.0-0.2	186
Fluoranthene	0.5-0.6	0.037
Pyrene	0.5-0.6	0.044
Total PAHs (Normalised)	0.5-0.6	0.246

Site 18 - OSA SED18 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	0.909
Pyrene	0.0-0.1	1.068
Total PAHs (Normalised)	0.0-0.1	5.909

Site 17 - OSA SED17 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	5.614
Pyrene	0.0-0.1	4.737
Total PAHs (Normalised)	0.0-0.1	**24.56**

Site 16 - OSA SED016 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.1	23.143
Pyrene	0.0-0.1	21.71
Total PAHs (Normalised)	0.0-0.1	97.14
TRH >C10-C40	0.0-0.1	454.3

Site 12 - OSA SED12 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.103
Pyrene	0.0-0.2	0.125
Total PAHs (Normalised)	0.0-0.2	0.637
Fluoranthene	0.5-0.6	<0.005
Pyrene	0.5-0.6	<0.005
Total PAHs (Normalised)	0.5-0.6	<0.005

Site 6 - OSA SED06 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.21
Pyrene	0.0-0.2	0.22
Total PAHs (Normalised)	0.0-0.2	1.17
Fluoranthene	0.5-0.6	<0.005
Pyrene	0.5-0.6	<0.005
Total PAHs (Normalised)	0.5-0.6	<0.005

Site 11 - OSA SED11 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.187
Pyrene	0.0-0.2	0.187
Total PAHs (Normalised)	0.0-0.2	1.053
Fluoranthene	0.5-0.6	1.417
Pyrene	0.5-0.6	1.639
Total PAHs (Normalised)	0.5-0.6	7.222

Site 5 - OSA SED05 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.033
Pyrene	0.0-0.2	0.037
Total PAHs (Normalised)	0.0-0.2	0.200
Fluoranthene	0.5-0.6	<0.005
Pyrene	0.5-0.6	<0.005
Total PAHs (Normalised)	0.5-0.6	0.004

Site 4 - OSA SED04 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.47
Pyrene	0.0-0.2	0.485
Total PAHs (Normalised)	0.0-0.2	2.733
Fluoranthene	0.5-0.6	0..019
Pyrene	0.5-0.6	0.038
Total PAHs (Normalised)	0.5-0.6	0.208

Site 3 - OSA SED03 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.06
Pyrene	0.0-0.2	0.067
Total PAHs (Normalised)	0.0-0.2	0.343
Fluoranthene	0.5-0.6	<0.005
Pyrene	0.5-0.6	<0.005
Total PAHs (Normalised)	0.5-0.6	<0.005

Site 2 - OSA SED02 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.071
Pyrene	0.0-0.2	0.073
Total PAHs (Normalised)	0.0-0.2	0.389
Fluoranthene	0.5-0.6	<0.005
Pyrene	0.5-0.6	<0.005
Total PAHs (Normalised)	0.5-0.6	<0.005

Site 1 - OSA SED01 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.025
Pyrene	0.0-0.2	0.028
Total PAHs (Normalised)	0.0-0.2	0.154

Site 9 - OSA SED09 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	<0.5
Pyrene	0.0-0.2	0.035
Total PAHs (Normalised)	0.0-0.2	0.035

Site 10 - OSA SED10 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.106
Pyrene	0.0-0.2	0.144
Total PAHs (Normalised)	0.0-0.2	0.635

Site 7 - OSA SED07 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.145
Pyrene	0.0-0.2	0.169
Total PAHs (Normalised)	0.0-0.2	0.910

Site 8 - OSA SED08 Analyte	Depth (mbgs)	Concentration (mg/kg)
Fluoranthene	0.0-0.2	0.088
Pyrene	0.0-0.2	0.093
Total PAHs (Normalised)	0.0-0.2	0.488

Legend:

Approximate Investigation

Sample Locations

Sediment/Surface Water/Pore Water/Biota

Sediment

Result — Highlighted value is equal to or exceeds D-GV (ANZAST 2018)

Result — Highlighted value is equal to or exceeds GV-High (ANZAST 2018)

Job No: 54083

Client: RMS

Version: R02_Rev0 | Date: 23-Aug-2019

Drawn By: RF | Checked By: CB

Scale 1:6,500

0 75 150

metres

Coor. Sys. GDA 1994 MGA Zone 56

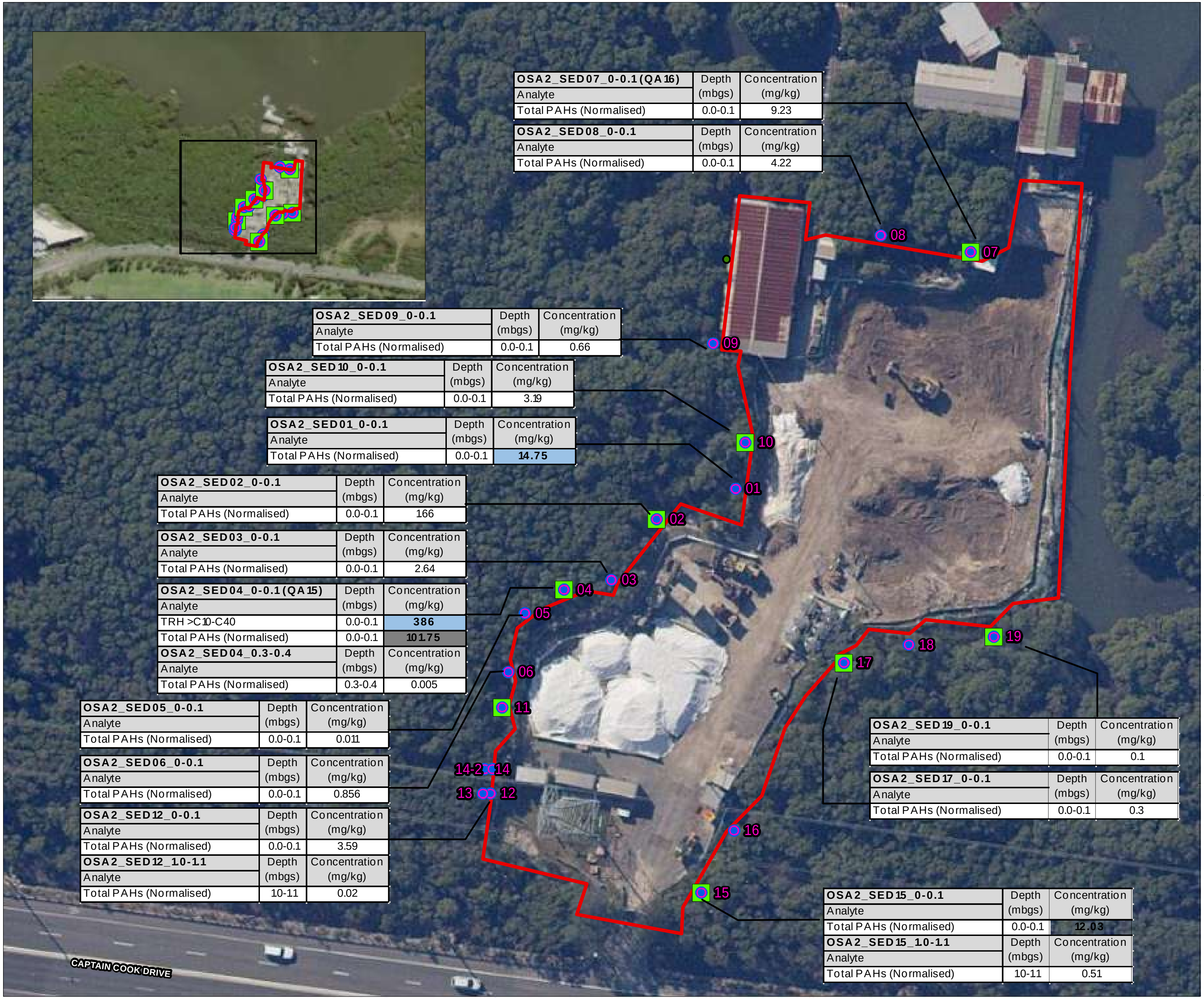
Woolooware Bay, NSW

SEDIMENT SAMPLE RESULTS

FIGURE 5A

File Name: 54083_05

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



OSA2_SED07_0-0.1 (QA16)	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	9.23

OSA2_SED08_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	4.22

OSA2_SED09_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	0.66

OSA2_SED10_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	3.19

OSA2_SED01_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	14.75

OSA2_SED02_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	166

OSA2_SED03_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	2.64

OSA2_SED04_0-0.1 (QA15)	Depth (mbgs)	Concentration (mg/kg)
Analyte		
TRH >C10-C40	0.0-0.1	386
Total PAHs (Normalised)	0.0-0.1	101.75
OSA2_SED04_0.3-0.4	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.3-0.4	0.005

OSA2_SED05_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	0.011

OSA2_SED06_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	0.856

OSA2_SED12_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	3.59
OSA2_SED12_1.0-1.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	10-11	0.02

OSA2_SED19_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	0.1

OSA2_SED17_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	0.3

OSA2_SED15_0-0.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	0.0-0.1	12.03
OSA2_SED15_1.0-1.1	Depth (mbgs)	Concentration (mg/kg)
Analyte		
Total PAHs (Normalised)	10-11	0.51

Legend:

Approximate Investigation Area

Pore Water/Surface Water/Sediment Sample Locations

Pore Water/Sediment Sample Locations

Pore Water/Surface Water/Sediment Sample Locations

NOTE: Sediment sample numbers include location ID (01-19) and respective depths eg...OSA2_SED01_0-0.1

Result — Highlighted value is equal to or exceeds D-GV (ANZAST 2018)

Result — Highlighted value is equal to or exceeds GV-High (ANZAST 2018)

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev0 | Date: 14-Nov-2019

Drawn By: RF | Checked By: CB

Scale 1:850

0 10 20

metres

Coor. Sys. GDA 1994 MGA Zone 56

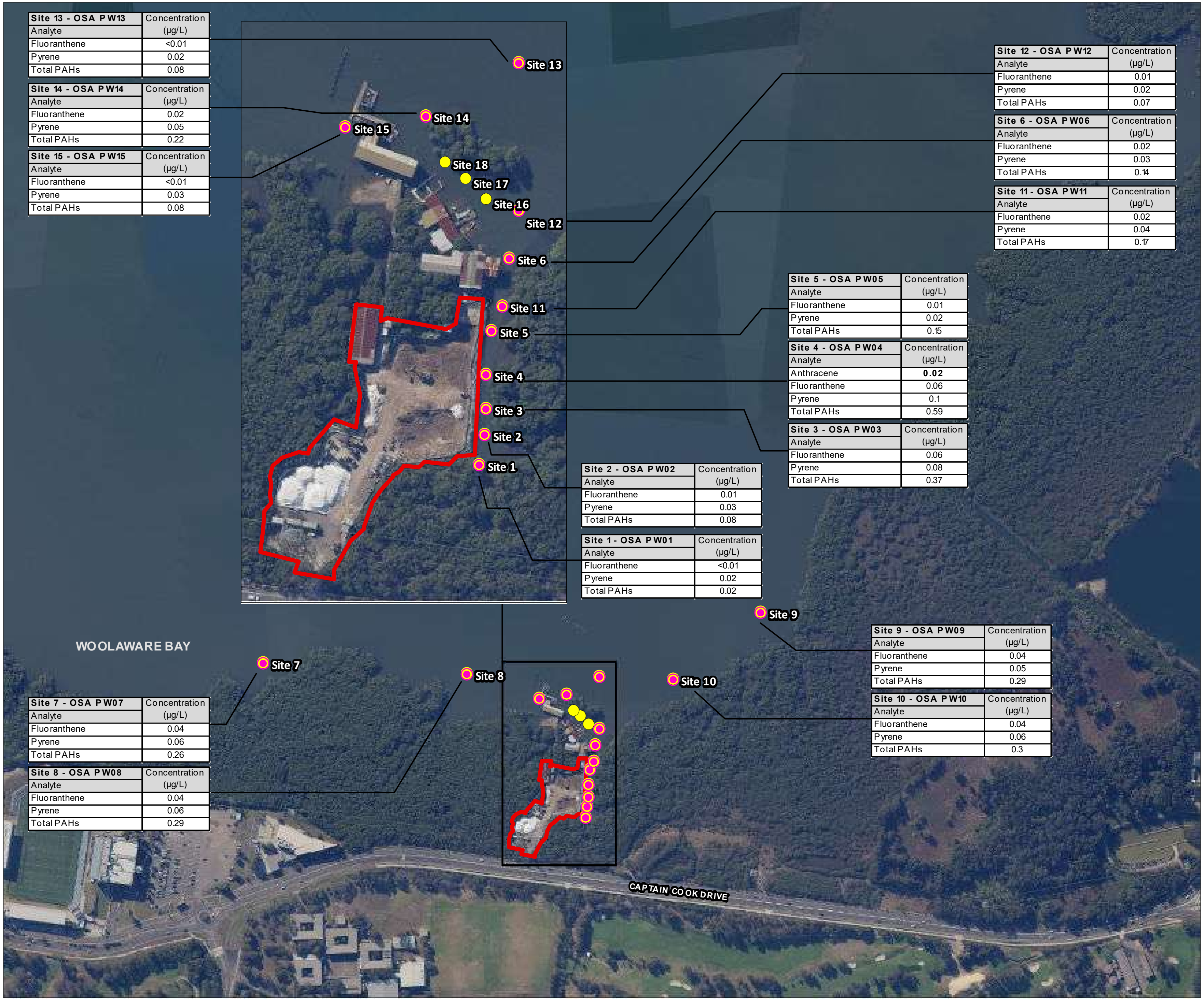
Woolooware Bay, NSW

SEDIMENT SAMPLE RESULTS

FIGURE 5B

File Name: 51163_05_SedimentSampleResults

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



Site 13 - OSA PW13 Analyte	Concentration (µg/L)
Fluoranthene	<0.01
Pyrene	0.02
Total PAHs	0.08

Site 14 - OSA PW14 Analyte	Concentration (µg/L)
Fluoranthene	0.02
Pyrene	0.05
Total PAHs	0.22

Site 15 - OSA PW15 Analyte	Concentration (µg/L)
Fluoranthene	<0.01
Pyrene	0.03
Total PAHs	0.08

Site 12 - OSA PW12 Analyte	Concentration (µg/L)
Fluoranthene	0.01
Pyrene	0.02
Total PAHs	0.07

Site 6 - OSA PW06 Analyte	Concentration (µg/L)
Fluoranthene	0.02
Pyrene	0.03
Total PAHs	0.14

Site 11 - OSA PW11 Analyte	Concentration (µg/L)
Fluoranthene	0.02
Pyrene	0.04
Total PAHs	0.17

Site 5 - OSA PW05 Analyte	Concentration (µg/L)
Fluoranthene	0.01
Pyrene	0.02
Total PAHs	0.15

Site 4 - OSA PW04 Analyte	Concentration (µg/L)
Anthracene	**0.02**
Fluoranthene	0.06
Pyrene	0.1
Total PAHs	0.59

Site 3 - OSA PW03 Analyte	Concentration (µg/L)
Fluoranthene	0.06
Pyrene	0.08
Total PAHs	0.37

Site 2 - OSA PW02 Analyte	Concentration (µg/L)
Fluoranthene	0.01
Pyrene	0.03
Total PAHs	0.08

Site 1 - OSA PW01 Analyte	Concentration (µg/L)
Fluoranthene	<0.01
Pyrene	0.02
Total PAHs	0.02

Site 9 - OSA PW09 Analyte	Concentration (µg/L)
Fluoranthene	0.04
Pyrene	0.05
Total PAHs	0.29

Site 10 - OSA PW10 Analyte	Concentration (µg/L)
Fluoranthene	0.04
Pyrene	0.06
Total PAHs	0.3

Site 7 - OSA PW07 Analyte	Concentration (µg/L)
Fluoranthene	0.04
Pyrene	0.06
Total PAHs	0.26

Site 8 - OSA PW08 Analyte	Concentration (µg/L)
Fluoranthene	0.04
Pyrene	0.06
Total PAHs	0.29

Legend:

Approximate Investigation Area

Sample Locations

Sediment/Surface Water/Pore Water/Biota

Sediment

0.020	Recreational
0.220	ANZAST 2018 Marine 95%
0.150	ANZAST 2018 Marine 99%

Result — Highlighted value is equal to or exceeds D-GV (ANZAST 2018)

Result — Highlighted value is equal to or exceeds GV-High (ANZAST 2018)

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 23-Aug-2019

Drawn By: RF | Checked By: CB

Scale 1:6,500

0 75 150 metres

Coor. Sys. GDA 1994 MGA Zone 56

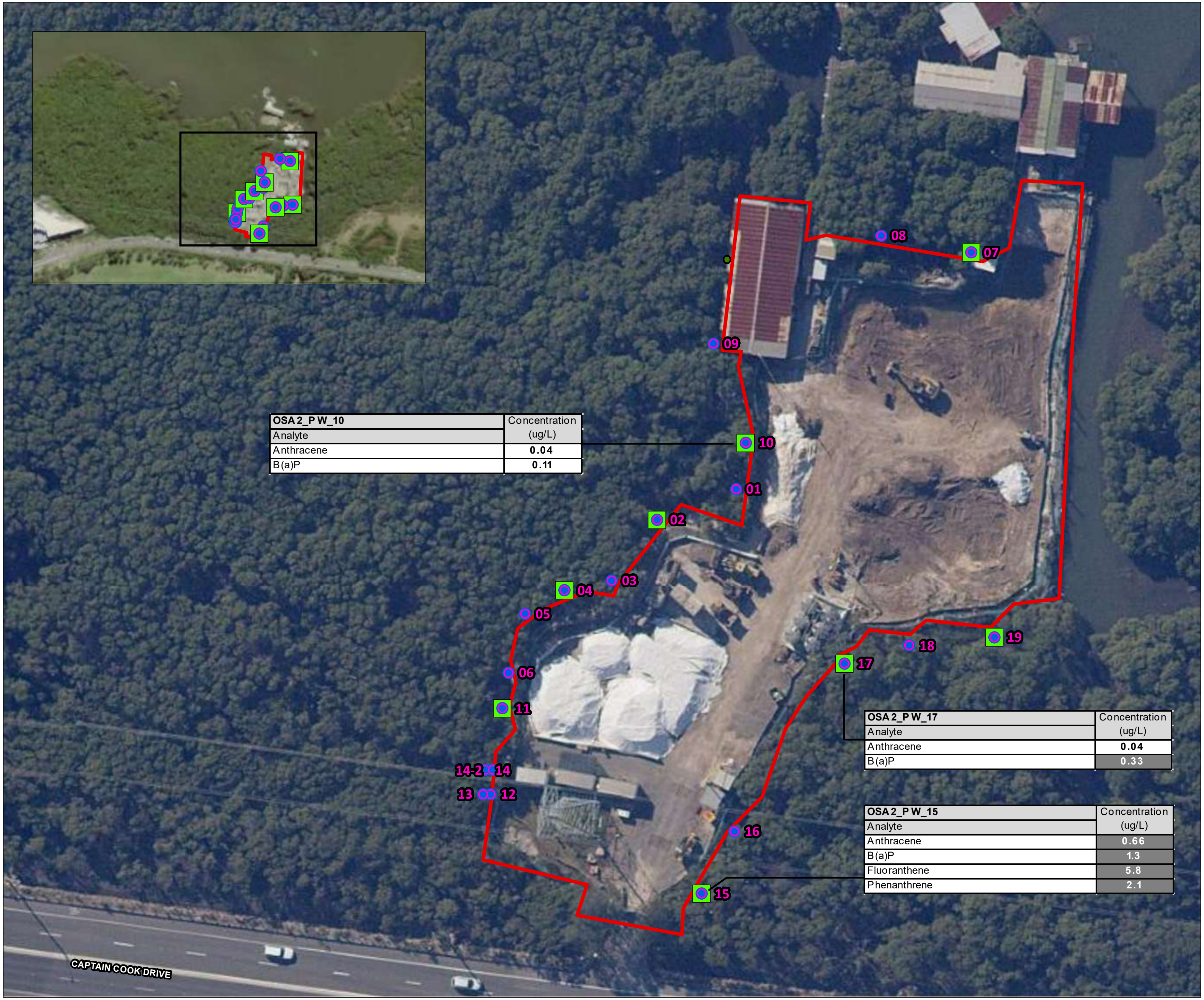
Woolooware Bay, NSW

PORE WATER SAMPLE RESULTS

FIGURE 6A

File Name: 54083_06

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



OSA2_PW_10	Concentration (ug/L)
Analyte	
Anthracene	**0.04**
B(a)P	**0.11**

OSA2_PW_17	Concentration (ug/L)
Analyte	
Anthracene	**0.04**
B(a)P	**0.33**

OSA2_PW_15	Concentration (ug/L)
Analyte	
Anthracene	**0.66**
B(a)P	**1.3**
Fluoranthene	**5.8**
Phenanthrene	**2.1**

Legend:

Pore Water/Surface Water/Sediment Sample Locations

- Pore Water/Sediment Sample Locations
- Pore Water/Surface Water/Sediment Sample Locations
- Approximate Investigation Area

0.020	Recreational
0.220	ANZAST 2018 Marine 95%
0.150	ANZAST 2018 Marine 99%

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 13-Nov-2019

Drawn By: RF | Checked By: CB

Scale 1:7,500

0 75 150
metres

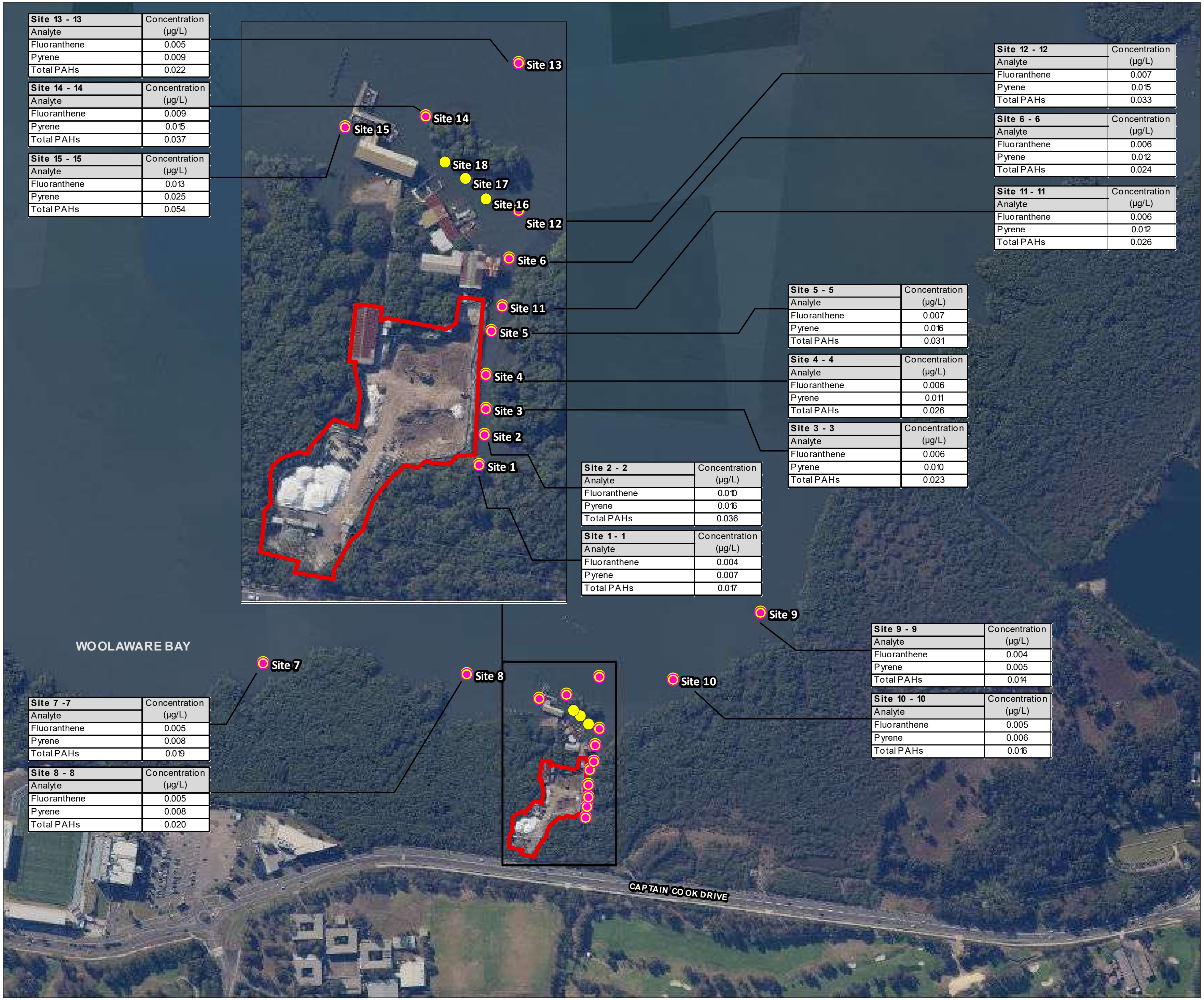
Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

PORE WATER EXCEEDANCES

FIGURE 6B

File Name: 51163_06_PoreWaterResults
Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



Site 13 - 13	Concentration
Analyte	(µg/L)
Fluoranthene	0.005
Pyrene	0.009
Total PAHs	0.022

Site 14 - 14	Concentration
Analyte	(µg/L)
Fluoranthene	0.009
Pyrene	0.015
Total PAHs	0.037

Site 15 - 15	Concentration
Analyte	(µg/L)
Fluoranthene	0.013
Pyrene	0.025
Total PAHs	0.054

Site 12 - 12	Concentration
Analyte	(µg/L)
Fluoranthene	0.007
Pyrene	0.015
Total PAHs	0.033

Site 6 - 6	Concentration
Analyte	(µg/L)
Fluoranthene	0.006
Pyrene	0.012
Total PAHs	0.024

Site 11 - 11	Concentration
Analyte	(µg/L)
Fluoranthene	0.006
Pyrene	0.012
Total PAHs	0.026

Site 5 - 5	Concentration
Analyte	(µg/L)
Fluoranthene	0.007
Pyrene	0.016
Total PAHs	0.031

Site 4 - 4	Concentration
Analyte	(µg/L)
Fluoranthene	0.006
Pyrene	0.011
Total PAHs	0.026

Site 3 - 3	Concentration
Analyte	(µg/L)
Fluoranthene	0.006
Pyrene	0.010
Total PAHs	0.023

Site 2 - 2	Concentration
Analyte	(µg/L)
Fluoranthene	0.010
Pyrene	0.016
Total PAHs	0.036

Site 1 - 1	Concentration
Analyte	(µg/L)
Fluoranthene	0.004
Pyrene	0.007
Total PAHs	0.017

Site 9 - 9	Concentration
Analyte	(µg/L)
Fluoranthene	0.004
Pyrene	0.005
Total PAHs	0.014

Site 10 - 10	Concentration
Analyte	(µg/L)
Fluoranthene	0.005
Pyrene	0.006
Total PAHs	0.016

Site 7 -7	Concentration
Analyte	(µg/L)
Fluoranthene	0.005
Pyrene	0.008
Total PAHs	0.019

Site 8 - 8	Concentration
Analyte	(µg/L)
Fluoranthene	0.005
Pyrene	0.008
Total PAHs	0.020

Legend:

Approximate Investigation Area

Sample Locations

- Sediment/Surface Water/Pore Water/Biota
- Sediment

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 31-Jul-2019

Drawn By: RF | Checked By: CB

Scale 1:6,500

0 75 150 metres

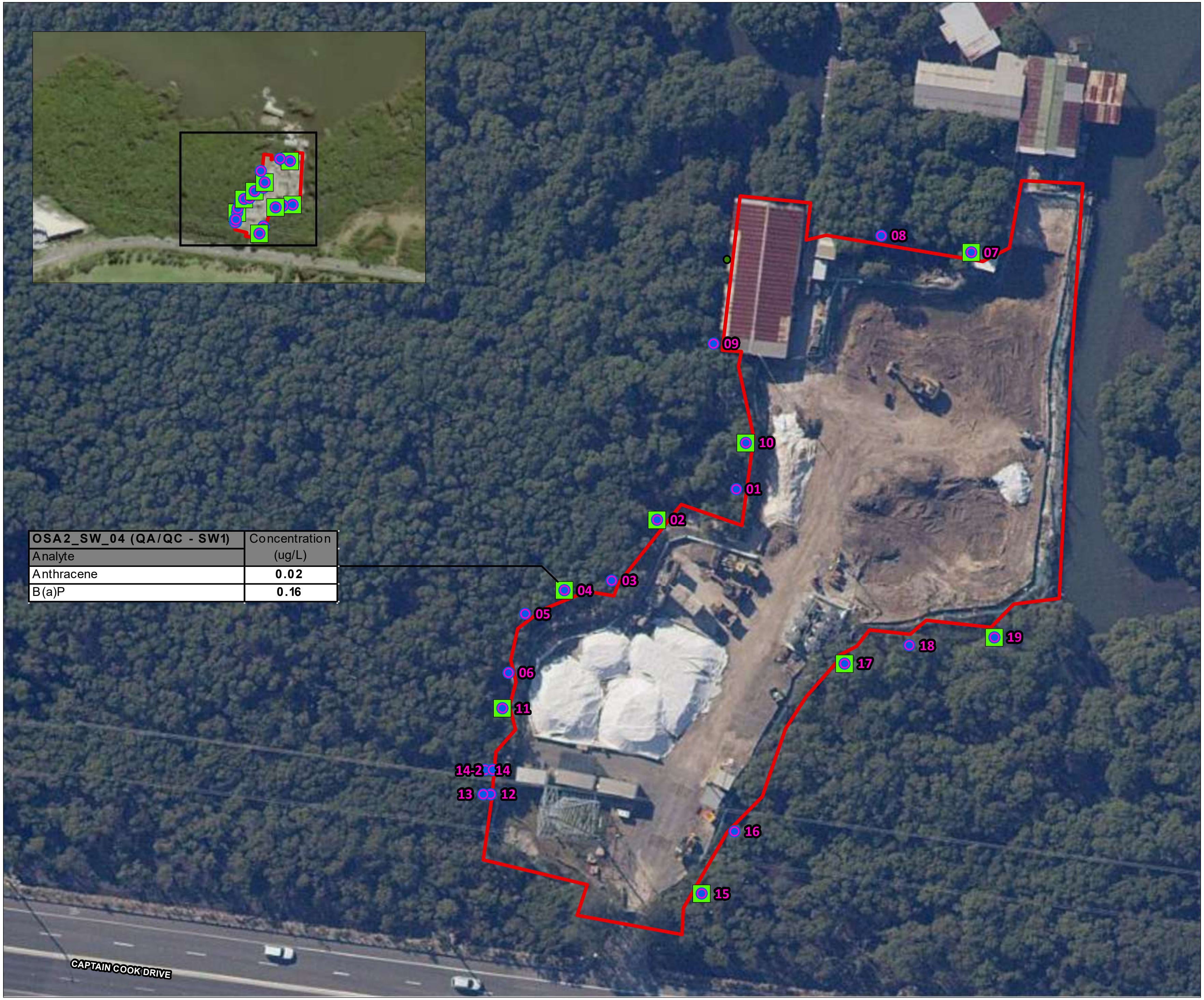
Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SURFACE WATER (PASSIVE) SAMPLE RESULTS

FIGURE 7A

File Name: 54083_07
Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



OSA2_SW_04 (QA/QC - SW1)	Concentration (ug/L)
Analyte	
Anthracene	0.02
B(a)P	0.16

Legend:

Pore Water/Surface Water/Sediment Sample Locations

- Pore Water/Sediment Sample Locations
- Pore Water/Surface Water/Sediment Sample Locations
- Approximate Investigation Area

0.020	Recreational
0.220	ANZAST 2018 Marine 95%
0.150	ANZAST 2018 Marine 99%

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 13-Nov-2019

Drawn By: RF | Checked By: CB

Scale 1:7,500

0 75 150
metres

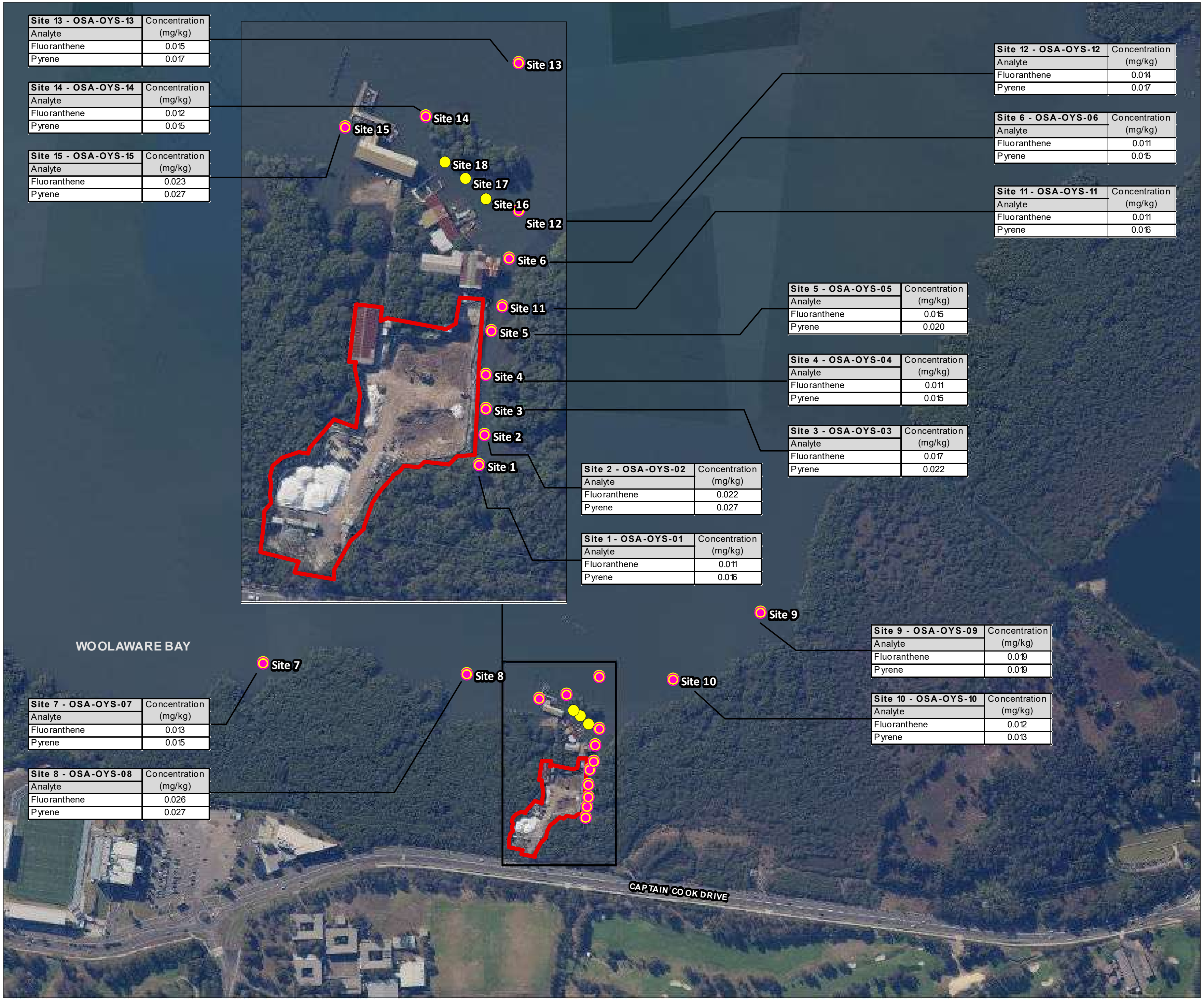
Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

SURFACE WATER GRAB SAMPLE EXCEEDANCES

FIGURE 7B

File Name: 51163_07_SurfaceWaterGrabSampleResults
Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017



Site 13 - OSA-OYS-13	Concentration
Analyte	(mg/kg)
Fluoranthene	0.015
Pyrene	0.017

Site 14 - OSA-OYS-14	Concentration
Analyte	(mg/kg)
Fluoranthene	0.012
Pyrene	0.015

Site 15 - OSA-OYS-15	Concentration
Analyte	(mg/kg)
Fluoranthene	0.023
Pyrene	0.027

Site 12 - OSA-OYS-12	Concentration
Analyte	(mg/kg)
Fluoranthene	0.014
Pyrene	0.017

Site 6 - OSA-OYS-06	Concentration
Analyte	(mg/kg)
Fluoranthene	0.011
Pyrene	0.015

Site 11 - OSA-OYS-11	Concentration
Analyte	(mg/kg)
Fluoranthene	0.011
Pyrene	0.016

Site 5 - OSA-OYS-05	Concentration
Analyte	(mg/kg)
Fluoranthene	0.015
Pyrene	0.020

Site 4 - OSA-OYS-04	Concentration
Analyte	(mg/kg)
Fluoranthene	0.011
Pyrene	0.015

Site 3 - OSA-OYS-03	Concentration
Analyte	(mg/kg)
Fluoranthene	0.017
Pyrene	0.022

Site 2 - OSA-OYS-02	Concentration
Analyte	(mg/kg)
Fluoranthene	0.022
Pyrene	0.027

Site 1 - OSA-OYS-01	Concentration
Analyte	(mg/kg)
Fluoranthene	0.011
Pyrene	0.016

Site 9 - OSA-OYS-09	Concentration
Analyte	(mg/kg)
Fluoranthene	0.019
Pyrene	0.019

Site 10 - OSA-OYS-10	Concentration
Analyte	(mg/kg)
Fluoranthene	0.012
Pyrene	0.013

Site 7 - OSA-OYS-07	Concentration
Analyte	(mg/kg)
Fluoranthene	0.013
Pyrene	0.015

Site 8 - OSA-OYS-08	Concentration
Analyte	(mg/kg)
Fluoranthene	0.026
Pyrene	0.027

Legend:

Approximate Investigation

Sample Locations

- Sediment/Surface Water/Pore Water/Biota
- Sediment

JBS&G

Job No: 54083

Client: RMS

Version: R02_Rev1 | Date: 31-Jul-2019

Drawn By: RF | Checked By: CB

Scale 1:6,500

0 75 150
metres

Coor. Sys. GDA 1994 MGA Zone 56

Woolooware Bay, NSW

BIOTA SAMPLE RESULTS

FIGURE 8

File Name: 54083_08

Reference: sixmaps/LPI Imagery_Best_© Department of Finance, Services & Innovation 2017

Appendix A Summary Tables

Table A1: Sediment Total Concentration Results 2016-2019
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

					Metals & Metalloids															TPHs (NEPC 1999)					TRHs (NEPC 2013)							BTEXN					
Field ID	Sample Date	Sample Type	Location	Report Number	Aluminium	Antimony	Arsenic (Total)	Cadmium	Chromium (Total)	Cobalt	Copper	Lead	Manganese	Mercury (Inorganic)	Nickel	Selenium (Total)	Silver	Vanadium	Zinc	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					1	0.5	0.5	0.1	0.5	0.5	0.5	0.5	1	0.01	0.5	0.1	0.1	0.5	0.5	20	20	50	50	50	50	100	100	50	50	20	20	0.1	0.1	0.1	0.1	0.2	0.3
Geochemical Assessments 2016																																					
SS01-0-0.1	11/05/2016	Sediment	Boat Channel South	146626	4300	<0.5	8.6	0.3	12	1	7	12	40	0.04	5	0.6	<0.1	19	39	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS01-0.1-0.5	11/05/2016	Sediment	Boat Channel South	146626	6900	<0.5	10	0.2	14	1	3	6.4	44	0.03	5	0.8	<0.1	18	17	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS01 - TRIPLICATE-0-0.1	12/05/2016	Sediment	Boat Channel South	146626	4200	<0.5	7.8	0.2	10	1	4	7.2	46	0.02	4	0.7	<0.1	18	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SS02-0-0.1	11/05/2016	Sediment	Boat Channel South	146626	4400	<0.5	5.2	0.2	11	2	37	24	44	0.04	4	0.2	<0.1	13	130	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS02-0.1-0.5	11/05/2016	Sediment	Boat Channel South	146626	5300	<0.5	8.7	0.2	19	2	18	19	41	0.03	5.6	0.6	<0.1	18	78	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS03-0-0.1	11/05/2016	Sediment	Boat Channel Centre	146626	5400	<0.5	6.7	0.1	15	2	26	22	53	0.05	7.3	0.3	<0.1	14	190	<25	<50	<100	<100	-	<50	130	<100	-	-	<25	-	-	-	-	-	-	-
SS03-0.1-0.5	11/05/2016	Sediment	Boat Channel Centre	146626	4500	<0.5	7.9	0.2	10	1	3	4	39	<0.01	4	0.8	<0.1	16	8.5	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS04-0-0.1	11/05/2016	Sediment	Boat Channel North	146626	5000	<0.5	6.2	0.1	11	1	16	20	30	0.05	4	0.3	<0.1	13	61	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
QS01-0.1-0.5	11/05/2016	Sediment	Boat Channel North	146626	5700	<0.5	7.5	0.2	13	2	22	22	34	0.06	5	0.4	<0.1	15	71	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS04-0.1-0.5	11/05/2016	Sediment	Boat Channel North	146626	3400	<0.5	5.9	0.1	8	1	8.8	11	26	0.03	3	0.4	<0.1	12	31	<25	<50	170	<100	-	<50	230	<100	-	-	<25	-	-	-	-	-	-	-
SS05-0-0.1	12/05/2016	Sediment	Mangroves West of Site	146626	5400	<0.5	8.2	0.2	13	2	18	22	19	0.05	5	0.4	<0.1	15	130	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS05-0.1-0.5	12/05/2016	Sediment	Mangroves West of Site	146626	4600	<0.5	5.2	0.3	8.4	1	3	5.3	31	0.01	3	0.4	<0.1	11	21	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS06-0-0.1	12/05/2016	Sediment	Mangroves North of Site	146626	4600	<0.5	6.4	0.1	11	1	14	18	18	0.04	3	0.3	<0.1	12	71	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS06-0.1-0.5	12/05/2016	Sediment	Mangroves North of Site	146626	5100	<0.5	9.3	0.3	9.7	2	7.6	17	19	0.06	4	0.3	<0.1	14	71	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS07-0-0.1	12/05/2016	Sediment	Mangroves North of Site	146626	4300	<0.5	6.7	0.1	10	1	15	23	19	0.05	3	0.3	<0.1	13	150	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS07-0.1-0.5	12/05/2016	Sediment	Mangroves North of Site	146626	5300	<0.5	5.9	0.1	9.8	1	3	5.5	22	<0.01	4	0.5	<0.1	15	15	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS07 - TRIPLICATE-0-0.1	12/05/2016	Sediment	Mangroves North of Site	146626	5200	<0.5	7	0.1	11	1	14	20	18	0.04	4	0.3	<0.1	13	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SS08-0-0.1	12/05/2016	Sediment	Reference Location	146626	4600	<0.5	6.5	<0.1	10	1	7	13	27	0.05	4	0.3	<0.1	11	36	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS09-0-0.1	12/05/2016	Sediment	Reference Location	146626	7300	<0.5	12	0.2	16	2	11	21	33	0.09	5.4	0.4	<0.1	19	60	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS10-0-0.1	12/05/2016	Sediment	Boat Channel North	146626	7600	<0.5	8.4	0.2	16	2	25	28	35	0.08	5.1	0.3	0.1	19	130	<25	<50	<100	<100	-	<50	110	<100	-	-	<25	-	-	-	-	-	-	-
QS02-0.1-0.5	12/05/2016	Sediment	Boat Channel North	146626	8200	<0.5	8.6	0.2	18	2	31	33	38	0.09	6	0.4	0.1	19	130	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
SS10-0.1-0.5	12/05/2016	Sediment	Boat Channel North	146626	10,000	<0.5	12	0.2	24	3	52	41	53	0.19	7.4	0.5	0.1	26	190	<25	<50	<100	<100	-	<50	<100	<100	-	-	<25	-	-	-	-	-	-	-
JBS&G 2018																																					
OSA SED 01-0-0.2	17/10/2018	Sediment	Boat Channel South	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 02-0-0.2	17/10/2018	Sediment	Boat Channel South	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 03-0-0.2	17/10/2018	Sediment	Boat Channel South	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 04-0-0.2	17/10/2018	Sediment	Boat Channel Centre	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 05-0-0.2	17/10/2018	Sediment	Boat Channel Centre	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 06-0-0.2	17/10/2018	Sediment	North-East of Site	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 07-0-0.2	18/10/2018	Sediment	Reference Location West	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 08-0-0.2	18/10/2018	Sediment	Reference Location West	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 09-0-0.2	18/10/2018	Sediment	Reference Location East	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 10-0-0.2	18/10/2018	Sediment	Reference Location East	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 11-0-0.2	18/10/2018	Sediment	Boat Channel North	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QC18102018-1	18/10/2018	Sediment	Boat Channel North	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QA18102018-1	18/10/2018	Sediment	Boat Channel North	203550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<50	<100	<100	-	<50	<100	<100	<50	<50	<25	<25	<0.2	<1	<0.5	<1	<2	<1
OSA SED 12-0-0.2	18/10/2018	Sediment	North-East of Site	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 13-0-0.2	18/10/2018	Sediment	North of Site	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	160	52	212	<50	190	<100	190	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 14-0-0.2	18/10/2018	Sediment	North of Site	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	140	<50	140	<50	160	<100	160	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA SED 15-0-0.2	18/10/2018	Sediment	North-West of Site	623691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	480	130	610	<50	540	<100	540	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED02-0.5-0.6	15/11/2018	Sediment	Boat Channel South	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED03-0.5-0.6	15/11/2018	Sediment	Boat Channel South	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED04-0.5-0.6	15/11/2018	Sediment	Boat Channel Centre	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED05-0.5-0.6	15/11/2018	Sediment	Boat Channel Centre	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED06-0.5-0.6	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED11-0.5-0.6	15/11/2018	Sediment	Boat Channel North	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED12-0.5-0.6	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED13-0.5-0.6	16/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED13-0-0.1	16/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	98	<50	98	<50	130	<100	130	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
QA16112018-SED01	16/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	<50	<100	<100	-	<50	<100	<100	<50	<50	<25	<25	<0.2	<1	<0.5	<1	<2	<1
QC16112018-SED01	16/11/2018	Sediment	North-East of Site	205815	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	140	81	221	<50	200	<100	200	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED14-0-0.1	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED15-0.5-0.6	16/11/2018	Sediment	North of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED15-0-0.1	16/11/2018	Sediment	North of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	90	1600	630	2320	210	2100	300	2610	210	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED16-0-0.1	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	990	440	1430	<50	1400	190	1590	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED17-0-0.1	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	130	75	205	<50	180	<100	180	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3
OSA-SED18-0-0.1	15/11/2018	Sediment	North-East of Site	628128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<20	140	78	218	<50	200	<100	200	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3

Table A1: Sediment Total Concentration Results 2016-2019
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

				Polycyclic Aromatic Hydrocarbons																							Other
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene TEQ (lower bound)*	Benzo(a)pyrene TEQ (medium bound)*	Benzo(a)pyrene TEQ (upper bound)*	Benzo(b,j)fluoranthene	Benzo(b,k)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzo(b,j+k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Carcinogenic PAHs as B(a)P TEQ	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	Moisture
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL				0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.2	0.005	0.005		0.005	0.005		0.005	0.005	0.005	0.005	0.005	0.005	0.005	1
Field ID	**Sample Date**	**Sample Type**	**Location**																								
Geochemical Assessments 2016																											
SS01-0-0.1	11/05/2016	Sediment	Boat Channel South	<0.1	<0.1	<0.1	0.2	0.3	<0.5	<0.5	0.5	-	0.5	0.2	-		0.3	<0.1	0.395	0.6	<0.1	0.2	<0.1	0.1	3.2	0.6	12
SS01-0.1-0.5	11/05/2016	Sediment	Boat Channel South	<0.1	<0.1	0.1	0.4	0.4	<0.5	0.5	0.6	-	0.5	0.2	-		0.4	<0.1	0.516	0.9	<0.1	0.2	<0.1	0.3	4.3	0.9	14
SS01 - TRIPLICATE-0-0.1	12/05/2016	Sediment	Boat Channel South	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
SS02-0-0.1	11/05/2016	Sediment	Boat Channel South	<0.1	<0.1	<0.1	0.2	0.2	<0.5	<0.5	<0.5	-	0.3	0.1	-		0.3	<0.1	0.284	0.5	<0.1	0.1	<0.1	0.1	2.2	0.5	34
SS02-0.1-0.5	11/05/2016	Sediment	Boat Channel South	<0.1	<0.1	<0.1	<0.1	0.09	<0.5	<0.5	<0.5	-	0.2	<0.1	-		0.1	<0.1	0.1515	0.2	<0.1	<0.1	<0.1	<0.1	0.91	0.2	21
SS03-0-0.1	11/05/2016	Sediment	Boat Channel Centre	0.2	0.5	0.4	3.1	2.6	3.7	3.7	3.7	-	4.1	1.6	-		2.7	0.3	3.413	5.6	0.1	1.6	0.3	1.7	31	6.4	18
SS03-0.1-0.5	11/05/2016	Sediment	Boat Channel Centre	<0.1	<0.1	<0.1	<0.1	<0.05	<0.5	<0.5	<0.5	-	<0.2	<0.1	-		<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1	18
SS04-0-0.1	11/05/2016	Sediment	Boat Channel North	<0.1	0.1	<0.1	1	1.2	1.6	1.6	1.6	-	2	0.7	-		1.2	0.1	1.479	2.1	<0.1	0.6	0.1	0.4	12	2.9	28
QS01-0.1-0.5	11/05/2016	Sediment	Boat Channel North	<0.1	<0.1	0.1	0.6	0.57	0.8	0.8	0.9	-	1	0.3	-		0.6	<0.1	0.719	1.4	<0.1	0.3	<0.1	0.3	6.9	1.4	32
SS04-0.1-0.5	11/05/2016	Sediment	Boat Channel North	0.4	0.8	0.6	3.7	3.4	4.9	4.9	4.9	-	4.4	2	-		3.8	0.4	4.408	5.7	0.2	1.8	0.3	2.8	39	8.4	9.5
SS05-0-0.1	12/05/2016	Sediment	Mangroves West of Site	<0.1	<0.1	0.1	1	0.9	1.2	1.3	1.3	-	2	0.6	-		1	<0.1	1.126	2	<0.1	0.6	<0.1	0.4	10	2.2	25
SS05-0.1-0.5	12/05/2016	Sediment	Mangroves West of Site	<0.1	<0.1	<0.1	<0.1	0.09	<0.5	<0.5	<0.5	-	<0.2	<0.1	-		<0.1	<0.1	0.151	0.2	<0.1	<0.1	<0.1	<0.1	0.5	0.2	20
SS06-0-0.1	12/05/2016	Sediment	Mangroves North of Site	<0.1	<0.1	<0.1	0.9	0.82	1.1	1.2	1.2	-	2	0.6	-		1	<0.1	1.036	1.8	<0.1	0.6	<0.1	0.5	9.4	1.8	21
SS06-0.1-0.5	12/05/2016	Sediment	Mangroves North of Site	<0.1	0.2	0.2	1.1	1.1	1.5	1.5	1.6	-	2	0.6	-		1.4	<0.1	1.34	2.4	<0.1	0.6	0.1	0.9	14	3.5	26
SS07-0-0.1	12/05/2016	Sediment	Mangroves North of Site	<0.1	0.2	0.3	2.6	2.1	3.1	3.1	3.1	-	3.5	1.3	-		2.4	0.2	2.727	4.7	<0.1	1.3	<0.1	1.3	25	5.1	21
SS07-0.1-0.5	12/05/2016	Sediment	Mangroves North of Site	<0.1	<0.1	<0.1	<0.1	0.1	<0.5	<0.5	<0.5	-	0.2	<0.1	-		<0.1	<0.1	0.161	0.3	<0.1	<0.1	<0.1	0.1	1.1	0.3	40
SS07 - TRIPLICATE-0-0.1	12/05/2016	Sediment	Mangroves North of Site	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
SS08-0-0.1	12/05/2016	Sediment	Reference Location	<0.1	<0.1	<0.1	0.1	0.2	<0.5	<0.5	<0.5	-	0.3	0.1	-		0.2	<0.1	0.273	0.3	<0.1	0.1	<0.1	<0.1	1.7	0.3	26
SS09-0-0.1	12/05/2016	Sediment	Reference Location	<0.1	<0.1	<0.1	0.2	0.3	<0.5	<0.5	<0.5	-	0.5	0.2	-		0.3	<0.1	0.395	0.6	<0.1	0.2	<0.1	0.2	3.1	0.6	43
SS10-0-0.1	12/05/2016	Sediment	Boat Channel North	0.2	0.1	0.4	2.8	2.2	3.3	3.3	3.3	-	4.2	1.4	-		2.5	0.2	2.869	5.4	0.1	1.5	<0.1	1.5	27	4.8	20
QS02-0.1-0.5	12/05/2016	Sediment	Boat Channel North	<0.1	<0.1	0.2	1.7	1.5	2.2	2.2	2.2	-	2.8	0.9	-		1.6	0.1	1.895	3.2	<0.1	1	<0.1	0.6	17	3.4	10
SS10-0.1-0.5	12/05/2016	Sediment	Boat Channel North	<0.1	<0.1	<0.1	1.6	1.2	1.6	1.7	1.7	-	2.2	0.7	-		1.4	<0.1	1.501	3.1	<0.1	0.7	<0.1	0.6	15	3.2	31
JBS&G 2018																											
OSA SED 01-0-0.2	17/10/2018	Sediment	Boat Channel South	<0.05	<0.05	<0.05	0.07	0.09	0.12	0.15	0.17	0.08	-	0.08	0.08	-	0.1	<0.05	0.1478	0.14	<0.05	0.08	<0.05	<0.05	0.88	0.16	69
OSA SED 02-0-0.2	17/10/2018	Sediment	Boat Channel South	<0.05	<0.05	<0.05	0.28	0.31	0.49	0.49	0.49	0.27	-	0.25	0.27	-	0.34	0.07	0.4949	0.64	<0.05	0.27	<0.05	0.14	3.5	0.66	68
OSA SED 03-0-0.2	17/10/2018	Sediment	Boat Channel South	<0.05	<0.05	<0.05	0.17	0.19	0.26	0.28	0.31	0.15	-	0.15	0.15	-	0.2	<0.05	0.2825	0.35	<0.05	0.17	<0.05	0.07	1.99	0.39	64
OSA SED 04-0-0.2	17/10/2018	Sediment	Boat Channel Centre	0.14	0.05	0.31	1.6	1.7	2.6	2.6	2.6	1.5	-	1.1	1.3	-	1.7	0.29	2.578	3.1	0.12	1.2	<0.05	0.73	18.04	3.2	66
OSA SED 05-0-0.2	17/10/2018	Sediment	Boat Channel Centre	<0.05	<0.05	<0.05	0.14	0.19	0.25	0.28	0.3	0.15	-	0.14	0.15	-	0.17	<0.05	0.2791	0.3	<0.05	0.17	<0.05	0.07	1.82	0.34	66
OSA SED 06-0-0.2	17/10/2018	Sediment	North-East of Site	<0.05	<0.05	<0.05	0.1	0.11	0.15	0.18	0.2	0.11	-	0.09	0.1	-	0.12	<0.05	0.1791	0.21	<0.05	0.11	<0.05	<0.05	1.17	0.22	64
OSA SED 07-0-0.2	18/10/2018	Sediment	Reference Location West	<0.05	<0.05	0.05	0.22	0.26	0.35	0.37	0.4	0.19	-	0.2	0.2	-	0.26	<0.05	0.3726	0.42	<0.05	0.22	<0.05	0.13	2.64	0.49	52
OSA SED 08-0-0.2	18/10/2018	Sediment	Reference Location West	<0.05	<0.05	<0.05	0.17	0.19	0.26	0.28	0.31	0.16	-	0.15	0.16	-	0.22	<0.05	0.2827	0.38	<0.05	0.15	<0.05	0.12	2.1	0.4	56
OSA SED 09-0-0.2	18/10/2018	Sediment	Reference Location East	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.12	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	<0.121	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.06	37
OSA SED 10-0-0.2	18/10/2018	Sediment	Reference Location East	<0.05	<0.05	<0.05	0.19	0.2	0.26	0.29	0.31	0.13	-	0.12	0.16	-	0.26	<0.05	0.2878	0.36	<0.05	0.11	<0.05	0.14	2.16	0.49	53
OSA SED 11-0-0.2	18/10/2018	Sediment	Boat Channel North	<0.05	<0.05	<0.05	0.11	0.13	0.18	0.2	0.23	0.12	-	0.11	0.11	-	0.13	<0.05	0.2024	0.23	<0.05	0.11	<0.05	<0.05	1.3	0.25	64
QC18102018-1	18/10/2018	Sediment	Boat Channel North	<0.05	<0.05	<0.05	0.38	0.39	0.6	0.6	0.6	0.32	-	0.21	0.29	-	0.38	0.07	0.5959	0.71	<0.05	0.31	<0.05	0.15	3.96	0.75	65
QA18102018-1	18/10/2018	Sediment	Boat Channel North	0.05	0.07	0.07	0.68	0.76	1.1	1.1	1.1	-	-	0.45	-	1.3	0.76	0.1	0.9781	1.4	0.05	0.38	<1 - 0.05	0.32	7.9	1.4	45
OSA SED 12-0-0.2	18/10/2018	Sediment	North-East of Site	<0.05	<0.05	<0.05	0.31	0.36	0.54	0.54	0.54	0.24	-	0.27	0.3	-	0.35	0.07	0.5442	0.61	<0.05	0.23	<0.05	0.28	3.76	0.74	63
OSA SED 13-0-0.2	18/10/2018	Sediment	North of Site	0.12	0.07	0.2	1.9	2	3.2	3.2	3.2	1.8	-	1.2	1.8	-	2	0.45	3.172	3.7	0.14	1.4	<0.05	0.98	21.46	3.7	51
OSA SED 14-0-0.2	18/10/2018	Sediment	North of Site	<0.05	0.06	0.19	1.2	1.1	1.6	1.6	1.6	0.68	-	0.53	0.81	-	1.1	0.19	1.647	2.1	0.08	0.72	<0.5 - 0.05	0.74	12.05	2.5	34
OSA SED 15-0-0.2	18/10/2018	Sediment	North-West of Site	0.38	0.72	2.3	14	14	20	20	20	9.5	-	6.6	9.8	-	13	2	20.31	20	0.66	7.8	<0.5 - 0.72	7.8	132.3	23	36
OSA-SED02-0.5-0.6	15/11/2018	Sediment	Boat Channel South	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.012	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	<0.0121	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	62
OSA-SED03-0.5-0.6	15/11/2018	Sediment	Boat Channel South	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.012	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	<0.0121	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	57
OSA-SED04-0.5-0.6	15/11/2018	Sediment	Boat Channel Centre	0.006	<0.005	0.01	0.1	0.1	0.17	0.17	0.17	0.09	-	0.096	0.11	-	0.12	0.033	0.1683	0.1	<0.005	0.031	<0.5 - 0.014	0.055	1.1	0.2	62
OSA-SED05-0.5-0.6	15/11/2018	Sediment	Boat Channel Centre	<0.005	<0.005	<0.005	0.008	<0.005	<0.005	0.007	0.012	<0.005	-	<0.005	<0.005	-	0.006	<0.005	0.006635	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005	63
OSA-SED06-0.5-0.6	15/11/2018	Sediment	North-East of Site	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.012	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	<0.0121	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	63
OSA-SED11-0.5-0.6	15/11/2018	Sediment	Boat Channel North	0.17	0.036	0.22	2.3	2.2	3.3	3.3	3.3	3.1	-	1.3	0.22	-	2.8	0.4	3.313	5.1	0.13	1.1	<0.5 - 0.083	1.2	26	5.9	55
OSA-SED12-0.5-0.6	15/11/2018	Sediment	North-East of Site	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.012	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	<0.0121	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	70
OSA-SED13-0.5-0.6	16/11/2018	Sediment	North-East of Site	<0.005	<0.005	<0.005	0.016	0.026	0.032	0.035	0.037	0.015	-	<0.005	0.024	-	0.028	<0.005	0.03456	0.029	<0.005	<0.005	<0.005	0.006	0.18	0.036	53
OSA-SED13-0-0.1	16/11/2018	Sediment	North-East of Site	0.044	0.06	0.16	1.8	2.3	3.5	3.5	3.5	1.9	-	0.91	1.5	-	1.8	0.5	3.467	3.3	0.072	1.2	<0.5 - 0.049	0.74	20	3.4	49
QA16112018-SED01	16/11/2018	Sediment	North-East of Site	<0.1	0.1	0.2	1.6	1.6	2.7	2.7	2.7	-	-	1.1	-	5.9	1.9	0.2	2.07	3.2	<0.1	0.8	<0.1	0.7	20	3.2	-
QC16112018-SED01	16/11/2018	Sediment	North-East of Site	0.1	0.09	0.26	3	3	5.1	5.1	5.1	3.2	-	1.5	2.8	-	3.1	0.88	5.056	6.8	0.15	2.3	<0.5 - 0.061	1.3	35	6.4	47
OSA-SED14-0-0.1	15/11/2018	Sediment	North-East of Site	<0.005	0.014	0.091	0.75	1.9	2.9	2.9	2.9	2	-	0.84	2.4	-	1.1	0.35	2.894	1.5	0.028	1.1	<0.5 - 0.051	0.29	14	1.7	50
OSA-SED15-0.5-0.6	16/11/2018	Sediment	North of Site	0.012	0.019	0.021	0.12	0.15	0.22	0.22	0.22	0.092	-	0.062	0.13	-	0.17	0.026	0.2206	0.21	0.016	0.081	<0.5 - 0.009	0.074	1.4	0.25	61
OSA-SED15-0-0.1	16/11/2018	Sediment	North of Site	1.2	1.5	3.7	20	17	25	25	25	9.3	-	3.6	9.3	-	21	2.8	24.62	30	3.2	7.1	<0.5 - 1.6	21	190	41	49
OSA-SED16-0-0.1	15/11/2018	Sediment	North-East of Site	3.2	0.68	7.3	27	19	28	28	28	18	-	5.7	17	-	35	1.8	28.36	81	3.7	9.5	<0.5 - 0.59	32	340	76	60
OSA-SED17-0-0.1	15/11/2018	Sediment	North-East of Site	0.56	0.17	1.9	15	11	18	18	18	11	-	5.5	7.2	-	14	3.3	18.42	32	0.94	6	<0.5 - 0.1	7.1	140	27	66
OSA-SED18-0-0.1	15/11/2018	Sediment	North-East of Site	0.075	0.13	0.23	2.3	3.1	4.7	4.7	4.7	2.3	-	1.4	2.1	-	2.4	0.7	4.668	4	0.12	1.6	<0.5 - 0.12	1.1	26	4.7	64

Table A2: Offsite ERA 2018-2019 Sediment Analytical Results (Normalised)
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

Field ID	Sample Date	Locations	Report Number	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Carcinogenic PAHs as B(a)P TEQ	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	% Moisture 103oC	Total Organic Carbon	LOE Score
				TPHs (NEPC 1999)					TRHs (NEPC 2013)							BTEXN						Polycyclic Aromatic Hydrocarbons																		Other		
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	
EQL				20	20	50	50	50	50	100	100	50	50	20	20	0.1	0.1	0.1	0.1	0.2	0.3	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005		0.005	0.005	0.005	0.005	0.005	0.005	0.005	1	0.1	
D-GV (ANZAST 2018)[1]												280																										10				
GV-High (ANZAST 2018)[1]												550																										50				
JBS&G 2018																																										
OSA SED 01-0-0.2	17/10/2018	Boat Channel South	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.01228	0.01579	0.014	0.014	0.014035088	0.0175	<0.05	0.026	0.0246	<0.05	0.014	<0.05	<0.05	0.15	0.028	69	5.7	1
OSA SED 02-0-0.2	17/10/2018	Boat Channel South	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.03111	0.03444	0.03	0.0278	0.03	0.0378	0.0078	0.055	0.0711	<0.05	0.03	<0.05	0.0156	0.39	0.073	68	9	1
OSA SED 03-0-0.2	17/10/2018	Boat Channel South	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.02931	0.03276	0.0259	0.0259	0.025862069	0.0345	<0.05	0.049	0.0603	<0.05	0.0293	<0.05	0.0121	0.34	0.067	64	5.8	1
OSA SED 04-0-0.2	17/10/2018	Boat Channel Centre	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0212	0.00758	0.04697	0.24242	0.25758	0.2273	0.1667	0.196969697	0.2576	0.0439	0.391	0.4697	0.0182	0.1818	<0.05	0.1106	2.73	0.485	66	6.6	1
OSA SED 05-0-0.2	17/10/2018	Boat Channel Centre	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.01538	0.02088	0.0165	0.0154	0.016483516	0.0187	<0.05	0.031	0.033	<0.05	0.0187	<0.05	0.0077	0.20	0.037	66	9.1	1
OSA SED 06-0-0.2	17/10/2018	North-East of Site	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.01923	0.02115	0.11	0.09	0.1	0.12	<0.05	0.1791	0.21	<0.05	0.11	<0.05	<0.05	1.17	0.22	64	5.2	1
OSA SED 07-0-0.2	18/10/2018	Reference Location West	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	0.01724	0.07586	0.08966	0.0655	0.069	0.068965517	0.0897	<0.05	0.128	0.1448	<0.05	0.0759	<0.05	0.0448	0.91	0.169	52	2.9	1
OSA SED 08-0-0.2	18/10/2018	Reference Location West	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.03953	0.04419	0.0372	0.0349	0.037209302	0.0512	<0.05	0.066	0.0884	<0.05	0.0349	<0.05	0.0279	0.49	0.093	56	4.3	1
OSA SED 09-0-0.2	18/10/2018	Reference Location East	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.121	<0.05	<0.05	<0.05	<0.05	<0.05	0.04	0.035	37	1.7	1
OSA SED 10-0-0.2	18/10/2018	Reference Location East	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.05588	0.05882	0.0382	0.0353	0.047058824	0.0765	<0.05	0.085	0.1059	<0.05	0.0324	<0.05	0.0412	0.64	0.144	53	3.4	1
OSA SED 11-0-0.2	18/10/2018	Boat Channel North	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.01392	0.01646	0.0152	0.0139	0.013924051	0.0165	<0.05	0.026	0.0291	<0.05	0.0139	<0.05	<0.05	0.16	0.032	64	7.9	1
QC18102018-1	18/10/2018	Boat Channel North (dup 11 0.0-0.2)	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.05205	0.05342	0.0438	0.0288	0.039726027	0.0521	0.0096	0.082	0.0973	<0.05	0.0425	<0.05	0.0205	0.54	0.103	65	7.3	1
QA18102018-1	18/10/2018	Boat Channel North (dup 11 0.0-0.2)	203550	<25	<50	<100	<100	-	<50	<100	<100	<50	<50	<25	<25	<0.2	<1	<0.5	<1	<2	<1	0.05	0.07	0.07	0.68	0.76	-	0.06	-	0.1013	0.0133	0.13	0.1867	0.0067	0.0507	<1 - 0.05	0.0427	1.05	0.187	45	-	1
OSA SED 12-0-0.2	18/10/2018	North-East of Site	623691	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	<0.05	<0.05	0.05254	0.06102	0.0407	0.0458	0.050847458	0.0593	0.0119	0.092	0.1034	<0.05	0.039	<0.05	0.0475	0.64	0.125	63	5.9	1
OSA SED 13-0-0.2	18/10/2018	North of Site	623691	<20	<20	45.71	14.86	60.57	<50	54.29	<100	54.2857	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0343	0.02	0.05714	0.54286	0.57143	0.5143	0.3429	0.514285714	0.5714	0.1286	0.906	1.0571	0.04	0.4	<0.05	0.28	6.13	1.057	51	3.5	1
OSA SED 14-0-0.2	18/10/2018	North of Site	623691	<20	<20	56	<50	56	<50	64	<100	64	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.05	0.024	0.076	0.48	0.44	0.272	0.212	0.324	0.44	0.076	0.659	0.84	0.032	0.288	<0.5 - 0.0	0.296	4.82	1.000	34	2.5	1
OSA SED 15-0-0.2	18/10/2018	North-West of Site	623691	<20	<20	165.517	44.83	210.345	<50	186.2	<100	186.207	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.131	0.24828	0.7931	4.82759	4.82759	3.2759	2.2759	3.379310345	4.4828	0.6897	7.003	6.8966	0.2276	2.6897	<0.5 - 0.7	2.6897	45.6207	7.931	36	2.9	2
OSA-SED02-0.5-0.6	15/11/2018	Boat Channel South	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	62	3.5	1
OSA-SED03-0.5-0.6	15/11/2018	Boat Channel South	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	57	3.8	1
OSA-SED04-0.5-0.6	15/11/2018	Boat Channel Centre	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0011	<0.005	0.00189	0.01887	0.01887	0.017	0.0181	0.020754717	0.0226	0.0062	0.032	0.0189	<0.005	0.0058	<0.5 - 0.0	0.0104	0.21	0.038	62	5.3	1
OSA-SED05-0.5-0.6	15/11/2018	Boat Channel Centre	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	0.0017	<0.005	<0.005	<0.005	<0.005	0	<0.005	0.002	<0.005	<0.005	<0.005	<0.005	<0.005	0.00	<0.005	63	4.7	1
OSA-SED06-0.5-0.6	15/11/2018	North-East of Site	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	63	3.3	1
OSA-SED11-0.5-0.6	15/11/2018	Boat Channel North	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0472	0.01	0.06111	0.63889	0.61111	0.8611	0.3611	0.611111111	0.7778	0.1111	0.92	1.4167	0.0361	0.3056	<0.5 - 0.0	0.3333	7.22	1.639	55	3.6	1
OSA-SED12-0.5-0.6	15/11/2018	North-East of Site	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	70	7.4	1
OSA-SED13-0.5-0.6	16/11/2018	North-East of Site	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	0.00381	0.00619	0.0036	<0.005	0.005714286	0.0067	<0.005	0.008	0.0069	<0.005	<0.005	<0.005	0.0014	0.04	0.009	53	4.2	1
OSA-SED13-0-0.1	16/11/2018	North-East of Site	628128	<20	<20	46.6667	<50	46.6667	<50	61.9	<100	61.9048	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.021	0.02857	0.07619	0.85714	1.09524	0.9048	0.4333	0.714285714	0.8571	0.2381	1.651	1.5714	0.0343	0.5714	<0.5 - 0.0	0.3524	9.52	1.619	49	2.1	1
QC16112018-SED01	16/11/2018	North-East of Site (dup of 13 0.0-0.1)	628128	<20	<20	43.75	25.3125	69.0625	<50	62.5	<100	62.5	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0313	0.02813	0.08125	0.9375	0.9375	1	0.4688	0.875	0.9688	0.275	1.58	2.125	0.0469	0.7188	<0.5 - 0.06	0.4063	10.9375	2.000	47	3.2	2
QA16112018-SED01	16/11/2018	North-East of Site (dup of 13 0.0-0.1)	205815	<25	<50	<100	<100	-	<50	<100	<100	<50	<50	<25	<25	<0.2	<1	<0.5	<1	<2	<1	<0.1	-	0.2	1.6	1.6	-	0.3793	-	0.6552	0.069	0.714	1.1034	<0.1	0.2759	<0.1	0.2414	6.90	1.103	51	-	1
OSA-SED14-0-0.1	15/11/2018	North-East of Site	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	0.005	0.0325	0.26786	0.67857	0.7143	0.3	0.857142857	0.3929	0.125	1.034	0.5357	0.01	0.3929	<0.5 - 0.05	0.1036	5	0.607	50	2.8	1
OSA-SED15-0.5-0.6	16/11/2018	North of Site	628128	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0021	0.00333	0.00368	0.02105	0.02632	0.0161	0.0109	0.022807018	0.0298	0.0046	0.039	0.0368	0.0028	0.0142	<0.5 - 0.00	0.013	0.24561	0.044	61	5.7	1
OSA-SED15-0-0.1	16/11/2018	North of Site	628128	<20	25.71	457.143	180	662.857	60	600	85.71	745.714	60	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.3429	0.42857	1.05714	5.71429	4.85714	2.6571	1.0286	2.657142857	6	0.8	7.034	8.5714	0.9143	2.0286	<0.5 - 1.6	6	54.2857	11.714	49	3.5	3
OSA-SED16-0-0.1	15/11/2018	North-East of Site	628128	<20	<20	282.857	125.714	408.571	<50	400	54.29	454.286	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.9143	0.19429	2.08571	7.71429	5.42857	5.1429	1.6286	4.857142857	10	0.5143	8.103	23.143	1.0571	2.7143	<0.5 - 0.5	9.1429	97.1429	21.714	60	3.5	3
OSA-SED17-0-0.1	15/11/2018	North-East of Site	628128	<20	<20	22.807	13.1579	35.9649	<50	31.58	<100	31.5789	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0982	0.02982	0.33333	2.63158	1.92982	1.9298	0.9649	1.263157895	2.4561	0.5789	3.232	5.614	0.1649	1.0526	<0.5 - 0.1	1.2456	24.5614	4.737	66	5.7	2
OSA-SED18-0-0.1	15/11/2018	North-East of Site	628128	<20	<20	31.8182	17.7273	49.5455	<50	45.45	<100	45.4545	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.017	0.02955	0.05227	0.52273	0.70455	0.5227	0.3182	0.477272727	0.5455	0.1591	1.061	0.9091	0.0273	0.3636	<0.5 - 0.1	0.25	5.91	1.068	64	4.4	1
JBS&G 2019 - Additional Offsite Assessment																																										
OSA2_SED01_0-0.1	15/10/2019	West of Site	683343	<20	<20	46	26	72	<50	62	11	73	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.091	0.079	0.18	1.2	1.3	1.1	1.2	0.99	1.2	0.51	2.257	2.6	0.13	0.94	0.012	0.92	14.75	2.3	69	13	2
OSA2_SED01_0.5-0.6	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	67	6.9	1
OSA2_SED02_0-0.1	15/10/2019	West of Site	683343	<20	<20	14	9.2	23.2	<50	19	<100	190	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.009	0.022	0.023	0.14	0.15	0.11	0.12	0.11	0.15	0.037	0.233	0.27	0.013	0.073	0.01	0.082	1.66	0.34	74	15	1
OSA2_SED02_0.5-0.6	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	67	6.9	1
OSA2_SED03_0-0.1	15/10/2019	West of Site	683343	<20	<20	16	8.7	24.7	<50	21	<100	21	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.015	0.031	0.041	0.19	0.22	0.13	0.18	0.17	0.21	0.038	0.332	0.44	0.019	0.21	0.011	0.18	2.64	0.55	69	16	1
OSA2_SED03_0.9-1.0	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	62	6.1	1
OSA2_SED04_0-0.1	15/10/2019	West of Site	683343	<20	<20	5.3	5.4	10.7	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.001	0.006	0.004	0.019	0.018	0.007	0.011	0.022	0.021	0.001	0.025	0.032	0.002	0.009	0.004	0.017	0.23	0.057	75	17	1
QC15102019_SED01	15/10/2019	West of Site (dup of 04 0-0.1)	683343	<20	<20	45	<50	45	<50	50	<100	50	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.03	0.086	0.11	0.55	0.49	0.28	0.3	0.32	0.53	0.13	0.784	1	0.057	0.41	0.025	0.38	5.90	1.2	74	14	1
QA15102019-SED1	15/10/2019	West of Site (dup of 04 0-0.1)	228610	<25	<50	<50	<50	<50	31.58	<100	54.39	386	31.58	<25	<25	<0.2	<1	<0.5	<1	<2	<3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	10.42	<0.005	<0.005	<0.005	0.1908	<0.005	101.75	<0.005	76	5.7	3
OSA2_SED04_0.3-0.4	15/10/2019	West of Site	684897	<20	3.8	5.7	<50	9.5	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121	0.0019	<0.005	<0.005	<0.005	0.0007	0.0049	0.002	74	11	1
OSA2_SED04_0.7-0.8	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	64	5.6	1
OSA2_SED04_1.4-1.5	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	57	4.4	1
OSA2_SED05_0-0.1	15/10/2019	West of Site	684897	<20	5.5	8.2	<50	13.7	5.9	<100	<100	<100	5.9	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121	0.0041	<0.005	<0.005	<0.005	0.0018	0.0114	0.006	79	14	1
OSA2_SED05_1.0-1.1	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	71	9.9	1
OSA2_SED06_0-0.1	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.003	0.009	0.009	0.072	0.082	0.065	0.056	0.076	0.087	0.006	0.117	0.13	0.004	0.066	0.004	0.037	0.856	0.15	70	13	1
OSA2_SED06_0.9-1.0	15/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	54	6.3	1
OSA2_SED07_0-0.1	16/10/2019	North of Site	683343	<20	<20	7.8	<50	7.8	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0225	0.01461	0.03483	0.21348	0.21348	0.191	0.1573	0.202247191	0.2472	0.0416	0.339	0.6067	0.0315	0.191	0.0022	0.2247	2.91	0.517	69	8.9	1
QA16102019-SED1	16/10/2019	North of Site (dup of 07 0-0.1)	228610	<25	<50	<50	<50	<50	<50	<100	<100	56.4102	<50	<25	<25	<0.2	<1	<0.5	<1	<2	<3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1.112	<0.005	<0.005	<0.005	0.002	<0.005	9.23	<0.005	72	3.9	1
QC16102019_SED01	16/10/2019	North of Site (dup of 07 0-0.1)	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0202	0.02143	0.025	0.20238	0.19048	0.1667	0.119	0.142857143	0.2262	0.056	0.317	0.4881	0.0286	0.1548	0.0061	0.2024	2.48	0.429	71	8.4	1
OSA2_SED07_1.5-1.6	16/10/2019	North of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	68	6.8	1
OSA2_SED08_0-0.1	16/10/2019	North of Site	683343	<20	<20	14	6.8	20.8	<50	18	<100	18	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.015	0.018	0.034	0.33	0.37	0.3	0.32	0.32	0.38	0.092	0.609	0.71	0.018	0.45	0.006	0.15	4.22	0.71	71	13	1
OSA2_SED08_0.8-0.9	16/10/2019	North of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	67	2.6	1
OSA2_SED09_0-0.1	16/10/2019	West of Red Roofed Shed	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0031	0.0125	0.00938	0.05781	0.05469	0.0297	0.0391	0.046875	0.0594	0.0078	0.081	0.0969	0.0063	0.0359	0.0109	0.0469	0.66	0.147	62	6.4	1
OSA2_SED09_0.8-0.9	16/10/2019	West of Red Roofed Shed	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	69	8.2	1
OSA2_SED10_0-0.1	16/10/2019	West of Site	683343	<20	<20	10	5.4	15.4	<50	13	<100	13	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.029	0.014	0.049	0.25	0.26	0.22	0.21	0.25	0.27	0.014	0.377	0.61	0.027	0.26	0.003	0.2	3.19	0.52	70	14	1
OSA2_SED10_0.3-0.4	16/10/2019	West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	78	17	1
OSA2_SED11_0-0.1	16/10/2019	South-West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	0.008	0.006	0.004	0.003	0.006	0.011	<0.005	0.008	0.021	<0.005	<0.005	<0.005	<0.005	<0.005	0.031	77	15	1
OSA2_SED11_1.0-1.1	16/10/2019	South-West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	69	6.7	1
OSA2_SED12_0-0.1	16/10/2019	South-West of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0153	0.018	0.03467	0.32667	0.30667	0.2667	0.16	0.26	0.4067	0.0487	0.476	0.6667	0.0187	0.2933	0.0033	0.16	3.59	0.607	28	1.5	1
OSA2_SED12_1.0-1.1	15/10/2019	South-West of Site	684897	<20	5.536	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121	0.0039	<0.005	<0.005	<0.005	0.0055	0.02	0.007	62	5.6	1
OSA2_SED15_0-0.1	17/10/2019	South-East of Site	683343	<20	<20	63	19	82	<50	72	<100	72	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.019	0.11	0.39	1	0.71	0.66	0.47	0.61	0.71	0.2	1.186	2.6	0.37	0.37	0.013	2	12.03	1.8	86	32	2
OSA2_SED15_1.0-1.1	17/10/2019	South-East of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0026	0.00789	0.01316	0.03947	0.03158	0.0368	0.0184	0.031578947	0.0421	0.0026	0.048	0.1184	0.0053	0.0211	<0.005	0.0605	0.51	0.079	60	3.8	1
OSA2_SED16_0-0.1	17/10/2019	South-East of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	77	16	1
OSA2_SED17_0.4-0.5	17/10/2019	South of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	75	13	1
OSA2_SED17_0-0.1	17/10/2019	South of Site	683343	<20	<20	6	11	17	<50	13	<100	13	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.001	0.006	0.006	0.024	0.021	0.016	0.012	0.017	0.025	0.002	0.03	0.056	0.004	0.01	0.006	0.034	0.30	0.064	75	21	1
OSA2_SED18_0-0.1	17/10/2019	South of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0121#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	67	7.3	1
OSA2_SED19_0-0.1	17/10/2019	South of Site	683343	<20	<20	<50	<50	<50	<50	<100	<100	<100	<50	<20	<20	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	0.0018	0.0007	0.0015	0.009	0.0078	0.0055	0.0043	0.0065	0.0091	0.0007	0.011	0.022	0.0006	0.0061	<0.005	0.0042	0.10	0.019	73	12	1

#1 TRH and PAH values presented are normalised to 1% total organic carbon (TOC). Where TOC values are greater than 10%, values are normalised to 10% TOC.

Table A3: 2016 Geochemical Assessments Sediment Analytical Results (Normalised)

Project Number: 54083

Project Name: Woolooware Off-Site Assessment

				Metals & Metalloids															TPHs (NEPC 1999)				TRHs (NEPC 2013)				
				Aluminium	Antimony	Arsenic (Total)	Cadmium	Chromium (Total)	Cobalt	Copper	Lead	Manganese	Mercury (Inorganic)	Nickel	Selenium (Total)	Silver	Vanadium	Zinc	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total	C6-C10 Fraction
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				1	0.5	0.5	0.1	0.5	0.5	0.5	0.5	1	0.01	0.5	0.1	0.1	0.5	0.5	20	20	50	50	50	100	100	50	20
D-GV (ANZAST 2018)[1]					2.0	20	1.5	80		65	50		0.15	21		1.0		200								280	
GV-High (ANZAST 2018)[1]					25	70	10	370		270	220		1.0	52		4.0		410								550	
Field ID	**Sample Date**	**Locations**	**Report Number**																								
SS01-0-0.1	11/05/2016	Boat Channel South	146626	4300	<0.5	8.6	0.3	12	1	7	12	40	0.04	5	0.6	<0.1	19	39	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS01-0.1-0.5	11/05/2016	Boat Channel South	146626	6900	<0.5	10	0.2	14	1	3	6.4	44	0.03	5	0.8	<0.1	18	17	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS02-0-0.1	11/05/2016	Boat Channel South	146626	4400	<0.5	5.2	0.2	11	2	37	24	44	0.04	4	0.2	<0.1	13	130	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS02-0.1-0.5	11/05/2016	Boat Channel South	146626	5300	<0.5	8.7	0.2	19	2	18	19	41	0.03	5.6	0.6	<0.1	18	78	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS03-0-0.1	11/05/2016	Boat Channel Centre	146626	5400	<0.5	6.7	0.1	15	2	26	22	53	0.05	7.3	0.3	<0.1	14	190	<25	<50	<100	<100	<50	54.2	<100	54.2	<25
SS03-0.1-0.5	11/05/2016	Boat Channel Centre	146626	4500	<0.5	7.9	0.2	10	1	3	4	39	<0.01	4	0.8	<0.1	16	8.5	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS04-0-0.1	11/05/2016	Boat Channel North	146626	5000	<0.5	6.2	0.1	11	1	16	20	30	0.05	4	0.3	<0.1	13	61	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS04-0.1-0.5	11/05/2016	Boat Channel North	146626	3400	<0.5	5.9	0.1	8	1	8.8	11	26	0.03	3	0.4	<0.1	12	31	<25	<50	77.273	<100	<50	104.55	<100	104.5	<25
SS05-0-0.1	12/05/2016	Mangroves West of Site	146626	5400	<0.5	8.2	0.2	13	2	18	22	19	0.05	5	0.4	<0.1	15	130	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS05-0.1-0.5	12/05/2016	Mangroves West of Site	146626	4600	<0.5	5.2	0.3	8.4	1	3	5.3	31	0.01	3	0.4	<0.1	11	21	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS06-0-0.1	12/05/2016	Mangroves North of Site	146626	4600	<0.5	6.4	0.1	11	1	14	18	18	0.04	3	0.3	<0.1	12	71	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS06-0.1-0.5	12/05/2016	Mangroves North of Site	146626	5100	<0.5	9.3	0.3	9.7	2	7.6	17	19	0.06	4	0.3	<0.1	14	71	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS07-0-0.1	12/05/2016	Mangroves North of Site	146626	4300	<0.5	6.7	0.1	10	1	15	23	19	0.05	3	0.3	<0.1	13	150	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS07-0.1-0.5	12/05/2016	Mangroves North of Site	146626	5300	<0.5	5.9	0.1	9.8	1	3	5.5	22	<0.01	4	0.5	<0.1	15	15	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS08-0-0.1	12/05/2016	Reference Location	146626	4600	<0.5	6.5	<0.1	10	1	7	13	27	0.05	4	0.3	<0.1	11	36	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS09-0-0.1	12/05/2016	Reference Location	146626	7300	<0.5	12	0.2	16	2	11	21	33	0.09	5.4	0.4	<0.1	19	60	<25	<50	<100	<100	<50	<100	<100	<100	<25
SS10-0-0.1	12/05/2016	Boat Channel North	146626	7600	<0.5	8.4	0.2	16	2	25	28	35	0.08	5.1	0.3	0.1	19	130	<25	<50	<100	<100	<50	36.7	<100	36.7	<25
SS10-0.1-0.5	12/05/2016	Boat Channel North	146626	10,000	<0.5	12	0.2	24	3	52	41	53	0.19	7.4	0.5	0.1	26	190	<25	<50	<100	<100	<50	<100	<100	<100	<25

Table A3: 2016 Geochemical Assessments Sediment Analytical Results (Normalised)

Project Number: 54083

Project Name: Woolooware Off-Site Assessment

			Polycyclic Aromatic Hydrocarbons															
			Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Napthalene	Phenanthrene	PAHs (Total)	Pyrene	Moisture	Total Organic Carbon	LOE Score
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	
EQL			0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.1	0.1	
D-GV (ANZAST 2018)[1]														10				
GV-High (ANZAST 2018)[1]														50				
Field ID	**Sample Date**	**Locations**																
SS01-0-0.1	11/05/2016	Boat Channel South	0.023	0.023	0.023	0.0909	0.1364	0.1364	0.023	0.2727	0.023	0.023	0.0455	1.455	0.2727	12	2.2	1
SS01-0.1-0.5	11/05/2016	Boat Channel South	0.024	0.024	0.048	0.1905	0.1905	0.1905	0.024	0.4286	0.024	0.024	0.1429	2.048	0.4286	14	2.1	1
SS02-0-0.1	11/05/2016	Boat Channel South	0.019	0.019	0.019	0.0769	0.0769	0.1154	0.019	0.1923	0.019	0.019	0.0385	0.846	0.1923	34	2.6	1
SS02-0.1-0.5	11/05/2016	Boat Channel South	0.02	0.019	0.019	0.019	0.0346	0.0385	0.019	0.0769	0.019	0.019	0.019	0.350	0.0769	21	2.6	1
SS03-0-0.1	11/05/2016	Boat Channel Centre	0.083	0.208	0.167	1.2917	1.0833	1.125	0.125	2.3333	0.0417	0.125	0.7083	12.917	2.6667	18	2.4	2
SS03-0.1-0.5	11/05/2016	Boat Channel Centre	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.230	0.02	18	2.5	1
SS04-0-0.1	11/05/2016	Boat Channel North	0.019	0.038	0.019	0.3846	0.4615	0.4615	0.038	0.8077	0.019	0.038	0.1538	4.615	1.1154	28	2.6	1
SS04-0.1-0.5	11/05/2016	Boat Channel North	0.182	0.364	0.273	1.6818	1.5455	1.7273	0.1818	2.5909	0.091	0.136	1.2727	17.727	3.8182	9.5	2.2	2
SS05-0-0.1	12/05/2016	Mangroves West of Site	0.012	0.012	0.024	0.2439	0.2195	0.2439	0.012	0.4878	0.012	0.012	0.0976	2.439	0.5366	25	4.1	1
SS05-0.1-0.5	12/05/2016	Mangroves West of Site	0.016	0.016	0.016	0.016	0.029	0.016	0.016	0.0645	0.016	0.016	0.016	0.161	0.0645	20	3.1	1
SS06-0-0.1	12/05/2016	Mangroves North of Site	0.015	0.015	0.015	0.2727	0.2485	0.303	0.015	0.5455	0.015	0.015	0.1515	2.848	0.5455	21	3.3	1
SS06-0.1-0.5	12/05/2016	Mangroves North of Site	0.014	0.054	0.054	0.2973	0.2973	0.3784	0.014	0.6486	0.014	0.027	0.2432	3.784	0.9459	26	3.7	1
SS07-0-0.1	12/05/2016	Mangroves North of Site	0.015	0.059	0.088	0.7647	0.6176	0.7059	0.0588	1.3824	0.015	0.015	0.3824	7.353	1.500	21	3.4	1
SS07-0.1-0.5	12/05/2016	Mangroves North of Site	0.013	0.013	0.013	0.013	0.0256	0.013	0.013	0.0769	0.013	0.013	0.0256	0.282	0.0769	40	3.9	1
SS08-0-0.1	12/05/2016	Reference Location	0.025	0.025	0.025	0.05	0.1	0.1	0.025	0.15	0.025	0.025	0.025	0.850	0.150	26	2	1
SS09-0-0.1	12/05/2016	Reference Location	0.014	0.014	0.014	0.0541	0.0811	0.0811	0.014	0.1622	0.014	0.014	0.0541	0.838	0.1622	43	3.7	1
SS10-0-0.1	12/05/2016	Boat Channel North	0.033	0.033	0.133	0.9333	0.7333	0.8333	0.067	1.8	0.033	0.017	0.5	9.000	1.600	20	3	1
SS10-0.1-0.5	12/05/2016	Boat Channel North	0.016	0.016	0.016	0.5	0.375	0.4375	0.016	0.9688	0.016	0.016	0.1875	4.688	1.000	31	3.2	2

Table B1: Pore Water Analytical Results 2018
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

Field ID	Sample Date	Location	Report Number	Sample Matrix	TPHs (NEPC 1999) C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	TRHs (NEPC 2013) >C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	BTEXN Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					10	50	100	100	100	50	100	100	100	50	10	10	1	1	1	1	2	3	0.01	0.01	0.01	0.01	0.01
ANZAST 2018 Marine Water 95%																	500	5	180	350					0.4		0.2
ANZAST 2018 Marine Water 99%																	500								0.01		0.1
Recreational Criteria - primary and secondary contact																	10	3000	8000			6000					0.1
JBS&G 2018																											
OSA PW 01	17/10/2018	Boat Channel South	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	2	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA PW 02	17/10/2018	Boat Channel South	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	2	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA PW 03	17/10/2018	Boat Channel South	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	1	<1	<2	<3	<0.01	<0.01	<0.01	0.02	0.03
OSA PW 04	17/10/2018	Boat Channel Centre	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	1	<1	<2	<3	0.01	0.01	0.02	0.04	0.05
OSA PW 05	17/10/2018	Boat Channel Centre	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.02
OSA PW 06	17/10/2018	Boat Channel North	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.02
OSA PW 07	18/10/2018	Reference Location West	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	1	<1	<2	<3	<0.01	<0.01	<0.01	0.01	0.03
OSA PW 08	18/10/2018	Reference Location West	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	1	<1	5	<1	<2	<3	<0.01	<0.01	<0.01	0.01	0.03
OSA PW 09	18/10/2018	Reference Location East	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	2	<1	<2	<3	<0.01	<0.01	<0.01	0.01	0.03
OSA PW 10	18/10/2018	Reference Location East	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	1	<1	5	<1	<2	<3	<0.01	<0.01	<0.01	0.01	0.03
OSA PW 11	18/10/2018	Boat Channel North	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	3	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.02
QC19102018-1	18/10/2018	Boat Channel North (dup 11)	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	3	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.01
QA19102018-1	18/10/2018	Boat Channel North (dup 11)	203550	Pore Water	<10	<50	<100	<100	-	<50	<100	<100	-	<50	<10	<10	<1	<1	2	<1	<2	-	<0.1	<0.1	<0.1	<0.1	<0.1
OSA PW 12	18/10/2018	North-East of Site	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	4	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA PW 13	18/10/2018	North-East of Site	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	1	<1	7	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.01
OSA PW 14	18/10/2018	North of Site	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	3	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.03
OSA PW 15	18/10/2018	North of Site	623693	Pore Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	2	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	0.01

Table B1: Pore Water Analytical Results 2018

Project Number: 54083

Project Name: Woolooware Off-Site Assessment

					Polycyclic Aromatic Hydrocarbons												Other
					Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	LOE in WOE SCORE
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
ANZAST 2018 Marine Water 95%										1.4			70	2			
ANZAST 2018 Marine Water 99%										1			50	0.6			
Recreational Criteria - primary and secondary contact																	
Field ID	**Sample Date**	**Location**	**Report Number**	**Sample Matrix**													
JBS&G 2018																	
OSA PW 01	17/10/2018	Boat Channel South	623693	Pore Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	1
OSA PW 02	17/10/2018	Boat Channel South	623693	Pore Water	0.02	0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.03	1
OSA PW 03	17/10/2018	Boat Channel South	623693	Pore Water	0.04	0.03	0.04	0.04	<0.01	0.06	<0.01	0.03	<0.01	<0.01	0.37	0.08	1
OSA PW 04	17/10/2018	Boat Channel Centre	623693	Pore Water	0.06	0.05	0.06	0.05	<0.01	0.06	0.01	0.05	<0.01	0.02	0.59	0.1	2
OSA PW 05	17/10/2018	Boat Channel Centre	623693	Pore Water	0.03	0.02	0.02	<0.01	<0.01	0.01	<0.01	0.03	<0.01	<0.01	0.15	0.02	1
OSA PW 06	17/10/2018	Boat Channel North	623693	Pore Water	0.02	0.02	0.02	<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	0.14	0.03	1
OSA PW 07	18/10/2018	Reference Location West	623693	Pore Water	0.03	0.02	0.03	0.02	<0.01	0.04	<0.01	0.02	<0.01	<0.01	0.26	0.06	1
OSA PW 08	18/10/2018	Reference Location West	623693	Pore Water	0.04	0.03	0.04	0.02	<0.01	0.04	<0.01	0.02	<0.01	<0.01	0.29	0.06	1
OSA PW 09	18/10/2018	Reference Location East	623693	Pore Water	0.04	0.03	0.04	0.02	<0.01	0.04	<0.01	0.03	<0.01	<0.01	0.29	0.05	1
OSA PW 10	18/10/2018	Reference Location East	623693	Pore Water	0.04	0.03	0.04	0.02	<0.01	0.04	<0.01	0.03	<0.01	<0.01	0.3	0.06	1
OSA PW 11	18/10/2018	Boat Channel North	623693	Pore Water	0.02	0.03	0.02	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	0.17	0.04	1
QC19102018-1	18/10/2018	Boat Channel North (dup 11)	623693	Pore Water	0.01	0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	0.09	0.03	1
QA19102018-1	18/10/2018	Boat Channel North (dup 11)	203550	Pore Water	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.1	1
OSA PW 12	18/10/2018	North-East of Site	623693	Pore Water	0.01	0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	0.07	0.02	1
OSA PW 13	18/10/2018	North-East of Site	623693	Pore Water	0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.08	0.02	1
OSA PW 14	18/10/2018	North of Site	623693	Pore Water	0.03	0.03	0.03	0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	0.22	0.05	1
OSA PW 15	18/10/2018	North of Site	623693	Pore Water	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	0.03	1

Table B2: Pore Water Analytical Results 2019
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

					TPHs (NEPC 1999)					TPHs (NEPC 1999) - Silica Gel				TRHs (NEPC 2013)							Hs (NEPC 2013) - Silica G			BTEXN						
					C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	C10-C14 Fraction (SG)	C15-C28 Fraction (SG)	C29-C36 Fraction (SG)	C10 - C36 Fraction (Total) (SG)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	>C10-C16 Fraction (SG)	>C16-C34 Fraction (SG)	>C34-C40 Fraction (SG)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)	Acenaphthene
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					10	50	100	100	100	50	100	100	100	50	100	100	100	50	10	10	50	100	100	1	1	1	1	2	3	0.01
ANZAST 2018 Marine Water 95%																								500	5	180	350			
ANZAST 2018 Marine Water 99%																								500						
Recreational Criteria - primary and secondary contact																								10	3000	8000			6000	
Field ID	**Sample Date**	**Location**	**Report Number**	**Sample Matrix**																										
2019 Pore Water Results (Total Unfiltered)																														
OSA2_PW_01	15/10/2019	West of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.09~~
QA15102019-PW1	15/10/2019	West of Site (dup of PW 01)	228610	Pore Water (not filtered)	<10	<50	120	140	-	-	-	-	-	<50	210	<100	210	<50	<10	<10	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~-~~	~~0.12~~
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	683343	Pore Water (not filtered)	<20	<50	200	100	300	-	-	-	-	<50	300	<100	300	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.71~~
OSA2_PW_02	15/10/2019	West of Site	683343	Pore Water (not filtered)	<20	110	200	100	410	-	-	-	-	180	200	<100	380	180	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.03~~
OSA2_PW_03	15/10/2019	West of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~3~~	~~<1~~	~~2~~	~~3~~	~~0.03~~
OSA2_PW_04	15/10/2019	West of Site	683343	Pore Water (not filtered)	<20	<50	100	<100	100	-	-	-	-	80	<100	<100	<100	80	<20	<20	-	-	-	<1	<1	<1	<1	<2	<3	<0.01
OSA2_PW_05	15/10/2019	West of Site	683343	Pore Water (not filtered)	<80	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<80	<80	-	-	-	~~<4~~	~~<4~~	~~<4~~	~~<4~~	~~<8~~	~~<12~~	~~0.1~~
OSA2_PW_06	15/10/2019	South-West of Site	683343	Pore Water (not filtered)	<20	140	200	<100	340	-	-	-	-	220	100	<100	320	220	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.06~~
OSA2_PW_07	16/10/2019	North of Site	684897	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	<1	<1	2	<1	2	<3	<0.01
OSA2_PW_08	16/10/2019	North of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.02~~
OSA2_PW_09	16/10/2019	West of Red Roofed Shed	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	<1	<1	<1	<1	<2	<3	<0.01
OSA2_PW_10	16/10/2019	West of Site	683343	Pore Water (not filtered)	<20	50	<100	<100	<100	-	-	-	-	50	<100	<100	<100	50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.02~~
OSA2_PW_11	15/10/2019	South-West of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.02~~
OSA2_PW_12	16/10/2019	South-West of Site	683343	Pore Water (not filtered)	<20	140	200	200	540	-	-	-	-	140	300	<100	440	140	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.04~~
OSA2_PW_15	16/10/2019	South-East of Site	683343	Pore Water (not filtered)	<80	80	200	100	380	-	-	-	-	100	200	<100	300	100	<80	<80	-	-	-	~~<4~~	~~<4~~	~~<4~~	~~<4~~	~~<8~~	~~<12~~	~~0.31~~
OSA2_PW_16	16/10/2019	South-East of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~<0.01~~
OSA2_PW_17	16/10/2019	South of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.04~~
OSA2_PW_18	16/10/2019	South of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	<1	<1	<1	<1	<2	<3	<0.01
OSA2_PW_19	16/10/2019	South of Site	683343	Pore Water (not filtered)	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-	~~<1~~	~~<1~~	~~<1~~	~~<1~~	~~<2~~	~~<3~~	~~0.03~~
Additional Silica Gel Clean Up TRH Results																														
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	686881	Pore Water (not filtered)	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<50	<100	<100	-	-	-	-	-	-	-
OSA2-PW-02	15/10/2019	West of Site	686881	Pore Water (not filtered)	<20	60	200	<100	260	<50	<100	<100	<100	130	100	<100	230	130	<80	<80	<50	<100	<100	-	-	-	-	-	-	-
OSA2-PW-06	15/10/2019	South-West of Site	686881	Pore Water (not filtered)	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<50	<100	<100	-	-	-	-	-	-	-
OSA2-PW-10	15/10/2019	West of Site	686881	Pore Water (not filtered)	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<50	<100	<100	-	-	-	-	-	-	-
OSA2-PW-12	15/10/2019	South-West of Site	686881	Pore Water (not filtered)	<80	50	<100	<100	<100	<50	<100	<100	<100	80	<100	<100	<100	80	<80	<80	<50	<100	<100	-	-	-	-	-	-	-
OSA2-PW-15	15/10/2019	South-East of Site	686881	Pore Water (not filtered)	<80	90	900	900	1890	<50	100	<100	100	160	1500	300	1960	160	<80	<80	<50	100	<100	-	-	-	-	-	-	-
2019 Pore Water Results (filtered, OSA2 PW 01 not filtered)																														
~~OSA2_PW_01~~	~~15/10/2019~~	~~West of Site~~	~~687337~~	~~Pore Water (not filtered)~~	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	~~0.17~~
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	686881	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
OSA2_PW_02	15/10/2019	West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
OSA2_PW_03	15/10/2019	West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
OSA2_PW_05	15/10/2019	West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
OSA2_PW_06	15/10/2019	South-West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
OSA2_PW_08	15/10/2019	North of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
OSA2_PW_10	15/10/2019	West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
OSA2_PW_11	15/10/2019	South-West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
OSA2_PW_12	15/10/2019	South-West of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
OSA2_PW_15	15/10/2019	South-East of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.27
OSA2_PW_16	15/10/2019	South-East of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
OSA2_PW_17	15/10/2019	South of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
OSA2_PW_19	15/10/2019	South of Site	687337	Pore Water (filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01

NB 1 : Analytes with a strikethrough do not form part of the final assessment results
* LOE scores have been raised based on PAH concentrations above detection limits as a conservative screening tool

Table B2: Pore Water Analytical Results 2019
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

					Polycyclic Aromatic Hydrocarbons																Other
					Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	LOE in WOE SCORE
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
ANZAST 2018 Marine Water 95%						0.4		0.2						1.4			70	2			
ANZAST 2018 Marine Water 99%						0.01		0.1						1			50	0.6			
Recreational Criteria - primary and secondary contact								0.1													
Field ID	**Sample Date**	**Location**	**Report Number**	**Sample Matrix**																	
2019 Pore Water Results (Total Unfiltered)																					
OSA2_PW_01	15/10/2019	West of Site	683343	Pore Water (not filtered)	~~0.15~~	~~0.16~~	~~2~~	~~2.2~~	~~2.5~~	~~1.9~~	~~2.3~~	~~3~~	~~0.24~~	~~3.1~~	~~0.09~~	~~2~~	~~0.05~~	~~0.59~~	~~23.27~~	~~2.9~~	-
QA15102019-PW1	15/10/2019	West of Site (dup of PW 01)	228610	Pore Water (not filtered)	~~0.15~~	~~0.18~~	~~3.1~~	~~2.6~~	~~–~~	~~2~~	~~–~~	~~2.4~~	~~0.34~~	~~4.9~~	~~0.12~~	~~1.4~~	~~0.03~~	~~0.92~~	~~28~~	~~4.4~~	-
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	683343	Pore Water (not filtered)	~~0.29~~	~~0.99~~	~~8.8~~	~~11~~	~~9.5~~	~~4.7~~	~~12~~	~~10~~	~~2.3~~	~~22~~	~~0.76~~	~~6.7~~	~~0.05~~	~~6~~	~~115.8~~	~~20~~	-
OSA2_PW_02	15/10/2019	West of Site	683343	Pore Water (not filtered)	~~0.03~~	~~<0.01~~	~~0.08~~	~~0.11~~	~~0.1~~	~~0.11~~	~~0.1~~	~~0.1~~	~~0.02~~	~~0.13~~	~~0.01~~	~~0.11~~	~~0.02~~	~~0.03~~	~~1.2~~	~~0.22~~	-
OSA2_PW_03	15/10/2019	West of Site	683343	Pore Water (not filtered)	~~0.02~~	~~<0.01~~	~~0.09~~	~~0.12~~	~~0.08~~	~~0.09~~	~~0.1~~	~~0.14~~	~~0.02~~	~~0.16~~	~~0.01~~	~~0.1~~	~~0.03~~	~~0.04~~	~~1.24~~	~~0.21~~	-
OSA2_PW_04	15/10/2019	West of Site	683343	Pore Water (not filtered)	<0.01	<0.01	0.01	0.01	0.02	0.02	0.01	0.02	<0.01	0.02	<0.01	0.02	0.01	0.01	0.18	0.03	1
OSA2_PW_05	15/10/2019	West of Site	683343	Pore Water (not filtered)	~~0.03~~	~~<0.01~~	~~0.35~~	~~0.43~~	~~0.43~~	~~0.37~~	~~0.48~~	~~0.62~~	~~0.12~~	~~0.65~~	~~0.03~~	~~0.42~~	~~0.05~~	~~0.18~~	~~4.94~~	~~0.68~~	-
OSA2_PW_06	15/10/2019	South-West of Site	683343	Pore Water (not filtered)	~~0.01~~	~~<0.01~~	~~0.05~~	~~0.05~~	~~0.04~~	~~0.05~~	~~0.04~~	~~0.05~~	~~0.01~~	~~0.07~~	~~0.03~~	~~0.04~~	~~0.03~~	~~0.06~~	~~0.7~~	~~0.11~~	-
OSA2_PW_07	16/10/2019	North of Site	684897	Pore Water (not filtered)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA2_PW_08	16/10/2019	North of Site	683343	Pore Water (not filtered)	~~0.02~~	~~<0.01~~	~~0.15~~	~~0.23~~	~~0.16~~	~~0.15~~	~~0.19~~	~~0.24~~	~~0.01~~	~~0.21~~	~~0.01~~	~~0.15~~	~~0.02~~	~~0.02~~	~~1.79~~	~~0.21~~	-
OSA2_PW_09	16/10/2019	West of Red Roofed Shed	683343	Pore Water (not filtered)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.04	0.02	1
OSA2_PW_10	16/10/2019	West of Site	683343	Pore Water (not filtered)	~~0.03~~	~~<0.01~~	~~0.26~~	~~0.31~~	~~0.3~~	~~0.3~~	~~0.28~~	~~0.37~~	~~0.07~~	~~0.36~~	~~0.03~~	~~0.33~~	~~0.04~~	~~0.16~~	~~3.3~~	~~0.44~~	-
OSA2_PW_11	15/10/2019	South-West of Site	683343	Pore Water (not filtered)	~~0.02~~	~~<0.01~~	~~0.06~~	~~0.08~~	~~0.08~~	~~0.11~~	~~0.08~~	~~0.07~~	~~0.02~~	~~0.1~~	~~0.01~~	~~0.08~~	~~0.03~~	~~0.03~~	~~0.9~~	~~0.12~~	-
OSA2_PW_12	16/10/2019	South-West of Site	683343	Pore Water (not filtered)	~~0.02~~	~~<0.01~~	~~0.13~~	~~0.2~~	~~0.17~~	~~0.21~~	~~0.16~~	~~0.16~~	~~0.05~~	~~0.18~~	~~0.01~~	~~0.24~~	~~0.02~~	~~0.05~~	~~1.85~~	~~0.21~~	-
OSA2_PW_15	16/10/2019	South-East of Site	683343	Pore Water (not filtered)	~~0.39~~	~~0.28~~	~~3~~	~~2.6~~	~~2.6~~	~~2.1~~	~~2.1~~	~~2.9~~	~~0.74~~	~~7.2~~	~~0.66~~	~~2.6~~	~~0.08~~	~~3.5~~	~~36.16~~	~~5.1~~	-
OSA2_PW_16	16/10/2019	South-East of Site	683343	Pore Water (not filtered)	~~<0.01~~	~~<0.01~~	~~0.17~~	~~0.2~~	~~0.22~~	~~0.18~~	~~0.21~~	~~0.19~~	~~0.04~~	~~0.21~~	~~<0.01~~	~~0.21~~	~~<0.01~~	~~0.03~~	~~1.85~~	~~0.19~~	-
OSA2_PW_17	16/10/2019	South of Site	683343	Pore Water (not filtered)	~~<0.01~~	~~0.03~~	~~0.36~~	~~0.41~~	~~0.41~~	~~0.32~~	~~0.41~~	~~0.58~~	~~0.08~~	~~0.5~~	~~0.02~~	~~0.35~~	~~<0.01~~	~~0.14~~	~~4.16~~	~~0.51~~	-
OSA2_PW_18	16/10/2019	South of Site	683343	Pore Water (not filtered)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA2_PW_19	16/10/2019	South of Site	683343	Pore Water (not filtered)	~~0.04~~	~~<0.01~~	~~0.19~~	~~0.15~~	~~0.32~~	~~0.29~~	~~0.31~~	~~0.33~~	~~<0.01~~	~~0.49~~	~~0.02~~	~~0.03~~	~~0.02~~	~~0.1~~	~~2.84~~	~~0.52~~	-
Additional Silica Gel Clean Up TRH Results																					
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSA2-PW-02	15/10/2019	West of Site	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSA2-PW-06	15/10/2019	South-West of Site	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSA2-PW-10	15/10/2019	West of Site	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSA2-PW-12	15/10/2019	South-West of Site	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSA2-PW-15	15/10/2019	South-East of Site	686881	Pore Water (not filtered)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2019 Pore Water Results (filtered, OSA2 PW 01 not filtered)																					
~~OSA2_PW_01~~	~~15/10/2019~~	~~West of Site~~	~~687337~~	~~Pore Water (not filtered)~~	~~0.1~~	~~<0.01~~	~~0.57~~	~~1.3~~	~~1.5~~	~~0.6~~	~~1.3~~	~~2.2~~	~~0.18~~	~~3.3~~	~~0.15~~	~~1.1~~	~~0.02~~	~~0.92~~	~~16.31~~	~~2.9~~	-
QC15102019_PW1	15/10/2019	West of Site (dup of PW 01)	686881	Pore Water (filtered)	0.01	<0.01	0.05	0.05	0.05	0.02	0.05	0.09	<0.01	0.1	<0.01	0.02	<0.01	0.02	0.57	0.1	1
OSA2_PW_02	15/10/2019	West of Site	687337	Pore Water (filtered)	0.01	0.01	0.08	0.06	0.07	0.04	0.09	0.1	0.01	0.1	<0.01	0.06	0.01	0.03	0.83	0.16	2*
OSA2_PW_03	15/10/2019	West of Site	687337	Pore Water (filtered)	0.01	0.01	0.06	0.04	0.05	0.03	0.06	0.06	0.01	0.12	0.01	0.05	0.02	0.04	0.75	0.16	2*
OSA2_PW_05	15/10/2019	West of Site	687337	Pore Water (filtered)	<0.01	<0.01	0.04	0.03	0.03	0.02	0.04	0.05	<0.01	0.07	<0.01	0.03	0.03	0.02	0.45	0.08	2*
OSA2_PW_06	15/10/2019	South-West of Site	687337	Pore Water (filtered)	<0.01	<0.01	0.04	0.03	0.04	0.03	0.03	0.06	0.01	0.06	0.01	0.04	0.02	0.02	0.49	0.08	2*
OSA2_PW_08	15/10/2019	North of Site	687337	Pore Water (filtered)	0.01	<0.01	0.09	0.07	0.06	0.03	0.09	0.11	0.02	0.1	<0.01	0.01	0.02	0.03	0.77	0.13	2*
OSA2_PW_10	15/10/2019	West of Site	687337	Pore Water (filtered)	<0.01	0.04	0.15	0.11	0.13	0.07	0.17	0.22	0.04	0.24	0.01	0.15	0.01	0.05	1.63	0.24	2
OSA2_PW_11	15/10/2019	South-West of Site	687337	Pore Water (filtered)	0.01	<0.01	0.07	0.06	0.06	0.04	0.07	0.1	0.01	0.13	0.01	0.06	0.03	0.03	0.84	0.15	2*
OSA2_PW_12	15/10/2019	South-West of Site	687337	Pore Water (filtered)	<0.01	<0.01	0.05	0.04	0.05	0.03	0.05	0.07	<0.01	0.08	<0.01	0.04	0.02	0.02	0.54	0.09	2*
OSA2_PW_15	15/10/2019	South-East of Site	687337	Pore Water (filtered)	0.31	0.66	1.6	1.3	1.6	0.65	1.5	2.1	0.22	5.8	0.43	1.2	0.1	2.1	24.24	4.4	3
OSA2_PW_16	15/10/2019	South-East of Site	687337	Pore Water (filtered)	0.01	<0.01	0.1	0.12	0.15	0.07	0.14	0.22	0.06	0.23	<0.01	0.15	0.01	0.05	1.57	0.25	2*
OSA2_PW_17	15/10/2019	South of Site	687337	Pore Water (filtered)	0.04	0.04	0.3	0.33	0.46	0.17	0.39	0.48	0.04	0.67	0.02	0.37	<0.01	0.16	4.16	0.67	3
OSA2_PW_19	15/10/2019	South of Site	687337	Pore Water (filtered)	<0.01	<0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.03	0.02	<0.01	0.05	<0.01	<0.01	0.22	0.02	1

NB 1 : Analytes with a strikethrough do not form part of the final assessment results
* LOE scores have been raised based on PAH concentrations above detection limits as a conservative screening tool

Table B3: Historical Pore Water Results (Geochemical Assessments 2016)
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

				Polycyclic Aromatic Hydrocarbons																	Other	
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	PAHs (Total)	Pyrene	Total Positive PAHs	Total Suspended Solids	LOE Score
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		5000	
ANZAST 2018 Marine Water 95%						0.4		0.2						1.4			2					
ANZAST 2018 Marine Water 99%						0.01		0.1						1			0.6					
Recreational Criteria - primary and secondary contact								0.1														
Field ID	**Sample Date**	**Report Number**	**Locations**																			
PW01	11/05/2016	146626	Boat Channel South	0.01	<0.01	0.02	0.04	0.03	-	0.03	-	0.03	0.03	0.07	<0.01	<0.01	0.09	-	0.07	0.6	-	2
PW02	11/05/2016	146626	Boat Channel South	0.01	<0.01	0.01	0.06	0.06	-	0.05	-	0.05	0.05	0.12	<0.01	<0.01	0.12	-	0.16	0.84	-	1
PW03	11/05/2016	146626	Boat Channel Centre	<0.01	0.01	<0.01	0.06	0.07	-	0.07	-	0.05	0.07	0.09	<0.01	<0.01	<0.05	-	0.11	0.67	-	1
PW04	11/05/2016	146626	Boat Channel North	<0.01	0.01	0.01	0.08	0.08	-	0.07	-	0.06	0.06	0.11	<0.01	<0.01	0.07	-	0.13	0.83	-	1
PW05	12/05/2016	146626	Mangroves West of Site	0.01	0.03	0.02	0.28	0.22	-	0.18	-	0.22	0.16	0.41	0.01	0.04	0.15	-	0.38	2.5	-	3
PW06	12/05/2016	146626	Mangroves North of Site	0.02	0.02	0.02	0.15	0.15	-	0.15	-	0.11	0.14	0.24	<0.01	0.02	0.11	-	0.22	1.6	-	2
PW07	12/05/2016	146626	Mangroves North of Site	0.02	0.03	0.03	0.28	0.20	-	0.2	-	0.23	0.18	0.45	0.02	0.03	0.24	-	0.43	2.8	-	2
PW08	12/05/2016	146626	Reference Location	0.02	<0.01	<0.01	0.02	0.02	-	0.03	-	0.02	0.03	0.04	<0.01	<0.01	<0.07	-	0.04	0.27	-	1
PW09	12/05/2016	146626	Reference Location	<0.01	<0.01	0.01	0.08	0.08	-	0.06	-	0.06	0.06	0.11	<0.01	<0.01	0.12	-	0.11	0.82	-	1
PW10	12/05/2016	146626	Boat Channel North	0.01	0.03	0.02	0.19	0.15	-	0.12	-	0.14	0.12	0.27	<0.01	0.02	0.19	-	0.29	1.8	-	2

Table C1: Passive Sampler Surface Water Results
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

				Polycyclic Aromatic Hydrocarbons												
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
ANZAST 2018 Marine Water 95%						0.4		0.2				1.4			70	2
ANZAST 2018 Marine Water 99%						0.01		0.1				1			50	0.6
Recreational Criteria - primary and secondary contact1								0.1								
Field ID	**Sample Media**	**Location**	**Sample Type**													
1	Passive Sampler	Southern Channel	Primary	0.00242	0.00060	0.00026	0.00016	0.00009	0.00005	0.00018	0.00002	0.00382	0.00110	0.00004	<0.003	0.00151
1* (QC-1)	Passive Sampler	Southern Channel	Duplicate	0.00249	0.00061	0.00023	0.00014	0.00008	0.00004	0.00016	0.00001	0.00387	0.00112	0.00004	<0.003	0.00162
1R (QA-1)	Passive Sampler	Southern Channel	Triplicate	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.00268	<0.5	<0.5	<0.5	<0.5
2	Passive Sampler	Southern Channel	Primary	0.00429	0.00081	0.00040	0.00025	0.00012	0.00005	0.00028	0.00002	0.00889	0.00194	0.00005	<0.003	0.002350
2* (QC-2)	Passive Sampler	Southern Channel	Duplicate	0.00313	0.00056	0.00052	0.00026	0.00009	0.00004	0.00031	0.00001	0.01015	0.00270	0.00003	<0.003	0.002578
2R (QA-2)	Passive Sampler	Southern Channel	Triplicate	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.004	<0.5	<0.5	<0.5	<0.5
3	Passive Sampler	Centre of Channel	Primary	0.00248	0.00048	0.00035	0.00021	0.00008	0.00004	0.00022	0.00001	0.00559	0.00152	0.00004	<0.003	0.00187
4	Passive Sampler	Centre of Channel	Primary	0.00393	0.00083	0.00034	0.00021	0.00011	0.00005	0.00022	0.00002	0.00557	0.00168	0.00005	<0.003	0.00203
5	Passive Sampler	North Channel	Primary	0.00310	0.00070	0.00041	0.00029	0.00015	0.00007	0.00030	0.00002	0.00735	0.00133	0.00007	<0.003	0.00174
6	Passive Sampler	North Channel	Primary	0.00262	0.00051	0.00034	0.00024	0.00012	0.00005	0.00022	0.00002	0.00561	0.00113	0.00005	<0.003	0.00161
7	Passive Sampler	Western Reference	Primary	0.00190	0.00077	0.00029	0.00020	0.00010	0.00005	0.00017	0.00001	0.00468	0.00111	0.00004	<0.003	0.00178
8	Passive Sampler	Western Reference	Primary	0.00204	0.00074	0.00029	0.00020	0.00010	0.00004	0.00018	0.00001	0.00522	0.00115	0.00004	<0.003	0.00195
9	Passive Sampler	Eastern Reference	Primary	0.00143	0.00054	0.00022	0.00014	0.00006	0.00004	0.00013	0.00001	0.00388	0.00088	0.00003	<0.003	0.00160

Table C1: Passive Sampler Surface Water Results

Project Number: 54083

Project Name: Woolooware Off-Site Assessment

						Other
				Pyrene	Total Positive PAHs	LOE in WOE SCORE
				µg/L	µg/L	
EQL				0.0001	0.0001	
ANZAST 2018 Marine Water 95%						
ANZAST 2018 Marine Water 99%						
Recreational Criteria - primary and secondary contact1						
Field ID	**Sample Media**	**Location**	**Sample Type**			
1	Passive Sampler	Southern Channel	Primary	0.00708	0.01731	1
1* (QC-1)	Passive Sampler	Southern Channel	Duplicate	0.00699	0.01740	1
1R (QA-1)	Passive Sampler	Southern Channel	Triplicate	0.00653	0.00921	1
2	Passive Sampler	Southern Channel	Primary	0.014140	0.033581	1
2* (QC-2)	Passive Sampler	Southern Channel	Duplicate	0.015737	0.036119	1
2R (QA-2)	Passive Sampler	Southern Channel	Triplicate	0.016	0.02100	1
3	Passive Sampler	Centre of Channel	Primary	0.01006	0.02295	1
4	Passive Sampler	Centre of Channel	Primary	0.01122	0.02626	1
5	Passive Sampler	North Channel	Primary	0.01591	0.03143	1
6	Passive Sampler	North Channel	Primary	0.01197	0.02449	1
7	Passive Sampler	Western Reference	Primary	0.00764	0.01873	1
8	Passive Sampler	Western Reference	Primary	0.00804	0.02000	1
9	Passive Sampler	Eastern Reference	Primary	0.00472	0.01369	1

Table D1: 2018 Surface Water Grab Sample Analytical Results
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

					TPHs (NEPC 1999)					TRHs (NEPC 2013)							BTEXN										
					C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					10	50	100	100	100	50	100	100	100	50	10	10	1	1	1	1	2	3	0.01	0.01	0.01	0.01	0.01
ANZAST 2018 Marine Water 95%																	500	5	180	350					0.4		0.2
ANZAST 2018 Marine Water 99%																	500								0.01		0.1
Recreational Criteria - primary and secondary contact																	10	3000	8000			6000					0.1
Field ID	**Sample Date**	**Location**	**Report Number**	**Sample Type**																							
JBS&G 2018																											
OSA-SW-01A	1/11/2018	Boat Channel South	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.02
OSA-SW-02B	16/11/2018	Boat Channel South	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-03A	1/11/2018	Boat Channel South	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
QC01112018-SW1	1/11/2018	Boat Channel South	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
QA01112018-SW01	1/11/2018	Boat Channel South	204602	Surface Water	<10	<50	<100	<100	-	<50	<100	<100	-	<50	<10	<10	<1	<1	<1	<1	<2	-	<1	<1	<1	<1	<1
OSA-SW-04B	16/11/2018	Boat Channel Centre	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-07A	1/11/2018	Reference Location West	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-08A	1/11/2018	Reference Location West	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-08B	16/11/2018	Reference Location West	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-09A	1/11/2018	Reference Location East	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-10A	1/11/2018	Reference Location East	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-11A	1/11/2018	Boat Channel North	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-11B	16/11/2018	Boat Channel North	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-12A	1/11/2018	Boat Channel North	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-12B	16/11/2018	Boat Channel North	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-13B	16/11/2018	North-East of Site	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
QC-16112018-SW01	16/11/2018	North-East of Site	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
QA16112018-SW01	16/11/2018	North-East of Site	205815	Surface Water	-	<50	<100	<100	-	<50	<100	<100	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
OSA-SW-14A	1/11/2018	North of Site	625694	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01
OSA-SW-15B	16/11/2018	North of Site	628153	Surface Water	-	<50	<100	<100	<100	<50	<100	<100	<100	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01

Table D1: 2018 Surface Water Grab Sample Analytical Results
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

Field ID	Sample Date	Location	Report Number	Sample Type	Polycyclic Aromatic Hydrocarbons												Other
					Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	LOE in WOE SCORE
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
ANZAST 2018 Marine Water 95%										1.4			50	2			
ANZAST 2018 Marine Water 99%										1			50	0.6			
Recreational Criteria - primary and secondary contact																	
JBS&G 2018																	
OSA-SW-01A	1/11/2018	Boat Channel South	625694	Surface Water	0.02	0.02	0.02	0.03	<0.01	0.04	<0.01	<0.01	<0.01	0.02	0.22	0.04	1
OSA-SW-02B	16/11/2018	Boat Channel South	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-03A	1/11/2018	Boat Channel South	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
QC01112018-SW1	1/11/2018	Boat Channel South	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
QA01112018-SW01	1/11/2018	Boat Channel South	204602	Surface Water	-	<1	-	<1	<1	<1	<1	<1	<1	<1	0	<1	1
OSA-SW-04B	16/11/2018	Boat Channel Centre	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-07A	1/11/2018	Reference Location West	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-08A	1/11/2018	Reference Location West	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-08B	16/11/2018	Reference Location West	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-09A	1/11/2018	Reference Location East	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-10A	1/11/2018	Reference Location East	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-11A	1/11/2018	Boat Channel North	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-11B	16/11/2018	Boat Channel North	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-12A	1/11/2018	Boat Channel North	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-12B	16/11/2018	Boat Channel North	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-13B	16/11/2018	North-East of Site	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
QC-16112018-SW01	16/11/2018	North-East of Site	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
QA16112018-SW01	16/11/2018	North-East of Site	205815	Surface Water	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0	<0.1	1
OSA-SW-14A	1/11/2018	North of Site	625694	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-SW-15B	16/11/2018	North of Site	628153	Surface Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1

Table D2: 2019 Surface Water Grab Sample Analytical Results
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

JBS&G

Field ID	Sample Date	Location	Report Number	Sample Type	TPHs (NEPC 1999)					TPHs (NEPC 1999) - Silica Gel				TRHs (NEPC 2013)							TRHs (NEPC 2013) - Silica Gel		
					C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Total)	C10-C14 Fraction (SG)	C15-C28 Fraction (SG)	C29-C36 Fraction (SG)	C10 - C36 Fraction (Total) (SG)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (Total)	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	>C10-C16 Fraction (SG)	>C16-C34 Fraction (SG)	>C34-C40 Fraction (SG)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					10	50	100	100	100	50	100	100	100	50	100	100	100	50	10	10	50	100	100
ANZAST 2018 Marine Water 95%																							
ANZAST 2018 Marine Water 99%																							
Recreational Criteria - primary and secondary contact																							
OSA2_SW_02	15/10/2019	West of Site	683343	Surface Water	<20	80	<100	<100	<100	-	-	-	-	70	<100	<100	<100	70	<20	<20	-	-	-
OSA2_SW_04	15/10/2019	West of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
QA15102019-SW1	16/10/2019	West of Site (dup of SW 04)	228610	Surface Water	<10	<50	<100	<100	-	-	-	-	-	<50	<100	<100	-	<50	<10	<10	-	-	-
QC15102019_SW1	15/10/2019	West of Site (dup of SW 04)	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_07	21/10/2019	North of Site	683945	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_10	16/10/2019	West of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_11	16/10/2019	South-West of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_15	17/10/2019	South-East of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_17	17/10/2019	South of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
OSA2_SW_19	17/10/2019	South of Site	683343	Surface Water	<20	<50	<100	<100	<100	-	-	-	-	<50	<100	<100	<100	<50	<20	<20	-	-	-
Additional Silica Gel Clean Up TRH Results																							
OSA2-SW-02	15/10/2019	West of Site	686881	Surface Water	<20	<50	<100	<100	<100	<50	<100	<100	<100	<50	<100	<100	<100	<50	<20	<20	<50	<100	<100

Field ID	BTEXN						Polycyclic Aromatic Hydrocarbons																			Other
	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene (Total)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b,j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	PAHs (Total)	Pyrene	LOE in WOE SCORE
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL	1	1	1	1	2	3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
ANZAST 2018 Marine Water 95%	500	5	180	350					0.4		0.2						1.4			50	2			
ANZAST 2018 Marine Water 99%	500								0.01		0.1						1			50	0.6			
Recreational Criteria - primary and secondary contact	10	3000	8000			6000					0.1													
OSA2_SW_02	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	0.02	0.01	0.03	<0.01	0.02	0.03	<0.01	0.04	<0.01	<0.01	0.02	0.01	0.24	0.06	2*
OSA2_SW_04	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	0.03	<0.01	2*
QA15102019-SW1	<1	<1	<1	<1	<2	-	0.08	0.02	0.02	0.26	0.16	-	0.12	-	0.14	0.02	0.48	0.02	0.08	<0.02	0.1	2.3	0.4	2
QC15102019_SW1	<1	<1	<1	<1	<2	<3	0.04	0.01	<0.01	0.02	0.02	0.02	<0.01	0.03	0.04	<0.01	0.05	0.01	<0.01	<0.02	0.03	0.34	0.07	2*
OSA2_SW_07	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA2_SW_10	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	0.05	<0.01	1
OSA2_SW_11	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	0.04	0.04	0.04	<0.01	0.05	0.05	<0.01	0.06	<0.01	<0.01	0.04	0.02	0.41	0.07	2*
OSA2_SW_15	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2*
OSA2_SW_17	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.02	1
OSA2_SW_19	<1	<1	<1	<1	<2	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.02	0.05	0.02	1
Additional Silica Gel Clean Up TRH Results																								
OSA2-SW-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* LOE scores have been raised based on PAH concentrations above detection limits as a conservative screening tool

Table D3: Historical Surface Water Results (Geochemical Assessments 2016)
Project Number: 54083
Project Name: Woolooware

					TPHs (NEPC 1999)				TRHs (NEPC 2013)						BTEXN										
					C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C16 less Naphthalene (F2)	C6-C10 Fraction	C6-C10 less BTEX (F1)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Naphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.01	0.05	0.1	0.1	0.05	0.1	0.1	0.05	0.01	0.01	0.001	0.001	0.001	0.001	0.002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001
ANZECC 2000 Marine Water 95%															0.7					0.05			0.0004		0.0002
ANZECC 2000 Marine Water 99%															0.5					0.05			0.00001		0.0001
Recreational Criteria - primary and secondary contact1															0.01	3	8			6					0.0001
Field ID	**Sample Date**	**Report Number**	**Sample Type**	**Location**																					
SW01	11/05/2016	146626	Surface Water	Boat Channel South	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001 - 0.00003	<0.00001	<0.00001	0.00002	0.00005	0.00005
SW02	11/05/2016	146626	Surface Water	Boat Channel Centre	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	0.001	<0.001	<0.002	<0.001 - 0.00006	<0.00001	0.00001	0.00002	0.00014	0.00011
SW03	11/05/2016	146626	Surface Water	Boat Channel Centre	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	0.00001
SW04	11/05/2016	146626	Surface Water	Boat Channel North	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	0.00002	0.00001
SW05	12/05/2016	146626	Surface Water	West of Site	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	0.00002	0.00003	0.00003	0.00025	0.00018
SW08	12/05/2016	146626	Surface Water	Eastern Reference	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	0.00001
SW09	12/05/2016	146626	Surface Water	Eastern Reference	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	0.00004	0.00004
SW10	12/05/2016	146626	Surface Water	Boat Channel	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
SW11	12/05/2016	146626	Surface Water	Boat Channel (close to site boundary)	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001 - 0.00002	<0.00001	<0.00001	<0.00001	0.00005	0.00004
SW12	12/05/2016	146626	Surface Water	Boat Channel (close to site boundary)	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	0.00003	0.00003
SW13	12/05/2016	146626	Surface Water	Boat Channel (close to site boundary)	<0.01	<0.05	<0.1	<0.1	<0.05	<0.1	<0.1	<0.05	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.002	<0.00002	<0.00001	<0.00001	<0.00001	0.00004	0.00004

Table D3: Historical Surface Water Results (Geochemical Assessments 2016)
Project Number: 54083
Project Name: Woolooware

			Polycyclic Aromatic Hydrocarbons										Other	
			Benzo(a)pyrene TEQ (WHO)	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	Total Positive PAHs	Total Suspended Solids	LOE Score
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
EQL			0.00005	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001		5	
ANZECC 2000 Marine Water 95%							0.0014			0.002				
ANZECC 2000 Marine Water 99%							0.001			0.0006				
Recreational Criteria - primary and secondary contact1														
Field ID	**Sample Date**	**Report Number**												
SW01	11/05/2016	146626	<0.00005	0.00004	0.00004	0.00004	0.00007	<0.00001	<0.00001	0.00009	0.00007	0.00059	37	2
SW02	11/05/2016	146626	<0.00005	0.00009	0.00009	0.00009	0.00017	<0.00001	0.00001	0.00009	0.00017	0.0012	220	2
SW03	11/05/2016	146626	<0.00005	0.00001	<0.00001	0.00001	0.00002	<0.00001	<0.00001	<0.00005	0.00002	0.0001	29	1
SW04	11/05/2016	146626	<0.00005	0.00001	0.00001	0.00002	0.00002	<0.00001	<0.00001	<0.00005	0.00002	0.00014	29	1
SW05	12/05/2016	146626	<0.00005	0.00019	0.00021	0.00021	0.00041	0.00001	0.00003	<0.00008	0.0004	0.0025	110	2
SW08	12/05/2016	146626	<0.00005	0.00001	<0.00001	0.00001	0.00002	<0.00001	<0.00001	<0.00004	0.00002	0.00009	37	1
SW09	12/05/2016	146626	<0.00005	0.00003	0.00003	0.00003	0.00005	<0.00001	<0.00001	<0.00006	0.00006	0.00035	93	1
SW10	12/05/2016	146626	<0.00005	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00003	<0.00001	0	30	1
SW11	12/05/2016	146626	<0.00005	0.00004	0.00004	0.00004	0.00007	<0.00001	<0.00001	0.00008	0.00007	0.00054	42	1
SW12	12/05/2016	146626	<0.00005	0.00003	0.00003	0.00003	0.00004	<0.00001	<0.00001	<0.00005	0.00005	0.0003	46	1
SW13	12/05/2016	146626	<0.00005	0.00003	0.00003	0.00004	0.00006	<0.00001	<0.00001	<0.00006	0.00006	0.00038	54	1

Table E: Biota Analytical Results
Project Number: 54083
Project Name: Woolooware Off-Site Assessment

					Polycyclic Aromatic Hydrocarbons																Other
					Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Benzo(b) and (k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Napthalene	Phenanthrene	Pyrene	PAHs (Total)	LOE in WOE SCORE
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
EQL					0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Field ID	**Sample Date**	**Location**	**Report Number**	**Sample Type**																	
OSA-OYS-01	18/10/2018	Field Blank	RN1212592	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-OYS-02	18/10/2018	Field Blank	RN1212592	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-OYS-03	18/10/2018	Field Blank	RN1212592	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
OSA-0YS-01	15/11/2018	Boat Channel South	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.016	0.027	1
QC-16112018-2	15/11/2018	Boat Channel South	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.016	0.027	1
OSA-045-02	15/11/2018	Boat Channel South	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.022	<0.01	<0.01	<0.01	<0.01	0.027	0.049	1
QC-16112018-1	15/11/2018	Boat Channel South	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	0.012	1
OSA-0YS-03	15/11/2018	Boat Channel South	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.017	<0.01	<0.01	<0.01	<0.01	0.022	0.039	1
OSA-0YS-04	15/11/2018	Boat Channel Centre	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.015	0.026	1
OSA-0YS-05	15/11/2018	Boat Channel Centre	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.015	<0.01	<0.01	<0.01	<0.01	0.02	0.035	1
OSA-0YS-06	15/11/2018	Boat Channel North	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.015	0.026	1
OSA-0YS-07	16/11/2018	Reference Location West	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.013	<0.01	<0.01	<0.01	<0.01	0.015	0.028	1
OSA-0YS-08	16/11/2018	Reference Location West	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.026	<0.01	<0.01	<0.01	<0.01	0.027	0.053	1
OSA-0YS-09	16/11/2018	Reference Location East	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.019	<0.01	<0.01	<0.01	<0.01	0.019	0.038	1
OSA-0YS-10	16/11/2018	Reference Location East	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.012	<0.01	<0.01	<0.01	<0.01	0.013	0.025	1
OSA-0YS-11	15/11/2018	Boat Channel North	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.016	0.027	1
OSA-0YS-12	16/11/2018	North-East of Site	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.014	<0.01	<0.01	<0.01	<0.01	0.017	0.031	1
OSA-0YS-13	16/11/2018	North-East of Site	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.015	<0.01	<0.01	<0.01	<0.01	0.017	0.032	1
OSA-0YS-14	16/11/2018	North of Site	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.012	<0.01	<0.01	<0.01	<0.01	0.015	0.027	1
OSA-0YS-15	16/11/2018	North of Site	JBSG01/181116	Biota	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	0.023	<0.01	<0.01	<0.01	<0.01	0.027	0.05	1

Table E: Historical Biota Analytical Results (Geochemical Assessments 2016)
Project Number: 54083
Project Name: Woolooware Off-site Assessment

				Polycyclic Aromatic Hydrocarbons												
				Acenaphthene	**Acenaphthylene**	**Anthracene**	**Benz(a)anthracene**	**Benzo(a)pyrene**	**Benzo(e)pyrene**	**Benzo(g,h,i)perylene**	**Benzo(b) and (k)fluoranthene**	**Chrysene**	**Coronene**	**Dibenz(a,h)anthracene**	**Fluoranthene**	**Fluorene**
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01
Field ID	**Sample Date**	**Location**	**Sample Type**													
OY1	11/05/2016	North-east of Site	Biota	<0.01	<0.01	<0.01	0.02	0.015	0.015	<0.01	0.05	0.03	<0.02	<0.01	0.06	<0.01
OY2	11/05/2016	Boat Channel South	Biota	<0.01	<0.01	<0.01	0.02	0.017	0.016	<0.01	0.05	0.03	<0.02	<0.01	0.05	<0.01
OY3	11/05/2016	Boat Channel Centre	Biota	<0.01	<0.01	<0.01	0.03	0.024	0.027	<0.01	0.09	0.05	<0.02	<0.01	0.08	<0.01
OY4	11/05/2016	Boat Channel North	Biota	<0.01	<0.01	<0.01	0.03	0.025	0.026	0.01	0.08	0.04	<0.02	<0.01	0.08	<0.01
OY5	12/05/2016	North of Site	Biota	<0.01	<0.01	<0.01	0.01	0.015	0.013	<0.01	0.04	0.02	<0.02	<0.01	0.03	<0.01

Table E: Historical Biota Analytical Results (Geochemical Assessments 2016)
Project Number: 54083
Project Name: Woolooware Off-site Assessment

Field ID	Sample Date	Location	Sample Type	Indeno(1,2,3-c,d)pyrene	Napthalene	1-methyl-napthalene	2-methyl-napthalene	Phenanthrene	Pyrene	PAHs (Total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.02	0.01	0.01	0.01	0.01	0.01	0.01
OY1	11/05/2016	North-east of Site	Biota	<0.02	<0.01	<0.01	<0.01	<0.01	0.075	0.3
OY2	11/05/2016	Boat Channel South	Biota	<0.02	<0.01	<0.01	<0.01	<0.01	0.054	0.2
OY3	11/05/2016	Boat Channel Centre	Biota	<0.02	<0.01	<0.01	<0.01	0.01	0.087	0.4
OY4	11/05/2016	Boat Channel North	Biota	<0.02	<0.01	<0.01	<0.01	0.01	0.088	0.4
OY5	12/05/2016	North of Site	Biota	<0.02	<0.01	<0.01	<0.01	<0.01	0.042	<0.2

Appendix B Sediment Bore Logs

Site 1

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 10/17/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.2
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329045
Northings (GDA 94): 6232060
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty Clay/mud, grey-brown, homogeneous, saturated, inclusions of shells and mangrove roots	OSA-SED 01-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour EOH at 0.2 m bgs - initial sampling event to determine surficial contamination extent
		0.20			Borehole Site 1 terminated at 0.2m		
	0.5						
	1.0						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 25/1/19

Site 2

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329047
Northings (GDA 94): 6232073
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SG	Gravelly sandy mud, heterogeneous, saturated, very soft, anoxic, inclusions of shells	OSA-SED 02-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour
	0.5	0.40		CL-GC	Gravelly mud, grey, heterogeneous, wet, soft to firm, inclusions of mangrove roots, shells, sand	OSA-SED02-0.5-0.6 PID = 0 ppm	No odours, staining or asbestos
							EOH at 0.8 m bgs - refusal on shell bed
	1.0	0.80			Borehole Site 2 terminated at 0.8m		

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 25/1/19

Site 3

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.86
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329048
Northings (GDA 94): 6232085
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-GC	Gravelly mud, dark grey-black, heterogeneous, saturated, soft, anoxic, inclusions of shells		No staining or asbestos, sulfuric odour
		0.02		CL-GC	Gravelly mud, grey, heterogeneous, soft-firm, wet, inclusions of organic matter, shells	OSA-SED 03-0-0.2 PID = 0 ppm	
							No odours, staining or asbestos
	0.5					OSA-SED03-0.5-0.6 PID = 0 ppm	
							EOH at 0.86 m bgs - refusal on shell bed
		0.86			Borehole Site 3 terminated at 0.86m		
	1.0						

Site 4

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.7
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329048
Northings (GDA 94): 6232100
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-GC	Gravelly mud, black, heterogeneous, saturated, soft, anoxic, inclusions of shells	OSA-SED 04-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour
		0.10		CL-GC	Gravelly sandy mud, heterogeneous, grey, wet, firm, inclusions of shells		No odours, staining or asbestos
	0.5					OSA-SED04-0.5-0.6 PID = 0 ppm	EOH at 0.7 m bgs - refusal on shell bed
		0.70			Borehole Site 4 terminated at 0.7m		
	1.0						

JBS&G

Site 5

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329050
Northings (GDA 94): 6232119
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SC	Sandy mud, black, heterogeneous, saturated, very soft, anoxic	OSA-SED 05-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour
		0.15		CL-SG	Gravelly sandy mud, grey, heterogeneous, soft, wet, inclusions of shells		
	0.5					OSA-SED05-0.5-0.6 PID = 0 ppm	No odours, staining or asbestos
		0.80			Borehole Site 5 terminated at 0.8m		
	1.0						

Site 6

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.8
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329058
Northings (GDA 94): 6232151
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty mud, black, heterogeneous, saturated, soft, poorly sorted	OSA-SED 06-0-0.2 PID = 0 ppm	No odours, staining or asbestos
		0.05		CL-GC	Gravelly mud, grey, heterogeneous, soft, saturated, poorly sorted, inclusions of shells		
	0.5					OSA-SED06-0.5-0.6 PID = 0 ppm	No odours, staining or asbestos
		0.85			Borehole Site 6 terminated at 0.8m		
	1.0						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 25/1/19

Site 7

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 10/17/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.2
Bore Diameter (mm): 50.8

Eastings (GDA 94): 328639
Northings (GDA 94): 6232254
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SG	Gravelly sandy mud, dark grey, saturated, very soft, inclusions of shells (approximately 10%)	OSA-SED 07-0-0.2 PID = 0 ppm	No odours, staining or asbestos EOH at 0.2 m bgs - initial sampling event to determine surficial contamination extent
		0.20			Borehole Site 7 terminated at 0.2m		
	0.5						
	1.0						

Site 8

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 10/17/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.2
Bore Diameter (mm): 50.8

Eastings (GDA 94): 328895
Northings (GDA 94): 6232241
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SG	Gravelly sandy mud, dark grey, saturated, very soft, inclusions of shells (approximately 20%)	OSA-SED 08-0-0.2 PID = 0 ppm	No odours, staining or asbestos EOH at 0.2 m bgs - initial sampling event to determine surficial contamination extent
		0.20			Borehole Site 8 terminated at 0.2m		
	0.5						
	1.0						

Site 9

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 10/17/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.2
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329265
Northings (GDA 94): 6232317
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SG	Gravelly sandy mud, dark grey, saturated, very soft, inclusions of shells (approximately 10%)	OSA-SED 09-0-0.2 PID = 0 ppm	No odours, staining or asbestos EOH at 0.2 m bgs - initial sampling event to determine surficial contamination extent
		0.20			Borehole Site 9 terminated at 0.2m		
	0.5						
	1.0						

Site 10

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 10/17/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.2
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329155
Northings (GDA 94): 6232233
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SG	Gravelly sandy mud, dark grey, saturated, very soft, inclusions of shells (approximately 5-10%)	OSA-SED 10-0-0.2 PID = 0 ppm	No odours, staining or asbestos EOH at 0.2 m bgs - initial sampling event to determine surficial contamination extent
		0.20			Borehole Site 10 terminated at 0.2m		
	0.5						
	1.0						

Site 11

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329055
Northings (GDA 94): 6232130
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty mud, black, heterogeneous, saturated, very soft, anoxic	OSA-SED 11-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour
		0.05		CL-GC	Gravelly mud, dark grey, heterogeneous, soft-firm, wet, poorly sorted, inclusions of gravels and sand		
	0.5					OSA-SED11-0.5-0.6 PID = 0 ppm	No odours, staining or asbestos
	1.0	1.00			Borehole Site 11 terminated at 1m		

Site 12

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.85
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329062
Northings (GDA 94): 6232172
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty mud, black, heterogeneous, saturated, soft, anoxic	OSA-SED 12-0-0.2 PID = 0 ppm	No odours, staining or asbestos
		0.10		CL-GC	Gravelly mud, dark grey, heterogeneous, firm, wet, inclusions of gravels and sand		
	0.5					OSA-SED12-0.5-0.6 PID = 0 ppm	No odours, staining or asbestos
		0.85			Borehole Site 12 terminated at 0.85m		
	1.0						

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Site 13

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/16/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 0.6
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329062
Northings (GDA 94): 6232237
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty clay/mud, grey-brown, homogeneous, saturated, low plasticity, soft, inclusions of mangrove roots and shells	OSA-SED 13-0-0.2 PID = 0 ppm	No staining or asbestos, sulfuric odour
		0.10		CL-ML	Silty clay/mud, grey-brown, homogeneous, low plasticity, wet, firm, inclusions of mangrove roots and shells		No odours, staining or asbestos
	0.5					OSA-SED13-0.5-0.6 PID = 0 ppm	EOH at 0.6 m bgs - refusal on shell bed
		0.60			Borehole Site 13 terminated at 0.6m		
	1.0						

Site 14

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329021
Northings (GDA 94): 6232214
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SC	Sandy mud, dark grey, saturated, soft, poorly sorted	OSA-SED 14-0-0.2 PID = 0 ppm	No odours, staining or asbestos
		0.10		CL-GC	Gravelly mud, grey, heterogeneous, wet, firm, poorly sorted, inclusions of shells		
	0.5						No odours, staining or asbestos
	1.0	1.00			Borehole Site 14 terminated at 1m		

Site 15

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/16/2018
Logged By: Jessica Staehli
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1
Bore Diameter (mm): 50.8

Eastings (GDA 94): 328986
Northings (GDA 94): 6232209
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-ML	Silty clay/mud, black, homogeneous, saturated, inclusions of mangrove roots	OSA-SED 15-0-0.2 PID = 0 ppm	Black stained soils, slight hydrocarbon odour, no asbestos
	0.5					OSA-SED15-0.5-0.6 PID = 0 ppm	
		0.60		CL-SC	Sandy mud, grey, wet, firm, inclusions of shells		No odours, staining or asbestos
	1.0	1.00			Borehole Site 15 terminated at 1m		

Site 16

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1.15
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329048
Northings (GDA 94): 6232177
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CL-SC	Sandy mud, black, heterogeneous, saturated, very soft, well sorted	OSA-SED16-0-0.1 PID = 0 ppm	No odours, black stained soils, no asbestos
	0.5						
		0.80		CL-GC	Gravelly mud, grey, heterogeneous, wet, firm, inclusions of shells		No odours, staining or asbestos
	1.0						
		1.15			Borehole Site 16 terminated at 1.15m		

Site 17

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1.04
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329039
Northings (GDA 94): 6232186
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube	0.0 – 0.5			CL-ML	Sandy mud, black, heterogeneous, black, saturated, poorly sorted	OSA-SED17-0-0.1 PID = 0 ppm	No odours, staining or asbestos
		0.55		CL-GC	Gravelly mud, grey, heterogeneous, wet, firm, poorly sorted, inclusions of shells		No odours, staining or asbestos
	1.0	1.00					
					Borehole Site 17 terminated at 1.04m		

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Site 18

Project Number: 54083
Client: RMS
Project Name: Woolooware Off-Site Assessment
Site Address: The Oyster Farm', Captain Cook Drive, Woolooware, NSW

Date: 11/15/2018
Logged By: Rachel Gray
Contractor: Geochem Assessments
Total Hole Depth (mbgs): 1
Bore Diameter (mm): 50.8

Eastings (GDA 94): 329030
Northings (GDA 94): 6232193
Zone/Area/Permit#:
Reference Level: Ground Surface
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube						OSA-SED18-0-0.1 PID = 0 ppm	
	0.5						
	1.0						

OSA2-SED01

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.3
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, grey-brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED01 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.30		CH-MH	Silty Clay, homogeneous, grey-brown, wet, very soft, high plasticity, inclusions of mangrove rootlets	OSA2-SED01 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5	0.50		CH-GM-MH	Gravelly Silty Clay, homogeneous, grey-brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED01 0.5-0.6 PID = 0 ppm	No staining or asbestos, very slight sulfurous odour
						OSA2-SED01 0.8-0.9 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, grey-brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and increased shell inclusions	OSA2-SED01 1.0-1.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED01 1.2-1.3 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.30			Borehole OSA2-SED01 terminated at 1.3m		EOH at 1.3mbgs - Refusal on roots
	1.5						
	2.0						

OSA2-SED02

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED02 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED02 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5	0.50		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells increasing with depth	OSA2-SED02 0.5-0.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED02 0.8-0.9 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0					OSA2-SED02 1.1-1.2 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.5					OSA2-SED02 1.5-1.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.80			Borehole OSA2-SED02 terminated at 1.8m		
	2.0						

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OSA2-SED03

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.4
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, grey-brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED03 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.30		CH-MH	Silty Clay, homogeneous, grey-brown, wet, very soft, high plasticity, inclusions of mangrove rootlets	OSA2-SED03 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
						OSA2-SED03 0.6-0.7 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.90		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells increasing with depth	OSA2-SED03 0.9-0.9 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0						
						OSA2-SED03 1.2-1.3 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.40			Borehole OSA2-SED03 terminated at 1.4m		EOH at 1.4mbgs - Refusal on roots
	1.5						
	2.0						

OSA2-SED04

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.5
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, grey-brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED04 0.0-0.1 PID = 0 ppm	No asbestos, strong sulfurous odour, stains observed on sampling equipment
						OSA2-SED04 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
						OSA2-SED04 0.7-0.8 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.90		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells increasing with depth	OSA2-SED04 0.9-1.0 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0						
						OSA2-SED04 1.4-1.5 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.5	1.50			Borehole OSA2-SED04 terminated at 1.5m		EOH at 1.5mbgs - Program depth achieved
	2.0						

OSA2-SED05

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED05 0.0-0.1 PID = 0 ppm	No asbestos, strong sulfurous odour, very slight hydrocarbon odour, stains observed on sampling equipment
						OSA2-SED05 0.3-0.4 PID = 0 ppm	No asbestos, strong sulfurous odour, stains observed on sampling equipment
	0.5						
		0.70		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove rootlets and shells	OSA2-SED05 0.7-0.8 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and decreasing shells	OSA2-SED05 1.0-1.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.5					OSA2-SED05 1.5-1.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.80			Borehole OSA2-SED05 terminated at 1.8m		
	2.0						

OSA2-SED06

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 15-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.9
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED06 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED06 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
						OSA2-SED06 0.9-1.0 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0						
		1.10		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove rootlets and shells	OSA2-SED06 1.1-1.2 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.5	1.50		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED06 1.5-1.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.90			Borehole OSA2-SED06 terminated at 1.9m		
	2.0						

OSA2-SED07

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.9
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED07 0.0-0.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
						OSA2-SED07 0.3-0.4 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	0.5						
						OSA2-SED07 0.7-0.8 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED07 1.0-1.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.5					OSA2-SED07 1.5-1.6 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED07 1.8-1.9 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.90			Borehole OSA2-SED07 terminated at 1.9m		
	2.0						

OSA2-SED08

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.6
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED08 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED08 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
		0.80		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove rootlets and shells	OSA2-SED08 0.8-0.9 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0						
	1.5					OSA2-SED08 1.5-1.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.60			Borehole OSA2-SED08 terminated at 1.6m		EOH at 1.6mbgs - Program depth achieved
	2.0						

OSA2-SED09

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED09 0.0-0.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED09 0.3-0.4 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	0.5						
						OSA2-SED09 0.8-0.9 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.0						
		1.10		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED09 1.1-1.2 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.5						
						OSA2-SED09 1.7-1.8 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.80			Borehole OSA2-SED09 terminated at 1.8m		
	2.0						

OSA2-SED10

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.9
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED10 0.0-0.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour, very slight sheen in pore water
						OSA2-SED10 0.3-0.4 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	0.5						
						OSA2-SED10 0.8-0.9 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0						
		1.10		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED10 1.1-1.2 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.5					OSA2-SED10 1.5-1.6 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED10 1.8-1.9 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.90			Borehole OSA2-SED10 terminated at 1.9m		
	2.0						

OSA2-SED11

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.2
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED11 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
						OSA2-SED11 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
						OSA2-SED11 0.8-0.9 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogenous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED11 1.0-1.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.20			Borehole OSA2-SED11 terminated at 1.2m		EOH at 1.2mbgs - Refusal on roots
	1.5						
	2.0						

OSA2-SED12

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16/10/2019
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.3
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				Fill	Fill - Silty Clay, heterogenous, wet, high plasticity, soft, grey-yellow-red mottled, inclusions of mangrove roots and rootlets	OSA2-SED12 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour, black/stained mangrove roots
						OSA2-SED12 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour, slight sheen observed in water run-off from cored soils from 0-0.7 m bgs
	0.5						
		0.70		CH-MH	Silty Clay, homogeneous, wet, dark grey/brown, high plasticity, soft, inclusions of mangrove roots	OSA2-SED12 0.7-0.8 PID = 0 ppm	No staining or asbestos, slight PAH odour
	1.0	1.00		CH-MH	Silty Clay, homogeneous, wet, dark grey/brown, high plasticity, soft, inclusions of tar impacted mangrove roots	OSA2-SED12 1.0-1.1 PID = 0 ppm	No staining or asbestos, sheen observed in soil profile
						OSA2-SED12 1.2-1.3 PID = 0 ppm	
		1.30			Borehole OSA2-SED12 terminated at 1.3m		EOH at 1.3mbgs - Refusal on roots
	1.5						
	2.0						

OSA2-SED13

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16/10/2019
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.3
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				Fill	Fill - Silty Clay, grey-red-orange mottled, homogeneous, wet, soft, high plasticity, inclusions of mangrove roots	OSA2-SED13 0.0-0.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED13 0.3-0.4 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	0.5	0.50		CH-MH	Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED13 0.5-0.6 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED13 1.0-1.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED13 1.2-1.3 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.30			Borehole OSA2-SED13 terminated at 1.3m		EOH at 1.3mbgs - Refusal on roots and shells
	1.5						
	2.0						

OSA2-SED14

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED14 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5					OSA2-SED14 0.5-0.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.70		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED14 0.7-0.8 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0					OSA2-SED14 1.0-1.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.5					OSA2-SED14 1.4-1.5 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED14 1.7-1.8 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.80			Borehole OSA2-SED14 terminated at 1.8m		
	2.0						

OSA2-SED14-2

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 16-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED14 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5					OSA2-SED14 0.5-0.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.70		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED14 0.7-0.8 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0					OSA2-SED14 1.0-1.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.5					OSA2-SED14 1.4-1.5 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
						OSA2-SED14 1.7-1.8 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.80			Borehole OSA2-SED14 terminated at 1.8m		
	2.0						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 18-10-19

OSA2-SED15

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 17-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.4
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED15 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.30		CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED15 0.3-0.4 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5						
						OSA2-SED15 0.7-0.8 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED15 1.0-1.1 PID = 0 ppm	No staining or asbestos, mild sulfurous odour
						OSA2-SED15 1.3-1.4 PID = 0 ppm	No staining or asbestos, mild sulfurous odour
		1.40			Borehole OSA2-SED15 terminated at 1.4m		EOH at 1.4mbgs - Program depth achieved
	1.5						
	2.0						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 18-10-19

OSA2-SED16

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 17-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.8
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED16 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5					OSA2-SED16 0.4-0.5 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		0.70		CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED16 0.7-0.8 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED16 1.0-1.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.5					OSA2-SED16 1.6-1.7 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
		1.90			Borehole OSA2-SED16 terminated at 1.8m		
	2.0						

BOREHOLE JBSG BOREHOLE - 2017.GPJ GINT STD AUSTRALIA.GDT 18-10-19

OSA2-SED17

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 17-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.9
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, very soft, medium plasticity, inclusions of mangrove roots/rootlets	OSA2-SED17 0.0-0.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour, very slight PAH odour
	0.5					OSA2-SED17 0.4-0.5 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
		0.70		CH-MH	Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED17 0.7-0.8 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, very soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED17 1.0-1.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.5					OSA2-SED17 1.7-1.8 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
		1.90			Borehole OSA2-SED17 terminated at 1.9m		
	2.0						

OSA2-SED18

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 17-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.9
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED18 0.0-0.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	0.5					OSA2-SED18 0.5-0.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED18 1.0-1.1 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
	1.5					OSA2-SED18 1.5-1.6 PID = 0 ppm	No staining or asbestos, strong sulfurous odour
		1.90			Borehole OSA2-SED18 terminated at 1.9m		
	2.0						

OSA2-SED19

Project Number: 51163
Client: RMS
Project Name: Woolooware Bay
Site Address: 445 Captain Cook Drive, Woolooware, NSW

Date: 17-Oct-19
Logged By: JS
Contractor: Geochemical
Total Hole Depth (mbgs): 1.7
Bore Diameter (mm): 50

Eastings (GDA 94):
Northings (GDA 94):
Zone/Area/Permit#:
Reference Level:
Elevation (m):

Method	Depth (mbgs)	Contact (mbgs)	Graphic Log	Lithological Class	Lithological Description	Samples Tests Remarks	Additional Observations
Push Tube				CH-MH	Silty Clay, homogeneous, brown, wet, soft, medium plasticity, inclusions of 50% mangrove roots/rootlets	OSA2-SED19 0.0-0.1 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	0.5	0.40		CH-MH	Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove roots/rootlets	OSA2-SED19 0.4-0.5 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
						OSA2-SED19 0.8-0.9 PID = 0 ppm	No staining or asbestos, moderate sulfurous odour
	1.0	1.00		CH-GM-MH	Gravelly Silty Clay, homogeneous, brown, wet, soft, high plasticity, inclusions of mangrove rootlets and shells	OSA2-SED19 1.0-1.1 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	1.5					OSA2-SED19 1.5-1.6 PID = 0 ppm	No staining or asbestos, slight sulfurous odour
	2.0	1.70			Borehole OSA2-SED19 terminated at 1.7m		

Appendix C Laboratory Results and Chain of Custody Documentation

PDMS Results, ng L^{-1}

Site Name	LOD (µg/ L extract)*	Estimated water concentration LOR (ng/ L)**	Passive sampler	Sampling phase	Southern Channel 1	Southern Channel 1	Southern Channel 2	Southern Channel 2	Centre Channel	Middle Channel	North Channel 1	North Channel 2	Western Reference 1	Western Reference 2	Eastern Reference 1	Eastern Reference 2	North Channel 1	North Channel 2	North of Site 1	North of Site 2	Northwest of Site
Site number					1	1*	2	2*	3	4	5	6	7	8	9	10	11	12	13	14	15
Day deployed					17/10/2018	17/10/2018	17/10/2018	17/10/2018	17/10/2018	17/10/2018	17/10/2018	17/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018	18/10/2018
Day retrieved					15/11/2018	15/11/2018	15/11/2018	15/11/2018	15/11/2018	15/11/2018	15/11/2018	15/11/2018	16/11/2018	16/11/2018	16/11/2018	16/11/2018	15/11/2018	16/11/2018	16/11/2018	16/11/2018	16/11/2018
Water Flow rate cm/s (PFM)					6.89	6.89	5.75	5.75	6.27	5.87	4.64	6.63	7.34	7.76	7.51	7.23	7.75	5.38	7.49	6.42	5.0
Water Concentration (ng/ L^{-1})																					
Analytes					**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**	**Water Concentration**
PAHs																					
Naphthalene	0.1	<0.1	PDMS	Equilibrium	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK	<3*BLK
Acenaphthylene	0.1	<0.1	PDMS	Equilibrium	0.60	0.61	0.81	0.56	0.48	0.83	0.70	0.51	0.77	0.74	0.54	0.55	0.70	0.94	0.81	1.11	1.18
Acenaphthene	0.5	<0.1	PDMS	Equilibrium	2.42	2.49	4.29	3.13	2.48	3.93	3.10	2.62	1.90	2.04	1.43	1.67	3.31	3.75	2.36	3.22	4.50
Fluorene	0.5	<0.1	PDMS	Equilibrium	1.10	1.12	1.94	2.70	1.52	1.68	1.33	1.13	1.11	1.15	0.88	0.94	1.48	1.76	1.36	4.28	2.44
Phenanthrene	0.1	<0.1	PDMS	Equilibrium	1.51	1.62	2.35	2.58	1.87	2.03	1.74	1.61	1.78	1.95	1.60	1.62	1.83	2.65	2.41	3.36	6.00
Anthracene	0.5	<0.1	PDMS	Equilibrium	0.26	0.23	0.40	0.52	0.35	0.34	0.41	0.34	0.29	0.29	0.22	0.23	0.42	0.41	0.33	0.41	0.62
Fluoranthene	0.5	<0.1	PDMS	Linear uptake	3.82	3.87	8.89	10.15	5.59	5.57	7.35	5.61	4.68	5.22	3.88	4.60	5.58	7.18	5.44	8.61	13.36
Pyrene	0.5	<0.1	PDMS	Linear uptake	7.08	6.99	14.14	15.74	10.06	11.22	15.91	11.97	7.64	8.04	4.72	5.90	11.82	15.09	9.11	15.28	25.12
Benzo (a) anthrancene	0.5	<0.1	PDMS	Linear uptake	0.16	0.14	0.25	0.26	0.21	0.21	0.29	0.24	0.20	0.20	0.14	0.17	0.23	0.27	0.20	0.26	0.36
Chrysene	0.5	<0.1	PDMS	Linear uptake	0.18	0.16	0.28	0.31	0.22	0.22	0.30	0.22	0.17	0.18	0.13	0.16	0.22	0.26	0.19	0.24	0.34
Benzo (bjk) fluoranthene	0.5	<0.1	PDMS	Linear uptake	0.13	0.12	0.20	0.15	0.14	0.19	0.24	0.21	0.19	0.18	0.12	0.14	0.19	0.25	0.16	0.21	0.31
Benzo (e) pyrene	1	<0.1	PDMS	Linear uptake	0.11	0.10	0.15	0.13	0.12	0.16	0.20	0.16	0.13	0.13	0.09	0.10	0.15	0.20	0.13	0.16	0.23
Benzo (a) pyrene	2.5	<0.1	PDMS	Linear uptake	0.09	0.08	0.12	0.09	0.08	0.11	0.15	0.12	0.10	0.10	0.06	0.07	0.12	0.16	0.09	0.11	0.17
Indeno (1,2,3-cd) pyrene	2.5	<0.1	PDMS	Linear uptake	0.04	0.04	0.05	0.03	0.04	0.05	0.07	0.05	0.04	0.04	0.03	0.03	0.05	0.07	0.04	0.05	0.08
Dibenzo (a,h) anthracene	2.5	<0.1	PDMS	Linear uptake	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02
Benzo (g,h,i) perylene	2.5	<0.1	PDMS	Linear uptake	0.05	0.04	0.05	0.04	0.04	0.05	0.07	0.05	0.05	0.04	0.04	0.04	0.05	0.08	0.04	0.06	0.08

< LOR below the limit of reporting
< 3*BLK = average blank level * 3
**LOR Limit of Reporting is for estimated water concentarion and is based on a 30 day deployment, maximum sampling rate and the LOD of instrument
*LOD based on 3x SD of the multiple (n=7) injection of a pure standard
N/A non detect

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CERTIFICATE OF ANALYSIS 208596

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Administration Email, Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**WOOLOOWARE**
Number of Samples	25 extract
Date samples received	20/12/2018
Date completed instructions received	20/12/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	07/01/2019
Date of Issue	04/02/2019
Reissue Details	This report replaces R00 created on 07/01/2019 due to: revised report with additional results.

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Results Approved By
Jeremy Faircloth, Organics Supervisor

Authorised By

Jacinta Hurst, Laboratory Manager

svTRH (C10-C40) in Water						
Our Reference	UNITS	208596-1	208596-2	208596-3	208596-4	208596-5
Your Reference		1	1R	2	2R	3
Date Sampled		01/12/2018	01/12/2018	01/12/2018	01/12/2018	01/12/2018
Type of sample		extract	extract	extract	extract	extract
Date extracted	-	03/01/2019	03/01/2019	03/01/2019	03/01/2019	03/01/2019
Date analysed	-	04/01/2019	04/01/2019	04/01/2019	04/01/2019	04/01/2019
TRH C_{10} - C_{14}	μg/L	120	110	75	<50	88
TRH C_{15} - C_{28}	μg/L	270	250	280	320	320
TRH C_{29} - C_{36}	μg/L	110	<100	110	140	140
TRH >C_{10} - C_{16}	μg/L	110	86	96	<50	93
TRH >C_{16} - C_{34}	μg/L	320	300	340	410	410
TRH >C_{34} - C_{40}	μg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	#	#	#	#	#

svTRH (C10-C40) in Water						
Our Reference	UNITS	208596-6	208596-7	208596-8	208596-9	208596-10
Your Reference		4	5	6	7	8
Date Sampled		01/12/2018	01/12/2018	01/12/2018	01/12/2018	01/12/2018
Type of sample		extract	extract	extract	extract	extract
Date extracted	-	03/01/2019	03/01/2019	03/01/2019	03/01/2019	03/01/2019
Date analysed	-	04/01/2019	04/01/2019	04/01/2019	04/01/2019	04/01/2019
TRH C_{10} - C_{14}	μg/L	94	120	120	130	84
TRH C_{15} - C_{28}	μg/L	310	280	280	350	240
TRH C_{29} - C_{36}	μg/L	130	110	<100	130	110
TRH >C_{10} - C_{16}	μg/L	89	120	93	110	64
TRH >C_{16} - C_{34}	μg/L	390	330	320	410	310
TRH >C_{34} - C_{40}	μg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	#	#	#	#	#

svTRH (C10-C40) in Water						
Our Reference	UNITS	208596-11	208596-12	208596-13	208596-14	208596-15
Your Reference		9	10	11	12	13
Date Sampled		01/12/2018	01/12/2018	01/12/2018	01/12/2018	01/12/2018
Type of sample		extract	extract	extract	extract	extract
Date extracted	-	03/01/2019	03/01/2019	03/01/2019	03/01/2019	03/01/2019
Date analysed	-	04/01/2019	04/01/2019	04/01/2019	04/01/2019	04/01/2019
TRH C_{10} - C_{14}	μg/L	230	<50	120	80	120
TRH C_{15} - C_{28}	μg/L	810	290	260	340	430
TRH C_{29} - C_{36}	μg/L	330	110	<100	170	170
TRH >C_{10} - C_{16}	μg/L	240	58	120	76	130
TRH >C_{16} - C_{34}	μg/L	960	340	300	440	500
TRH >C_{34} - C_{40}	μg/L	170	<100	<100	<100	<100
Surrogate o-Terphenyl	%	#	#	#	#	#

svTRH (C10-C40) in Water						
Our Reference		208596-16	208596-17	208596-18	208596-19	208596-20
Your Reference	UNITS	14	15	Blank 1	Blank 2	Field Blank 1
Date Sampled		01/12/2018	01/12/2018	01/12/2018	01/12/2018	01/12/2018
Type of sample		extract	extract	extract	extract	extract
Date extracted	-	03/01/2019	03/01/2019	03/01/2019	03/01/2019	03/01/2019
Date analysed	-	04/01/2019	04/01/2019	04/01/2019	04/01/2019	04/01/2019
TRH C_{10} - C_{14}	µg/L	<50	120	80	<50	100
TRH C_{15} - C_{28}	µg/L	260	350	120	120	190
TRH C_{29} - C_{36}	µg/L	120	160	<100	<100	140
TRH >C_{10} - C_{16}	µg/L	<50	96	<50	<50	72
TRH >C_{16} - C_{34}	µg/L	340	450	190	200	260
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	#	#	#	#	#

svTRH (C10-C40) in Water						
Our Reference		208596-21	208596-22	208596-23	208596-24	208596-25
Your Reference	UNITS	Field Blank 2	Ness	Replicate 1	Replicate 2	Blank 1
Date Sampled		01/12/2018	01/12/2018	01/12/2018	01/12/2018	01/12/2018
Type of sample		extract	extract	extract	extract	extract
Date extracted	-	03/01/2019	03/01/2019	03/01/2019	03/01/2019	03/01/2019
Date analysed	-	04/01/2019	04/01/2019	04/01/2019	04/01/2019	04/01/2019
TRH C_{10} - C_{14}	µg/L	120	<50	99	<50	78
TRH C_{15} - C_{28}	µg/L	210	<100	230	290	130
TRH C_{29} - C_{36}	µg/L	160	<100	<100	120	<100
TRH >C_{10} - C_{16}	µg/L	75	<50	74	<50	<50
TRH >C_{16} - C_{34}	µg/L	340	<100	270	370	200
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	#	#	#	#	#

PAHs in Water			
Our Reference		208596-2	208596-4
Your Reference	UNITS	1R	2R
Date Sampled		01/12/2018	01/12/2018
Type of sample		extract	extract
Date extracted	-	07/01/2019	07/01/2019
Date analysed	-	07/01/2019	07/01/2019
Naphthalene	µg/L	<0.5	<0.5
Acenaphthylene	µg/L	<0.5	<0.5
Acenaphthene	µg/L	<0.5	<0.5
Fluorene	µg/L	<0.5	<0.5
Phenanthrene	µg/L	<0.5	<0.5
Anthracene	µg/L	<0.5	<0.5
Fluoranthene	µg/L	0.6	1
Pyrene	µg/L	0.8	2
Benzo(a)anthracene	µg/L	<0.5	<0.5
Chrysene	µg/L	<0.5	<0.5
Benzo(b,j+k)fluoranthene	µg/L	<1	<1
Benzo(a)pyrene	µg/L	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	µg/L	<0.5	<0.5
Dibenzo(a,h)anthracene	µg/L	<0.5	<0.5
Benzo(g,h,i)perylene	µg/L	<0.5	<0.5
Benzo(a)pyrene TEQ	µg/L	<5	<5
Total +ve PAH's	µg/L	1.4	2.9
Surrogate p-Terphenyl-d14	%	#	#

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			03/01/2019	[NT]	[NT]	[NT]	[NT]	03/01/2019	[NT]
Date analysed	-			04/01/2019	[NT]	[NT]	[NT]	[NT]	04/01/2019	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	117	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	90	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	117	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	90	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate o-Terphenyl	%		Org-003	101	[NT]	[NT]	[NT]	[NT]	130	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			[NT]	[NT]	[NT]	[NT]	[NT]	03/01/2019	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	04/01/2019	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	115	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	115	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	[NT]	[NT]	[NT]	[NT]	125	[NT]

QUALITY CONTROL: PAHs in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			07/01/2019	[NT]	[NT]	[NT]	[NT]	07/01/2019	[NT]
Date analysed	-			07/01/2019	[NT]	[NT]	[NT]	[NT]	07/01/2019	[NT]
Naphthalene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	73	[NT]
Acenaphthylene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	82	[NT]
Phenanthrene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	84	[NT]
Anthracene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Pyrene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Benzo(a)anthracene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Benzo(b,j+k)fluoranthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	93	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.5	Org-012	<0.5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	120	[NT]	[NT]	[NT]	[NT]	114	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

PAHs in Extract - Extracts analysed and on column results reported.
TRHs in extract - Extracts analysed and on column results reported. # surrogate as NESS not consistent.

Sample list
Date submitted to Envirolab (Brisbane) 18/12/2018
Sampling method: Passive sampling of surface waters in Woolooware (NSW)
Submitted by: Gabriele Elisei - QAEHS

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 208596
Date Received:
Time Received:
Received by:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Site	Site Name	Date	Project name	Solvent	Final extract sample volume (ul)	Aliquot Volume (ul) TRH/BTEX Envirolab
1 1	Southern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
1 Replicate 2	Southern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
2 3	Southern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
2 Replicate 4	Southern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
3 5	Centre Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
4 6	Middle Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
5 7	Northern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
6 8	Northern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
7 9	Western Reference	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
8 10	Western Reference	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
9 11	Eastern Reference	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
10 12	Eastern Reference	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
11 13	Northern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
12 14	Northern Channel	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
13 15	Northern of site	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
14 16	Northern of site	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
15 17	North-West of site	Dec-18	JBS&G NSW SW	n-Hexane	1000	500
Blank 1 18		Dec-18	JBS&G NSW SW	n-Hexane	1000	500
Blank 2 19		Dec-18	JBS&G NSW SW	n-Hexane	1000	500
Field Blank 1 20		Dec-18	JBS&G NSW SW	n-Hexane	1000	500
Field Blank 2 21		Dec-18	JBS&G NSW SW	n-Hexane	1000	500
Ness(non extracted side spike 22		Dec-18	JBS&G NSW SW	n-Hexane	200	n/a

Extra
1 Replicate 23 12-1-18
2 Replicate 24 12-1-18
Blank 1 25

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CERTIFICATE OF ANALYSIS 205815

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Chris Bielby, Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54083, Woolooware**
Number of Samples	1 Water, 1 Soil
Date samples received	16/11/2018
Date completed instructions received	16/11/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	19/11/2018
Date of Issue	19/11/2018

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Results Approved By
Jeremy Faircloth, Organics Supervisor
Long Pham, Team Leader, Metals
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

svTRH (C10-C40) in Water		
Our Reference		205815-1
Your Reference	UNITS	QA16112018-SW01
Date Sampled		16/11/2018
Type of sample		Water
Date extracted	-	19/11/2018
Date analysed	-	19/11/2018
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	90

PAHs in Water - Low Level		
Our Reference		205815-1
Your Reference	UNITS	QA16112018-SW01
Date Sampled		16/11/2018
Type of sample		Water
Date extracted	-	19/11/2018
Date analysed	-	19/11/2018
Naphthalene	µg/L	<0.2
Acenaphthylene	µg/L	<0.1
Acenaphthene	µg/L	<0.1
Fluorene	µg/L	<0.1
Phenanthrene	µg/L	<0.1
Anthracene	µg/L	<0.1
Fluoranthene	µg/L	<0.1
Pyrene	µg/L	<0.1
Benzo(a)anthracene	µg/L	<0.1
Chrysene	µg/L	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2
Benzo(a)pyrene	µg/L	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	107

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		205815-2
Your Reference	UNITS	QA16112018-SED01
Date Sampled		16/11/2018
Type of sample		Soil
Date extracted	-	16/11/2018
Date analysed	-	19/11/2018
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	76

svTRH (C10-C40) in Soil		
Our Reference		205815-2
Your Reference	UNITS	QA16112018-SED01
Date Sampled		16/11/2018
Type of sample		Soil
Date extracted	-	16/11/2018
Date analysed	-	16/11/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	85

PAHs in Soil		
Our Reference		205815-2
Your Reference	UNITS	QA16112018-SED01
Date Sampled		16/11/2018
Type of sample		Soil
Date extracted	-	16/11/2018
Date analysed	-	19/11/2018
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	0.7
Anthracene	mg/kg	0.2
Fluoranthene	mg/kg	3.2
Pyrene	mg/kg	3.2
Benzo(a)anthracene	mg/kg	1.6
Chrysene	mg/kg	1.9
Benzo(b,j+k)fluoranthene	mg/kg	5.9
Benzo(a)pyrene	mg/kg	1.6
Indeno(1,2,3-c,d)pyrene	mg/kg	0.8
Dibenzo(a,h)anthracene	mg/kg	0.2
Benzo(g,h,i)perylene	mg/kg	1.1
Total +ve PAH's	mg/kg	20
Benzo(a)pyrene TEQ calc (zero)	mg/kg	2.7
Benzo(a)pyrene TEQ calc(half)	mg/kg	2.7
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	2.7
Surrogate p-Terphenyl-d14	%	86

Moisture		
Our Reference		205815-2
Your Reference	UNITS	QA16112018-SED01
Date Sampled		16/11/2018
Type of sample		Soil
Date prepared	-	16/11/2018
Date analysed	-	19/11/2018
Moisture	%	51

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
Date analysed	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH $>C_{10}$ - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH $>C_{16}$ - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH $>C_{34}$ - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate o-Terphenyl	%		Org-003	92	[NT]	[NT]	[NT]	[NT]	115	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
Date analysed	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	72	[NT]
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	77	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	113	[NT]	[NT]	[NT]	[NT]	110	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			16/11/2018	[NT]	[NT]	[NT]	[NT]	16/11/2018	[NT]
Date analysed	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	95	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	86	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	90	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	98	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	86	[NT]	[NT]	[NT]	[NT]	105	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			16/11/2018	[NT]	[NT]	[NT]	[NT]	16/11/2018	[NT]
Date analysed	-			16/11/2018	[NT]	[NT]	[NT]	[NT]	16/11/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	99	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	99	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
Surrogate o-Terphenyl	%		Org-003	74	[NT]	[NT]	[NT]	[NT]	91	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			16/11/2018	[NT]	[NT]	[NT]	[NT]	16/11/2018	[NT]
Date analysed	-			19/11/2018	[NT]	[NT]	[NT]	[NT]	19/11/2018	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	115	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	122	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	108	[NT]	[NT]	[NT]	[NT]	105	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

016769

CHAIN OF COUSTODY

JBS&G

PROJECT NO.:	54083	LABORATORY BATCH NO.:	
PROJECT NAME:	Wooloowane	SAMPLERS:	JS
DATE NEEDED BY:	STD T/A	QC LEVEL: NEPM (2013)	

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ......CBielby......@jbsg.com.au; (3) ......JStaehli......@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

	SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRHs	PAHs (low level)	TRH/BTEX	PAHs	IDENTIFICATION	NEPM/WA	NOTES:
1	QA16112018-SW01	Sur water	16/11/18	-	1x1Lamber+ice		X	X					
2	↓ -SED01	Soil	↓		1xsoil jar+ice				X	X			

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 205815
Date Received: 16/11/18
Time Received: 14:00
Received By: TN
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J Staehli DATE: 16/11/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: T.Nguyen DATE: 16/11/18 OF: ELS	COOLER SEAL – Yes...... No ...... Intact ...... Broken ...... COOLER TEMP ...... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes...... No...... Intact ...... Broken ...... COOLER TEMP ...... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

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Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report **628153-W**
Project name WOOLOOWARE
Project ID 54083
Received Date Nov 16, 2018

Client Sample ID			**OSA-SW-02B**	**OSA-SW-04B**	**OSA-SW-11B**	**OSA-SW-12B**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S18-No21616**	**S18-No21617**	**S18-No21618**	**S18-No21619**
Date Sampled			**Nov 16, 2018**	**Nov 16, 2018**	**Nov 16, 2018**	**Nov 16, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	93	101	115	99
p-Terphenyl-d14 (surr.)	1	%	80	71	104	85

Client Sample ID			OSA-SW-13B	OSA-SW-15B	OSA-SW-08B	QC-16112018-SW01
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No21620	S18-No21621	S18-No21622	S18-No21623
Date Sampled			Nov 16, 2018	Nov 16, 2018	Nov 16, 2018	Nov 16, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	96	123	98	99
p-Terphenyl-d14 (surr.)	1	%	77	106	96	69

Client Sample ID			R20 TS	TB
Sample Matrix			Water	Water
Eurofins | mgt Sample No.			S18-No21624	S18-No21625
Date Sampled			Nov 16, 2018	Nov 16, 2018
Test/Reference	LOR	Unit		
BTEX				
Benzene	0.001	mg/L	110	< 0.001
Toluene	0.001	mg/L	98	< 0.001
Ethylbenzene	0.001	mg/L	97	< 0.001
m&p-Xylenes	0.002	mg/L	93	< 0.002
o-Xylene	0.001	mg/L	100	< 0.001
Xylenes - Total	0.003	mg/L	96	< 0.003
4-Bromofluorobenzene (surr.)	1	%	81	123

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
BTEX	Melbourne	Nov 19, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Nov 20, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 20, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Nov 20, 2018	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 16, 2018 2:09 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	628153	**Due:**	Nov 23, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Total Recoverable Hydrocarbons - 1999 NEPM Fractions	BTEX	Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	OSA-SW-02B	Nov 16, 2018		Water	S18-No21616	X		X	X
2	OSA-SW-04B	Nov 16, 2018		Water	S18-No21617	X		X	X
3	OSA-SW-11B	Nov 16, 2018		Water	S18-No21618	X		X	X
4	OSA-SW-12B	Nov 16, 2018		Water	S18-No21619	X		X	X
5	OSA-SW-13B	Nov 16, 2018		Water	S18-No21620	X		X	X
6	OSA-SW-15B	Nov 16, 2018		Water	S18-No21621	X		X	X
7	OSA-SW-08B	Nov 16, 2018		Water	S18-No21622	X		X	X
8	QC-16112018-SW01	Nov 16, 2018		Water	S18-No21623	X		X	X
9	TS	Nov 16, 2018		Water	S18-No21624		X		

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Address: Level 1, 50 Margaret St
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NSW 2000

Project Name: WOOLOOWARE
Project ID: 54083

Order No.:
Report #: 628153
Phone: 02 8245 0300
Fax:

Received: Nov 16, 2018 2:09 PM
Due: Nov 23, 2018
Priority: 5 Day
Contact Name: Chris Bielby

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Total Recoverable Hydrocarbons - 1999 NEPM Fractions	BTEX	Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
10	TB	Nov 16, 2018		Water	S18-No21625		X		
Test Counts						8	2	8	8

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0			0.00001	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	112			70-130	Pass	
Toluene	%	108			70-130	Pass	
Ethylbenzene	%	104			70-130	Pass	
m&p-Xylenes	%	103			70-130	Pass	
Xylenes - Total	%	104			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C10-C14	%	112			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	118			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons (Trace level)							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Acenaphthene			%	80			70-130	Pass	
Acenaphthylene			%	83			70-130	Pass	
Anthracene			%	92			70-130	Pass	
Benz(a)anthracene			%	94			70-130	Pass	
Benzo(a)pyrene			%	104			70-130	Pass	
Benzo(b&j)fluoranthene			%	99			70-130	Pass	
Benzo(g.h.i)perylene			%	109			70-130	Pass	
Benzo(k)fluoranthene			%	114			70-130	Pass	
Chrysene			%	110			70-130	Pass	
Dibenz(a.h)anthracene			%	102			70-130	Pass	
Fluoranthene			%	115			70-130	Pass	
Fluorene			%	92			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	100			70-130	Pass	
Naphthalene			%	73			70-130	Pass	
Phenanthrene			%	102			70-130	Pass	
Pyrene			%	119			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-No22429	NCP	%	113			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-No22429	NCP	%	128			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-No20673	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M18-No20673	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M18-No20673	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-No20673	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	M18-No20673	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	M18-No20673	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	

Comments

Eurofins | mgt accreditation number 1261, corporate site 1254 is currently in progress of a controlled transition to a new custom built location at 6 Monterey Road, Dandenong South, Victoria 3175. All results on this report denoted as being performed by Eurofins | mgt 2-5 Kingston Town Close, Oakleigh Victoria 3166 corporate site 1254, will have been performed on either Oakleigh or new Dandenong South site.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	No
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Chris Bielby
Project name:	WOOLOOWARE
Project ID:	54083
COC number:	016772
Turn around time:	5 Day
Date/Time received:	Nov 16, 2018 2:09 PM
Eurofins | mgt reference:	**628153**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 3.4 degrees Celsius.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Vials not received for each sample; only semi-volatile analysis conducted.

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8415 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Chris Bielby - cbielby@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

016772

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54083	LABORATORY BATCH NO.:
PROJECT NAME: Woolooware	SAMPLERS: JS / CB
DATE NEEDED BY: STD T/A	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) CBielby @jbsg.com.au; (3) JStaehli @jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Please use same TS/TB results for soil/water - same environment.

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRHs	PAHs (low level)	BTEX	IDENTIFICATION	NEPM/WA	NOTES: 628153
OSA-SW-02B	Water	16/11/18		1x1L amber + ice		X	X				
-04B	↓	↓		↓		↓	↓				
-11B											
-12B											
-13B											
-15B											
-08B											
QC-16112018-SW01											
TS				2x vials + ice				X			
TB				↓				X			

(IDENTIFICATION and NEPM/WA columns under: TYPE OF ASBESTOS ANALYSIS)

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 16/11/18	CONSIGNMENT NOTE NO.	NAME: Elvis D DATE: 16/11/18	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF: JBS&G	TRANSPORT CO.	OF: Eurofins	COOLER TEMP 3.4 deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF:	TRANSPORT CO	OF:	COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

eurofins | mgt

30 years Testing For Life 1987–2017
Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report **625694-W**
Project name WOOLOOWARE
Project ID 54083
Received Date Nov 01, 2018

Client Sample ID			**OSA-SW-01A**	**OSA-SW-03A**	**OSA-SW-11A**	**OSA-SW-12A**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S18-No02108**	**S18-No02109**	**S18-No02110**	**S18-No02111**
Date Sampled			**Nov 01, 2018**	**Nov 01, 2018**	**Nov 01, 2018**	**Nov 01, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	115	109	104	115
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	0.00003	< 0.00001	< 0.00001	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	0.00004	< 0.00001	< 0.00001	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001

eurofins | mgt

Client Sample ID			OSA-SW-01A	OSA-SW-03A	OSA-SW-11A	OSA-SW-12A
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No02108	S18-No02109	S18-No02110	S18-No02111
Date Sampled			Nov 01, 2018	Nov 01, 2018	Nov 01, 2018	Nov 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	0.00004	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	0.00022	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	106	94	83	103
p-Terphenyl-d14 (surr.)	1	%	116	102	96	124

Client Sample ID			OSA-SW-14A	OSA-SW-07A	OSA-SW-08A	OSA-SW-09A
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No02112	S18-No02113	S18-No02114	S18-No02115
Date Sampled			Nov 01, 2018	Nov 01, 2018	Nov 01, 2018	Nov 01, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	115	106	110	114
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Client Sample ID			OSA-SW-14A	OSA-SW-07A	OSA-SW-08A	OSA-SW-09A
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No02112	S18-No02113	S18-No02114	S18-No02115
Date Sampled			Nov 01, 2018	Nov 01, 2018	Nov 01, 2018	Nov 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	108	105	117	120
p-Terphenyl-d14 (surr.)	1	%	133	125	146	142

Client Sample ID			OSA-SW-10A	TB	[R20]TS	QC01112018-SW1
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No02116	S18-No02117	S18-No02118	S18-No02119
Date Sampled			Nov 01, 2018	Oct 31, 2018	Oct 31, 2018	Nov 01, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	-	-	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	-	-	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	-	-	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	-	-	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	-	-	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	84	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	84	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	98	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	96	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	95	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	95	< 0.003
4-Bromofluorobenzene (surr.)	1	%	115	89	79	113
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	-	-	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	-	-	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	-	-	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	-	-	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	-	-	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	-	-	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	-	-	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	-	-	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	-	-	< 0.00001

Client Sample ID			OSA-SW-10A	TB	R20TS	QC01112018-SW1
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S18-No02116	S18-No02117	S18-No02118	S18-No02119
Date Sampled			Nov 01, 2018	Oct 31, 2018	Oct 31, 2018	Nov 01, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	-	-	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	-	-	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	95	-	-	129
p-Terphenyl-d14 (surr.)	1	%	107	-	-	85

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Nov 05, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 05, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 05, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Nov 05, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Nov 07, 2018	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			

ABN– 50 005 085 521
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Site # 1254 & 14271

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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 1, 2018 6:34 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	625694	**Due:**	Nov 8, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						BTEX	BTEX	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X		X	X
Sydney Laboratory - NATA Site # 18217							X	X	
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	OSA-SW-01A	Nov 01, 2018		Water	S18-No02108	X		X	X
2	OSA-SW-03A	Nov 01, 2018		Water	S18-No02109	X		X	X
3	OSA-SW-11A	Nov 01, 2018		Water	S18-No02110	X		X	X
4	OSA-SW-12A	Nov 01, 2018		Water	S18-No02111	X		X	X
5	OSA-SW-14A	Nov 01, 2018		Water	S18-No02112	X		X	X
6	OSA-SW-07A	Nov 01, 2018		Water	S18-No02113	X		X	X
7	OSA-SW-08A	Nov 01, 2018		Water	S18-No02114	X		X	X
8	OSA-SW-09A	Nov 01, 2018		Water	S18-No02115	X		X	X
9	OSA-SW-10A	Nov 01, 2018		Water	S18-No02116	X		X	X

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ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

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2-5 Kingston Town Close
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NATA # 1261
Site # 1254 & 14271

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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 1, 2018 6:34 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	625694	**Due:**	Nov 8, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						BTEX	BTEX	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X		X	X
Sydney Laboratory - NATA Site # 18217							X	X	
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
10	TB	Oct 31, 2018		Water	S18-No02117		X		
11	TS	Oct 31, 2018		Water	S18-No02118		X		
12	QC01112018-SW1	Nov 01, 2018		Water	S18-No02119	X		X	X
Test Counts						12	12	10	10

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

NOTE: pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	105			70-130	Pass	
TRH C10-C14	%	98			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	100			70-130	Pass	
Toluene	%	108			70-130	Pass	
Ethylbenzene	%	111			70-130	Pass	
m&p-Xylenes	%	117			70-130	Pass	
Xylenes - Total	%	114			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene			%	87			70-130	Pass	
TRH C6-C10			%	108			70-130	Pass	
TRH >C10-C16			%	100			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene			%	91			70-130	Pass	
Acenaphthylene			%	96			70-130	Pass	
Anthracene			%	87			70-130	Pass	
Benz(a)anthracene			%	105			70-130	Pass	
Benzo(a)pyrene			%	118			70-130	Pass	
Benzo(b&j)fluoranthene			%	115			70-130	Pass	
Benzo(g.h.i)perylene			%	125			70-130	Pass	
Benzo(k)fluoranthene			%	120			70-130	Pass	
Chrysene			%	111			70-130	Pass	
Dibenz(a.h)anthracene			%	119			70-130	Pass	
Fluoranthene			%	99			70-130	Pass	
Fluorene			%	89			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	124			70-130	Pass	
Naphthalene			%	87			70-130	Pass	
Phenanthrene			%	99			70-130	Pass	
Pyrene			%	96			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-No01407	NCP	%	108			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-No01407	NCP	%	115			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Acenaphthene	M18-Oc36881	NCP	%	100			70-130	Pass	
Acenaphthylene	M18-Oc36881	NCP	%	105			70-130	Pass	
Anthracene	M18-Oc36881	NCP	%	91			70-130	Pass	
Benz(a)anthracene	M18-Oc36881	NCP	%	116			70-130	Pass	
Benzo(a)pyrene	M18-Oc36881	NCP	%	111			70-130	Pass	
Benzo(b&j)fluoranthene	M18-Oc36881	NCP	%	75			70-130	Pass	
Benzo(g.h.i)perylene	M18-Oc36881	NCP	%	112			70-130	Pass	
Benzo(k)fluoranthene	M18-Oc36881	NCP	%	108			70-130	Pass	
Chrysene	M18-Oc36881	NCP	%	115			70-130	Pass	
Dibenz(a.h)anthracene	M18-Oc36881	NCP	%	107			70-130	Pass	
Fluoranthene	M18-Oc36881	NCP	%	104			70-130	Pass	
Fluorene	M18-Oc36881	NCP	%	92			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-Oc36881	NCP	%	114			70-130	Pass	
Naphthalene	M18-Oc36881	NCP	%	95			70-130	Pass	
Phenanthrene	M18-Oc36881	NCP	%	99			70-130	Pass	
Pyrene	M18-Oc36881	NCP	%	105			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-No00593	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M18-No00593	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M18-No00593	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-No00593	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	M18-No00593	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	M18-No00593	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Chris Bielby
Project name:	WOOLOOWARE
Project ID:	54083
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Nov 1, 2018 6:34 PM
Eurofins | mgt reference:	**625694**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 10.1 degrees Celsius.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8415 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Chris Bielby - cbielby@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

016759

CHAIN OF CUSTODY

JBS&G

PROJECT NO.:	54083	LABORATORY BATCH NO.:	
PROJECT NAME:	Wooloowane	SAMPLERS:	JS
DATE NEEDED BY:	STD TIA	QC LEVEL: NEPM (2013)	

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ......CBielby......@jbsg.com.au; (3) ......JStaehli......@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Please use same TS/TB results as 51163 job - same esky

Please label all samples with job 54083

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs	BTEX	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
OSA-SW-01A	Water	1/11/18		1x200mL amber, 2x vials + ice		X	X				
-03A											
-11A											
-12A											
-14A											
-07A											
-08A											
-09A											
-~~04~~10A											
TS		31/10/18		2x vials + ice				X			
TB								X			
QC01112018-SW1		1/11/18		1x200mL amber, 2x vials + ice		X	X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J. Staehli DATE: 1/11/18	CONSIGNMENT NOTE NO.	NAME: Luca D. 01-11-18 DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF: JBS&G	TRANSPORT CO.	OF: Eurofins MGT 6:34 PM	COOLER TEMP .... deg C 10.1°C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF:	TRANSPORT CO	OF:	COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

625694

Enviro Sample NSW

To: Nibha Vaidya; COC NSW
Subject: RE: Eurofins | mgt Sample Receipt Advice - Report 625694 : Site WOOLOOWARE (54083)

-------- Original message --------
From: Chris Bielby <CBielby@jbsg.com.au>
Date: 7/11/18 8:27 am (GMT+10:00)
To: Nibha Vaidya <NibhaVaidya@eurofins.com>
Subject: FW: Eurofins | mgt Sample Receipt Advice - Report 625694 : Site WOOLOOWARE (54083)

EXTERNAL EMAIL*

Hey Nibha, could I please request that the analysis of PAHs for these samples be low level reporting limit?

Thanks
Chris

From: EnviroSampleNSW@eurofins.com <EnviroSampleNSW@eurofins.com>
Sent: Thursday, 1 November 2018 9:45 PM
To: Chris Bielby <CBielby@jbsg.com.au>
Cc: AdminNSW <adminNSW@jbsg.com.au>; Jessica Staehli <JStaehli@jbsg.com.au>
Subject: Eurofins | mgt Sample Receipt Advice - Report 625694 : Site WOOLOOWARE (54083)

Dear Valued Client,

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins | mgt Analytical Services Manager as soon as possible to make certain that they get changed.

Regards

Luca Dominici
Sample Receipt

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LANE COVE WEST NSW 2066
AUSTRALIA
Phone: +61 29900 8492
Email: EnviroSampleNSW@eurofins.com
Website:environment.eurofins.com.au

EnviroNote 1079 - PFAS Fingerprinting
EnviroNote 1080 - Total Organofluorine Analysis & PFAS Investigations

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CERTIFICATE OF ANALYSIS 204602

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Chris Bielby
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54083, Woolooware**
Number of Samples	1 water
Date samples received	01/11/2018
Date completed instructions received	01/11/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	08/11/2018
Date of Issue	06/11/2018

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Results Approved By
Jeremy Faircloth, Organics Supervisor
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference		204602-1
Your Reference	UNITS	QA01112018-SW01
Date Sampled		01/11/2018
Type of sample		water
Date extracted	-	02/11/2018
Date analysed	-	05/11/2018
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	98
Surrogate toluene-d8	%	92
Surrogate 4-BFB	%	114

svTRH (C10-C40) in Water		
Our Reference		204602-1
Your Reference	UNITS	QA01112018-SW01
Date Sampled		01/11/2018
Type of sample		water
Date extracted	-	05/11/2018
Date analysed	-	06/11/2018
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	99

PAHs in Water		
Our Reference		204602-1
Your Reference	UNITS	QA01112018-SW01
Date Sampled		01/11/2018
Type of sample		water
Date extracted	-	05/11/2018
Date analysed	-	06/11/2018
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	100

Method ID	Methodology Summary
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			02/11/2018	[NT]	[NT]	[NT]	[NT]	02/11/2018	[NT]
Date analysed	-			05/11/2018	[NT]	[NT]	[NT]	[NT]	05/11/2018	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	116	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	116	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	118	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	119	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	96	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-016	92	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate 4-BFB	%		Org-016	112	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			05/11/2018	[NT]	[NT]	[NT]	[NT]	05/11/2018	[NT]
Date analysed	-			06/11/2018	[NT]	[NT]	[NT]	[NT]	06/11/2018	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	123	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	85	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	123	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	85	[NT]
Surrogate o-Terphenyl	%		Org-003	89	[NT]	[NT]	[NT]	[NT]	115	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			05/11/2018	[NT]	[NT]	[NT]	[NT]	05/11/2018	[NT]
Date analysed	-			06/11/2018	[NT]	[NT]	[NT]	[NT]	06/11/2018	[NT]
Naphthalene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Acenaphthylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Phenanthrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Benzo(a)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-012	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	100	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

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Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

016756

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54083	LABORATORY BATCH NO.:
PROJECT NAME: Wooloowane	SAMPLERS: JS
DATE NEEDED BY: STOT/A	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ......Cbielby......@jbsg.com.au; (3) ......JStaehi......@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHS																	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
(1) QA01112018-SW1	Water	1/11/18	–	1x500mL amber, 2x vials + ice		X	X																			

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 204602
Date Received: 1/11/18
Time Received: 15:10
Received By: TN
Temp: Cool/Ambient 16.4°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No:
Date Received:
Time Received:
Received By:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None
TN.

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehi DATE: 1/11/18 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: T.Nguyen DATE: 1/11/18 OF: ELS	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 205815-A

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54083, Woolooware**
Number of Samples	1 Water, 1 Soil
Date samples received	16/11/2018
Date completed instructions received	27/11/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	04/12/2018
Date of Issue	04/12/2018

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Misc Inorg - Soil		
Our Reference		205815-A-2
Your Reference	UNITS	QA16112018-SED01
Date Sampled		16/11/2018
Type of sample		Soil
Date prepared	-	04/12/2018
Date analysed	-	04/12/2018
Total Organic Carbon (Combustion)	mg/kg	29,000

Method ID	Methodology Summary
Inorg-128	Total Carbon or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/12/2018	2	04/12/2018	04/12/2018		04/12/2018	[NT]
Date analysed	-			04/12/2018	2	04/12/2018	04/12/2018		04/12/2018	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	2	29000	29000	0	83	[NT]

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>	Greater than
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Measurement Uncertainty estimates are available for most tests upon request.

Andrew Fitzsimons

From:	Jeremy Faircloth
Sent:	Tuesday, 27 November 2018 11:50 AM
To:	Jessica Staehli
Cc:	Nancy Zhang; Steven Luong; Aileen Hie; Andrew Fitzsimons
Subject:	RE: Results for Registration 205815 54083, Woolooware

Hi Jess,
Apologies for the delay, I've been xmas shopping all morning.
Unfortunately we will not be able to run that soil on a trace level method due to the high concentration of the other PAHs in the sample. In order to run on a trace method, we would have to dilute, which would give the current PQLs.

Fitzy, can you book in 205815-2 booked in for TOC on STD TAT please?

ELS:205815-A
TAT: 5 days
Due: 4/12/18
Fitz

Thanks,

Regards,

Jeremy Faircloth | Organics Supervisor | Envirolab Services Pty Ltd

Great Science, Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E jfaircloth@envirolab.com.au | **W** www.envirolab.com.au

Please note that all samples submitted to the Envirolab Group laboratories will be analysed under the Envirolab Group Terms and Conditions. The Terms and Conditions are accessible by clicking this link

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From: Jessica Staehli <JStaehli@jbsg.com.au>
Sent: Tuesday, 27 November 2018 8:22 AM
To: Jeremy Faircloth <JFaircloth@envirolab.com.au>
Cc: Nancy Zhang <NZhang@envirolab.com.au>; Steven Luong <SLuong@envirolab.com.au>
Subject: RE: Results for Registration 205815 54083, Woolooware

Hi Jeremy,

It would be good to know for the 3 PAHs that are <PQL if there are any lower values at all, is it possible to just run the trace level on the 3 PAHs that were <PQL? And also can I please get Total Organic Carbon analysis run on the soil sample?

If this is possible, can I please get it on a STD T/A.

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report	**628128-S**
Project name	WOOLOOWARE
Project ID	54083
Received Date	Nov 16, 2018

Client Sample ID			**OSA-SED02-0.5-0.6**	**OSA-SED03-0.5-0.6**	**OSA-SED04-0.5-0.6**	**OSA-SED05-0.5-0.6**
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**S18-No21446**	**S18-No21447**	**S18-No21448**	**S18-No21449**
Date Sampled			**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	62	61	66	66
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.005	mg/kg	< 0.005	< 0.005	0.17	< 0.005
Benzo(a)pyrene TEQ (medium bound) *	0.005	mg/kg	0.006	0.006	0.17	0.007
Benzo(a)pyrene TEQ (upper bound) *	0.005	mg/kg	0.012	0.012	0.17	0.012
Acenaphthene	0.005	mg/kg	< 0.005	< 0.005	0.006	< 0.005
Acenaphthylene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Anthracene	0.005	mg/kg	< 0.005	< 0.005	0.010	< 0.005
Benz(a)anthracene	0.005	mg/kg	< 0.005	< 0.005	0.10	0.008
Benzo(a)pyrene	0.005	mg/kg	< 0.005	< 0.005	0.10	< 0.005
Benzo(b&j)fluoranthene[N07]	0.005	mg/kg	< 0.005	< 0.005	0.090	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	< 0.005	0.096	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	0.11	< 0.005
Chrysene	0.005	mg/kg	< 0.005	< 0.005	0.12	0.006

Client Sample ID			OSA-SED02-0.5-0.6	OSA-SED03-0.5-0.6	OSA-SED04-0.5-0.6	OSA-SED05-0.5-0.6
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**S18-No21446**	**S18-No21447**	**S18-No21448**	**S18-No21449**
Date Sampled			**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	< 0.005	0.033	< 0.005
Fluoranthene	0.005	mg/kg	< 0.005	< 0.005	0.10	< 0.005
Fluorene	0.005	mg/kg	< 0.005	< 0.005	< 0.005	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	< 0.005	0.031	< 0.005
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	0.014	< 0.005
Phenanthrene	0.005	mg/kg	< 0.005	< 0.005	0.055	< 0.005
Pyrene	0.005	mg/kg	< 0.005	< 0.005	0.20	< 0.005
Total PAH*	0.005	mg/kg	< 0.005	< 0.005	1.1	0.014
2-Fluorobiphenyl (surr.)	0.005	%	85	79	76	72
p-Terphenyl-d14 (surr.)	0.005	%	71	79	91	53
Total Organic Carbon	0.1	%	3.5	3.8	5.3	4.7
% Moisture	1	%	62	57	62	63

Client Sample ID			OSA-SED06-0.5-0.6	OSA-SED11-0.5-0.6	OSA-SED12-0.5-0.6	OSA-SED14-0-0.1
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**S18-No21450**	**S18-No21451**	**S18-No21452**	**S18-No21453**
Date Sampled			**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**	**Nov 15, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	56	57	63	60
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.005	mg/kg	< 0.005	3.3	< 0.005	2.9
Benzo(a)pyrene TEQ (medium bound) *	0.005	mg/kg	0.006	3.3	0.006	2.9
Benzo(a)pyrene TEQ (upper bound) *	0.005	mg/kg	0.012	3.3	0.012	2.9
Acenaphthene	0.005	mg/kg	< 0.005	0.17	< 0.005	< 0.005

Client Sample ID			OSA-SED06-0.5-0.6	OSA-SED11-0.5-0.6	OSA-SED12-0.5-0.6	OSA-SED14-0-0.1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			S18-No21450	S18-No21451	S18-No21452	S18-No21453
Date Sampled			Nov 15, 2018	Nov 15, 2018	Nov 15, 2018	Nov 15, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthylene	0.005	mg/kg	< 0.005	0.036	< 0.005	0.014
Anthracene	0.005	mg/kg	< 0.005	0.22	< 0.005	0.091
Benz(a)anthracene	0.005	mg/kg	< 0.005	2.3	< 0.005	0.75
Benzo(a)pyrene	0.005	mg/kg	< 0.005	2.2	< 0.005	1.9
Benzo(b&j)fluoranthene[N07]	0.005	mg/kg	< 0.005	3.1	< 0.005	2.0
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	1.3	< 0.005	0.84
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	0.22	< 0.005	2.4
Chrysene	0.005	mg/kg	< 0.005	2.8	< 0.005	1.1
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	0.40	< 0.005	0.35
Fluoranthene	0.005	mg/kg	< 0.005	5.1	< 0.005	1.5
Fluorene	0.005	mg/kg	< 0.005	0.13	< 0.005	0.028
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	1.1	< 0.005	1.1
Naphthalene	0.005	mg/kg	< 0.005	0.083	< 0.005	0.051
Phenanthrene	0.005	mg/kg	< 0.005	1.2	< 0.005	0.29
Pyrene	0.005	mg/kg	< 0.005	5.9	< 0.005	1.7
Total PAH*	0.005	mg/kg	< 0.005	26	< 0.005	14
2-Fluorobiphenyl (surr.)	0.005	%	78	66	76	78
p-Terphenyl-d14 (surr.)	0.005	%	67	57	57	54
Total Organic Carbon	0.1	%	3.3	3.6	7.4	2.8
% Moisture	1	%	63	55	70	50

Client Sample ID			OSA-SED16-0-0.1	OSA-SED17-0-0.1	OSA-SED18-0-0.1	OSA-SED13-0-0.1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			S18-No21454	S18-No21455	S18-No21456	S18-No21457
Date Sampled			Nov 15, 2018	Nov 15, 2018	Nov 15, 2018	Nov 16, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	990	130	140	98
TRH C29-C36	50	mg/kg	440	75	78	< 50
TRH C10-36 (Total)	50	mg/kg	1430	205	218	98
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	59	54	58	63
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50

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Client Sample ID			OSA-SED16-0-0.1	OSA-SED17-0-0.1	OSA-SED18-0-0.1	OSA-SED13-0-0.1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			S18-No21454	S18-No21455	S18-No21456	S18-No21457
Date Sampled			Nov 15, 2018	Nov 15, 2018	Nov 15, 2018	Nov 16, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C16-C34	100	mg/kg	1400	180	200	130
TRH >C34-C40	100	mg/kg	190	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	1590	180	200	130
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.005	mg/kg	28	18	4.7	3.5
Benzo(a)pyrene TEQ (medium bound) *	0.005	mg/kg	28	18	4.7	3.5
Benzo(a)pyrene TEQ (upper bound) *	0.005	mg/kg	28	18	4.7	3.5
Acenaphthene	0.005	mg/kg	3.2	0.56	0.075	0.044
Acenaphthylene	0.005	mg/kg	0.68	0.17	0.13	0.060
Anthracene	0.005	mg/kg	7.3	1.9	0.23	0.16
Benz(a)anthracene	0.005	mg/kg	27	15	2.3	1.8
Benzo(a)pyrene	0.005	mg/kg	19	11	3.1	2.3
Benzo(b&j)fluoranthene[N07]	0.005	mg/kg	18	11	2.3	1.9
Benzo(g.h.i)perylene	0.005	mg/kg	5.7	5.5	1.4	0.91
Benzo(k)fluoranthene	0.005	mg/kg	17	7.2	2.1	1.5
Chrysene	0.005	mg/kg	35	14	2.4	1.8
Dibenz(a.h)anthracene	0.005	mg/kg	1.8	3.3	0.70	0.50
Fluoranthene	0.005	mg/kg	81	32	4.0	3.3
Fluorene	0.005	mg/kg	3.7	0.94	0.12	0.072
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	9.5	6.0	1.6	1.2
Naphthalene	0.005	mg/kg	0.59	0.10	0.12	0.049
Phenanthrene	0.005	mg/kg	32	7.1	1.1	0.74
Pyrene	0.005	mg/kg	76	27	4.7	3.4
Total PAH*	0.005	mg/kg	340	140	26	20
2-Fluorobiphenyl (surr.)	0.005	%	87	83	127	136
p-Terphenyl-d14 (surr.)	0.005	%	94	78	98	101
Total Organic Carbon	0.1	%	3.5	5.7	4.4	2.1
% Moisture	1	%	60	66	64	49

Client Sample ID			OSA-SED13-0.5-0.6	OSA-SED15-0-0.1	OSA-SED15-0.5-0.6	QC16112018-SED01
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			S18-No21458	S18-No21459	S18-No21460	S18-No21461
Date Sampled			Nov 16, 2018	Nov 16, 2018	Nov 16, 2018	Nov 16, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	90	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	1600	< 50	140
TRH C29-C36	50	mg/kg	< 50	630	< 50	81
TRH C10-36 (Total)	50	mg/kg	< 50	2320	< 50	221
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1

Client Sample ID			OSA-SED13-0.5-0.6	OSA-SED15-0-0.1	OSA-SED15-0.5-0.6	QC16112018-SED01
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**S18-No21458**	**S18-No21459**	**S18-No21460**	**S18-No21461**
Date Sampled			**Nov 16, 2018**	**Nov 16, 2018**	**Nov 16, 2018**	**Nov 16, 2018**
Test/Reference	LOR	Unit				
BTEX						
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	64	60	59	60
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene N02	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1) N04	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	210	< 50	< 50
TRH >C10-C16 less Naphthalene (F2) N01	50	mg/kg	< 50	210	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	2100	< 100	200
TRH >C34-C40	100	mg/kg	< 100	300	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	2610	< 100	200
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.005	mg/kg	0.032	25	0.22	5.1
Benzo(a)pyrene TEQ (medium bound) *	0.005	mg/kg	0.035	25	0.22	5.1
Benzo(a)pyrene TEQ (upper bound) *	0.005	mg/kg	0.037	25	0.22	5.1
Acenaphthene	0.005	mg/kg	< 0.005	1.2	0.012	0.10
Acenaphthylene	0.005	mg/kg	< 0.005	1.5	0.019	0.090
Anthracene	0.005	mg/kg	< 0.005	3.7	0.021	0.26
Benz(a)anthracene	0.005	mg/kg	0.016	20	0.12	3.0
Benzo(a)pyrene	0.005	mg/kg	0.026	17	0.15	3.0
Benzo(b&j)fluoranthene N07	0.005	mg/kg	0.015	9.3	0.092	3.2
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	3.6	0.062	1.5
Benzo(k)fluoranthene	0.005	mg/kg	0.024	9.3	0.13	2.8
Chrysene	0.005	mg/kg	0.028	21	0.17	3.1
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	2.8	0.026	0.88
Fluoranthene	0.005	mg/kg	0.029	30	0.21	6.8
Fluorene	0.005	mg/kg	< 0.005	3.2	0.016	0.15
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	7.1	0.081	2.3
Naphthalene	0.005	mg/kg	< 0.005	1.6	0.009	0.061
Phenanthrene	0.005	mg/kg	0.006	21	0.074	1.3
Pyrene	0.005	mg/kg	0.036	41	0.25	6.4
Total PAH*	0.005	mg/kg	0.18	190	1.4	35
2-Fluorobiphenyl (surr.)	0.005	%	131	125	141	112
p-Terphenyl-d14 (surr.)	0.005	%	106	99	133	88
Total Organic Carbon	0.1	%	4.2	3.5	5.7	3.2
% Moisture	1	%	53	49	61	47

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B1			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Nov 21, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Nov 21, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 21, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 21, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons	Melbourne	Nov 27, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Total Organic Carbon	Melbourne	Nov 22, 2018	28 Day
- Method: APHA 5310B Total Organic Carbon			
% Moisture	Melbourne	Nov 16, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 16, 2018 2:09 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	628128	**Due:**	Nov 26, 2018
		Phone:	02 8245 0300	**Priority:**	6 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	OSA-SED02-0.5-0.6	Nov 15, 2018		Sediment	S18-No21446		X	X		X	X
2	OSA-SED03-0.5-0.6	Nov 15, 2018		Sediment	S18-No21447		X	X		X	X
3	OSA-SED04-0.5-0.6	Nov 15, 2018		Sediment	S18-No21448		X	X		X	X
4	OSA-SED05-0.5-0.6	Nov 15, 2018		Sediment	S18-No21449		X	X		X	X
5	OSA-SED06-0.5-0.6	Nov 15, 2018		Sediment	S18-No21450		X	X		X	X
6	OSA-SED11-	Nov 15, 2018		Sediment	S18-No21451		X	X		X	X

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

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Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
7	OSA-SED12-0.5-0.6	Nov 15, 2018		Sediment	S18-No21452		X	X		X	X
8	OSA-SED14-0-0.1	Nov 15, 2018		Sediment	S18-No21453		X	X		X	X
9	OSA-SED16-0-0.1	Nov 15, 2018		Sediment	S18-No21454		X	X		X	X
10	OSA-SED17-0-0.1	Nov 15, 2018		Sediment	S18-No21455		X	X		X	X
11	OSA-SED18-0-0.1	Nov 15, 2018		Sediment	S18-No21456		X	X		X	X
12	OSA-SED13-0-0.1	Nov 16, 2018		Sediment	S18-No21457		X	X		X	X
13	OSA-SED13-	Nov 16, 2018		Sediment	S18-No21458		X	X		X	X

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NATA # 1261
Site # 23736

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Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
14	OSA-SED15-0-0.1	Nov 16, 2018		Sediment	S18-No21459		X	X		X	X
15	OSA-SED15-0.5-0.6	Nov 16, 2018		Sediment	S18-No21460		X	X		X	X
16	QC16112018-SED01	Nov 16, 2018		Sediment	S18-No21461		X	X		X	X
17	TS	Nov 16, 2018		Water	S18-No21462				X		
18	TB	Nov 16, 2018		Water	S18-No21463				X		
19	OSA-SED02-0.7-0.8	Nov 15, 2018		Sediment	S18-No21573	X					
20	OSA-SED03-0.6-0.7	Nov 15, 2018		Sediment	S18-No21574	X					
21	OSA-SED04-	Nov 15, 2018		Sediment	S18-No21575	X					

Company Name: JBS & G Australia (NSW) P/L
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Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.6-0.7										
22	OSA-SED05-0.6-0.7	Nov 15, 2018		Sediment	S18-No21576	X					
23	OSA-SED06-0.7-0.8	Nov 15, 2018		Sediment	S18-No21577	X					
24	OSA-SED11-0.6-0.7	Nov 15, 2018		Sediment	S18-No21578	X					
25	OSA-SED12-0.7-0.8	Nov 15, 2018		Sediment	S18-No21579	X					
26	OSA-SED14-0.5-0.6	Nov 15, 2018		Sediment	S18-No21580	X					
27	OSA-SED14-0.9-1.0	Nov 15, 2018		Sediment	S18-No21581	X					
28	OSA-SED16-	Nov 15, 2018		Sediment	S18-No21582	X					

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 16, 2018 2:09 PM
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	Sydney	**Phone:**	02 8245 0300	**Priority:**	6 Day
	NSW 2000	**Fax:**		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
29	OSA-SED16-1.05-1.15	Nov 15, 2018		Sediment	S18-No21583	X					
30	OSA-SED17-0.4-0.5	Nov 15, 2018		Sediment	S18-No21584	X					
31	OSA-SED17-0.9-1.0	Nov 15, 2018		Sediment	S18-No21585	X					
32	OSA-SED18-0.5-0.6	Nov 15, 2018		Sediment	S18-No21586	X					
33	OSA-SED18-0.9-1.0	Nov 15, 2018		Sediment	S18-No21587	X					
34	OSA-SED15-0.7-0.8	Nov 16, 2018		Sediment	S18-No21588	X					
35	OSA-SED11-	Nov 15, 2018		Sediment	S18-No21614	X					

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 16, 2018 2:09 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	628128	**Due:**	Nov 26, 2018
		Phone:	02 8245 0300	**Priority:**	6 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.9-1.0										
Test Counts						17	16	16	2	16	16

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.005			0.005	Pass	
Acenaphthylene	mg/kg	< 0.005			0.005	Pass	
Anthracene	mg/kg	< 0.005			0.005	Pass	
Benz(a)anthracene	mg/kg	< 0.005			0.005	Pass	
Benzo(a)pyrene	mg/kg	< 0.005			0.005	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.005			0.005	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.005			0.005	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.005			0.005	Pass	
Chrysene	mg/kg	< 0.005			0.005	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.005			0.005	Pass	
Fluoranthene	mg/kg	< 0.005			0.005	Pass	
Fluorene	mg/kg	< 0.005			0.005	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.005			0.005	Pass	
Naphthalene	mg/kg	< 0.005			0.005	Pass	
Phenanthrene	mg/kg	< 0.005			0.005	Pass	
Pyrene	mg/kg	< 0.005			0.005	Pass	
Method Blank							
Total Organic Carbon	%	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	125			70-130	Pass	
TRH C10-C14	%	74			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	94			70-130	Pass	
Toluene	%	99			70-130	Pass	
Ethylbenzene	%	96			70-130	Pass	
m&p-Xylenes	%	96			70-130	Pass	
Xylenes - Total	%	96			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			%	76			70-130	Pass	
TRH C6-C10			%	112			70-130	Pass	
TRH >C10-C16			%	81			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons									
Acenaphthene			%	82			70-130	Pass	
Acenaphthylene			%	84			70-130	Pass	
Anthracene			%	76			70-130	Pass	
Benz(a)anthracene			%	99			70-130	Pass	
Benzo(a)pyrene			%	85			70-130	Pass	
Benzo(b&j)fluoranthene			%	78			70-130	Pass	
Benzo(g.h.i)perylene			%	78			70-130	Pass	
Benzo(k)fluoranthene			%	82			70-130	Pass	
Chrysene			%	89			70-130	Pass	
Dibenz(a.h)anthracene			%	82			70-130	Pass	
Fluoranthene			%	103			70-130	Pass	
Fluorene			%	86			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	78			70-130	Pass	
Naphthalene			%	77			70-130	Pass	
Phenanthrene			%	95			70-130	Pass	
Pyrene			%	91			70-130	Pass	
LCS - % Recovery									
Total Organic Carbon			%	81			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-No23221	NCP	%	80			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-No23221	NCP	%	87			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M18-No26066	NCP	%	77			70-130	Pass	
Acenaphthylene	M18-No26066	NCP	%	80			70-130	Pass	
Anthracene	M18-No26066	NCP	%	76			70-130	Pass	
Benz(a)anthracene	M18-No26066	NCP	%	102			70-130	Pass	
Benzo(a)pyrene	M18-No26066	NCP	%	86			70-130	Pass	
Benzo(b&j)fluoranthene	M18-No26066	NCP	%	84			70-130	Pass	
Benzo(g.h.i)perylene	M18-No26066	NCP	%	73			70-130	Pass	
Benzo(k)fluoranthene	M18-No26066	NCP	%	78			70-130	Pass	
Chrysene	M18-No26066	NCP	%	93			70-130	Pass	
Dibenz(a.h)anthracene	M18-No26066	NCP	%	78			70-130	Pass	
Fluoranthene	M18-No26066	NCP	%	100			70-130	Pass	
Fluorene	M18-No26066	NCP	%	83			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M18-No26066	NCP	%	73			70-130	Pass	
Naphthalene	M18-No26066	NCP	%	71			70-130	Pass	
Phenanthrene	M18-No26066	NCP	%	89			70-130	Pass	
Pyrene	M18-No26066	NCP	%	90			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S18-No21456	CP	%	96			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
BTEX				Result 1					
Benzene	S18-No21456	CP	%	93			70-130	Pass	
Toluene	S18-No21456	CP	%	96			70-130	Pass	
Ethylbenzene	S18-No21456	CP	%	100			70-130	Pass	
m&p-Xylenes	S18-No21456	CP	%	97			70-130	Pass	
o-Xylene	S18-No21456	CP	%	106			70-130	Pass	
Xylenes - Total	S18-No21456	CP	%	100			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S18-No21456	CP	%	107			70-130	Pass	
TRH C6-C10	S18-No21456	CP	%	94			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-No25056	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M18-No25056	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M18-No25056	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-No25056	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M18-No26700	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Organic Carbon	S18-No21450	CP	%	3.3	3.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S18-No21455	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S18-No21455	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S18-No21455	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S18-No21455	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S18-No21455	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S18-No21455	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	S18-No21455	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S18-No21455	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S18-No21455	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S18-No21455	CP	%	66	67	<1	30%	Pass	

Comments

Eurofins | mgt accreditation number 1261, corporate site 1254 is currently in progress of a controlled transition to a new custom built location at 6 Monterey Road, Dandenong South, Victoria 3175. All results on this report denoted as being performed by Eurofins | mgt 2-5 Kingston Town Close, Oakleigh Victoria 3166 corporate site 1254, will have been performed on either Oakleigh or new Dandenong South site.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report **628128-W**
Project name WOOLOOWARE
Project ID 54083
Received Date Nov 16, 2018

Client Sample ID			**TS**	**TB**
Sample Matrix			**Water**	**Water**
Eurofins | mgt Sample No.			**S18-No21462**	**S18-No21463**
Date Sampled			**Nov 16, 2018**	**Nov 16, 2018**
Test/Reference	LOR	Unit		
BTEX				
Comments			R20	
Benzene	0.001	mg/L	94	< 0.001
Toluene	0.001	mg/L	87	< 0.001
Ethylbenzene	0.001	mg/L	85	< 0.001
m&p-Xylenes	0.002	mg/L	82	< 0.002
o-Xylene	0.001	mg/L	90	< 0.001
Xylenes - Total	0.003	mg/L	85	< 0.003
4-Bromofluorobenzene (surr.)	1	%	148	118

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B1			
BTEX	Melbourne	Nov 19, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 54083

Order No.:
Report #: 628128
Phone: 02 8245 0300
Fax:

Received: Nov 16, 2018 2:09 PM
Due: Nov 26, 2018
Priority: 6 Day
Contact Name: Chris Bielby

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	OSA-SED02-0.5-0.6	Nov 15, 2018		Sediment	S18-No21446		X	X		X	X
2	OSA-SED03-0.5-0.6	Nov 15, 2018		Sediment	S18-No21447		X	X		X	X
3	OSA-SED04-0.5-0.6	Nov 15, 2018		Sediment	S18-No21448		X	X		X	X
4	OSA-SED05-0.5-0.6	Nov 15, 2018		Sediment	S18-No21449		X	X		X	X
5	OSA-SED06-0.5-0.6	Nov 15, 2018		Sediment	S18-No21450		X	X		X	X
6	OSA-SED11-	Nov 15, 2018		Sediment	S18-No21451		X	X		X	X

eurofins mgt

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Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 54083

Order No.:
Report #: 628128
Phone: 02 8245 0300
Fax:

Received: Nov 16, 2018 2:09 PM
Due: Nov 26, 2018
Priority: 6 Day
Contact Name: Chris Bielby

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
7	OSA-SED12-0.5-0.6	Nov 15, 2018		Sediment	S18-No21452		X	X		X	X
8	OSA-SED14-0-0.1	Nov 15, 2018		Sediment	S18-No21453		X	X		X	X
9	OSA-SED16-0-0.1	Nov 15, 2018		Sediment	S18-No21454		X	X		X	X
10	OSA-SED17-0-0.1	Nov 15, 2018		Sediment	S18-No21455		X	X		X	X
11	OSA-SED18-0-0.1	Nov 15, 2018		Sediment	S18-No21456		X	X		X	X
12	OSA-SED13-0-0.1	Nov 16, 2018		Sediment	S18-No21457		X	X		X	X
13	OSA-SED13-	Nov 16, 2018		Sediment	S18-No21458		X	X		X	X

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

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Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
14	OSA-SED15-0-0.1	Nov 16, 2018		Sediment	S18-No21459		X	X		X	X
15	OSA-SED15-0.5-0.6	Nov 16, 2018		Sediment	S18-No21460		X	X		X	X
16	QC16112018-SED01	Nov 16, 2018		Sediment	S18-No21461		X	X		X	X
17	TS	Nov 16, 2018		Water	S18-No21462				X		
18	TB	Nov 16, 2018		Water	S18-No21463				X		
19	OSA-SED02-0.7-0.8	Nov 15, 2018		Sediment	S18-No21573	X					
20	OSA-SED03-0.6-0.7	Nov 15, 2018		Sediment	S18-No21574	X					
21	OSA-SED04-	Nov 15, 2018		Sediment	S18-No21575	X					

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		Phone:	02 8245 0300	**Priority:**	6 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.6-0.7										
22	OSA-SED05-0.6-0.7	Nov 15, 2018		Sediment	S18-No21576	X					
23	OSA-SED06-0.7-0.8	Nov 15, 2018		Sediment	S18-No21577	X					
24	OSA-SED11-0.6-0.7	Nov 15, 2018		Sediment	S18-No21578	X					
25	OSA-SED12-0.7-0.8	Nov 15, 2018		Sediment	S18-No21579	X					
26	OSA-SED14-0.5-0.6	Nov 15, 2018		Sediment	S18-No21580	X					
27	OSA-SED14-0.9-1.0	Nov 15, 2018		Sediment	S18-No21581	X					
28	OSA-SED16-	Nov 15, 2018		Sediment	S18-No21582	X					

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**	
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	628128
		Phone:	02 8245 0300
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		Priority:	6 Day
		Contact Name:	Chris Bielby

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.5-0.6										
29	OSA-SED16-1.05-1.15	Nov 15, 2018		Sediment	S18-No21583	X					
30	OSA-SED17-0.4-0.5	Nov 15, 2018		Sediment	S18-No21584	X					
31	OSA-SED17-0.9-1.0	Nov 15, 2018		Sediment	S18-No21585	X					
32	OSA-SED18-0.5-0.6	Nov 15, 2018		Sediment	S18-No21586	X					
33	OSA-SED18-0.9-1.0	Nov 15, 2018		Sediment	S18-No21587	X					
34	OSA-SED15-0.7-0.8	Nov 16, 2018		Sediment	S18-No21588	X					
35	OSA-SED11-	Nov 15, 2018		Sediment	S18-No21614	X					

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 16, 2018 2:09 PM
Address:	Level 1, 50 Margaret St	**Report #:**	628128	**Due:**	Nov 26, 2018
	Sydney	**Phone:**	02 8245 0300	**Priority:**	6 Day
	NSW 2000	**Fax:**		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
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Sample Detail						HOLD	Total Organic Carbon	Polycyclic Aromatic Hydrocarbons	BTEX	Moisture Set	Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
	0.9-1.0										
Test Counts						17	16	16	2	16	16

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	112			70-130	Pass	
Toluene	%	108			70-130	Pass	
Ethylbenzene	%	104			70-130	Pass	
m&p-Xylenes	%	103			70-130	Pass	
Xylenes - Total	%	104			70-130	Pass	

Comments

Eurofins | mgt accreditation number 1261, corporate site 1254 is currently in progress of a controlled transition to a new custom built location at 6 Monterey Road, Dandenong South, Victoria 3175. All results on this report denoted as being performed by Eurofins | mgt 2-5 Kingston Town Close, Oakleigh Victoria 3166 corporate site 1254, will have been performed on either Oakleigh or new Dandenong South site.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Melbourne
3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Chris Bielby
Project name:	WOOLOOWARE
Project ID:	54083
COC number:	016770-016771
Turn around time:	6 Day
Date/Time received:	Nov 16, 2018 2:09 PM
Eurofins | mgt reference:	**628128**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 6.1 degrees Celsius.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Additional sample OSA-SED11-0.9-1.0 received and placed on hold.

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8415 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Chris Bielby - cbielby@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

2 of 2

016771

JBS&G

CHAIN OF CUSTODY

PROJECT NO.: 51083	LABORATORY BATCH NO.:
PROJECT NAME: Woolloowure	SAMPLERS: JS
DATE NEEDED BY: STD T/A	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) CBelby @jbsg.com.au; (3) JStaehl @jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

628128

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs (Trace level)	TOC	HOLD	BTEX	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
OSA-SED16-1.05-1.15	Soil	15/11/18		Soil Jar + ice					X				
OSA-SED17-0-0.1	↓	↓		↓		X	X	X					
↓ -0.4-0.5									X				
-0.9-1.0									X				
OSA-SED18-0-0.1						X	X	X					
↓ -0.5-0.6									X				
-0.9-1.0									X				
OSA-SED13-0-0.1		16/11/18				X	X	X					
↓ -0.5-0.6		↓				X	X	X					
OSA-SED15-0-0.1						X	X	X					
↓ -0.5-0.6						X	X	X					
-0.7-0.8									X				
QC16112018-SED01						X	X	X	~~X~~				
TS	Water			2x vials + ice						X			
TB	↓	↓		↓						X			
~~QC16112018-SED01~~						~~X~~	~~X~~	~~X~~					

RELINQUISHED BY:		METHOD OF SHIPMENT:	RECEIVED BY:		FOR RECEIVING LAB USE ONLY:
NAME: J.Staehl	DATE: 16/11/18	CONSIGNMENT NOTE NO.	NAME: Elvis D DATE: 16/11/18		COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF: JBS&G		TRANSPORT CO.	OF: Eurofins		COOLER TEMP 6.1 deg C
NAME:	DATE:	CONSIGNMENT NOTE NO.	NAME:	DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF:		TRANSPORT CO	OF:		COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

016770

JBS&G

CHAIN OF CUSTODY

PROJECT NO.: 54083	LABORATORY BATCH NO.:
PROJECT NAME: Woolooware	SAMPLERS: JS
DATE NEEDED BY: STD T/A	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....CBielby....@jbsg.com.au; (3) ....JStaehl....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs	HOLD	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES: 628128
OSA-SED02-0.5-0.6	Soil	15/11/18		Soil Jar + Ice		X	X		X			
↓ -0.7-0.8	↓	↓		↓				X				
OSA-SED03-0.5-0.6						X	X		X			
↓ -0.6-0.7								X				
OSA-SED04-0.5-0.6						X	X		X			
↓ -0.6-0.7								X				
OSA-SED05-0.5-0.6						X	X		X			
↓ -0.6-0.7								X				
OSA-SED06-0.5-0.6						X	X		X			
↓ -0.7-0.8								X				
OSA-SED11-0.5-0.6						X	X		X			
↓ -0.6-0.7								X				
OSA-SED12-0.5-0.6						X	X		X			
↓ -0.7-0.8								X				
OSA-SED14-0-0.1						X	X		X			
-0.5-0.6								X				
↓ -0.9-1.0								X				
OSA-SED16-0-0.1						X	X		X			
-0.5-0.6								X				

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 16/11/18	CONSIGNMENT NOTE NO.	NAME: Elvis DATE: 16/11/18	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF: JBS&G	TRANSPORT CO.	OF: Eurofins	COOLER TEMP 6.1 deg C
NAME: DATE:	CONSIGNMENT NOTE NO.	NAME: DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF:	TRANSPORT CO	OF:	COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 203550

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Chris Bielby, Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54083, Woolooware**
Number of Samples	1 Sediment, 1 Water
Date samples received	19/10/2018
Date completed instructions received	19/10/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	26/10/2018
Date of Issue	26/10/2018

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Results Approved By
Jeremy Faircloth, Organics Supervisor
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	24/10/2018
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	89

svTRH (C10-C40) in Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	24/10/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	87

PAHs in Soil - Low Level		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	23/10/2018
Naphthalene	mg/kg	0.05
Acenaphthylene	mg/kg	0.07
Acenaphthene	mg/kg	0.05
Fluorene	mg/kg	0.05
Phenanthrene	mg/kg	0.32
Anthracene	mg/kg	0.07
Fluoranthene	mg/kg	1.4
Pyrene	mg/kg	1.4
Benzo(a)anthracene	mg/kg	0.68
Chrysene	mg/kg	0.76
Benzo(b,j+k)fluoranthene	mg/kg	1.3
Benzo(a)pyrene	mg/kg	0.76
Indeno(1,2,3-c,d)pyrene	mg/kg	0.38
Dibenzo(a,h)anthracene	mg/kg	0.1
Benzo(g,h,i)perylene	mg/kg	0.45
Benzo(a)pyrene TEQ calc (zero)	mg/kg	1.1
Benzo(a)pyrene TEQ calc(half)	mg/kg	1.1
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1.1
Total +ve PAH's	mg/kg	7.9
Surrogate p-Terphenyl-d14	%	107

Misc Inorg - Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date prepared	-	26/10/2018
Date analysed	-	26/10/2018
Total Organic Carbon (Combustion)	mg/kg	75,000

Moisture		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date prepared	-	22/10/2018
Date analysed	-	23/10/2018
Moisture	%	45

vTRH(C6-C10)/BTEXN in Water		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	22/10/2018
Date analysed	-	23/10/2018
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	2
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	100
Surrogate toluene-d8	%	95
Surrogate 4-BFB	%	105

svTRH (C10-C40) in Water		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	25/10/2018
Date analysed	-	25/10/2018
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	89

PAHs in Water - Low Level		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	25/10/2018
Date analysed	-	26/10/2018
Naphthalene	µg/L	<0.2
Acenaphthylene	µg/L	<0.1
Acenaphthene	µg/L	<0.1
Fluorene	µg/L	<0.1
Phenanthrene	µg/L	<0.1
Anthracene	µg/L	<0.1
Fluoranthene	µg/L	<0.1
Pyrene	µg/L	<0.1
Benzo(a)anthracene	µg/L	<0.1
Chrysene	µg/L	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2
Benzo(a)pyrene	µg/L	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	70

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-128	Total Carbon or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			24/10/2018	[NT]	[NT]	[NT]	[NT]	24/10/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	93	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	101	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	91	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	117	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
TRH >C_{10}-C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH >C_{16}-C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{34}-C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate o-Terphenyl	%		Org-003	76	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PAHs in Soil - Low Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
Naphthalene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
Acenaphthylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	106	[NT]
Phenanthrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	111	[NT]
Anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	92	[NT]
Benzo(a)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.02	Org-012	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	111	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	82	[NT]	[NT]	[NT]	[NT]	91	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date prepared	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Date analysed	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	[NT]	[NT]	[NT]	[NT]	74	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	103	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	101	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate toluene-d8	%		Org-016	97	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate 4-BFB	%		Org-016	105	[NT]	[NT]	[NT]	[NT]	92	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
Date analysed	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	91	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	91	[NT]
Surrogate o-Terphenyl	%		Org-003	81	[NT]	[NT]	[NT]	[NT]	127	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
Date analysed	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	73	[NT]
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	81	[NT]
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	81	[NT]
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	72	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	79	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	70	[NT]	[NT]	[NT]	[NT]	75	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

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016741

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54083	LABORATORY BATCH NO.:
PROJECT NAME: WOOLOOWARE	SAMPLERS:
DATE NEEDED BY: STD T/A	QC LEVEL: NEPM (2013)
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688	
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) CBIELBY@jbsg.com.au; (3) JSTAEHLI@jbsg.com.au	

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
LOW LEVEL ANALYSES
ALLOW WATER SAMPLES TO SETTLE BEFORE SUB-SAMPLING

	SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	PAH LOW	TRH/BTEX	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
1)	QA18102018-1	SED	18/10		NIL		✓	✓	✓			
2)	QA19102018-1	WATER	18/10				✓	✓				

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 203550
Date Received: 19/10/18
Time Received: 17:35
Received By: MY
Temp: Cool/Ambient 10.1
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: S.TAYLOR DATE: 19/10/18 OF: JBS&G S.Taylor	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Ming Yan Zo DATE: 19/10/18 17:35 OF: EL	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

TOC BY LECO COMBUSTION.

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report **623691-S**
Project name WOOLOOWARE
Project ID 54083
Received Date Oct 19, 2018

Client Sample ID			**OSA SED 01**	**OSA SED 02**	**OSA SED 03**	**OSA SED 04**
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**M18-Oc25895**	**M18-Oc25896**	**M18-Oc25897**	**M18-Oc25898**
Date Sampled			**Oct 17, 2018**	**Oct 17, 2018**	**Oct 17, 2018**	**Oct 17, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	57	52	55	52
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.05	mg/kg	0.12	0.49	0.26	2.6
Benzo(a)pyrene TEQ (medium bound) *	0.05	mg/kg	0.15	0.49	0.28	2.6
Benzo(a)pyrene TEQ (upper bound) *	0.05	mg/kg	0.17	0.49	0.31	2.6
Acenaphthene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.14
Acenaphthylene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Anthracene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.31
Benz(a)anthracene	0.05	mg/kg	0.07	0.28	0.17	1.6
Benzo(a)pyrene	0.05	mg/kg	0.09	0.31	0.19	1.7
Benzo(b&j)fluoranthene[N07]	0.05	mg/kg	0.08	0.27	0.15	1.5
Benzo(g.h.i)perylene	0.05	mg/kg	0.08	0.25	0.15	1.1
Benzo(k)fluoranthene	0.05	mg/kg	0.08	0.27	0.15	1.3
Chrysene	0.05	mg/kg	0.10	0.34	0.20	1.7

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Client Sample ID			OSA SED 01	OSA SED 02	OSA SED 03	OSA SED 04
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			M18-Oc25895	M18-Oc25896	M18-Oc25897	M18-Oc25898
Date Sampled			Oct 17, 2018	Oct 17, 2018	Oct 17, 2018	Oct 17, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Dibenz(a.h)anthracene	0.05	mg/kg	< 0.05	0.07	< 0.05	0.29
Fluoranthene	0.05	mg/kg	0.14	0.64	0.35	3.1
Fluorene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.12
Indeno(1.2.3-cd)pyrene	0.05	mg/kg	0.08	0.27	0.17	1.2
Naphthalene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	0.05	mg/kg	< 0.05	0.14	0.07	0.73
Pyrene	0.05	mg/kg	0.16	0.66	0.39	3.2
Total PAH*	0.05	mg/kg	0.88	3.5	1.99	18.04
2-Fluorobiphenyl (surr.)	1	%	68	63	64	69
p-Terphenyl-d14 (surr.)	1	%	76	70	73	76
Total Organic Carbon	0.1	%	5.7	9.0	5.8	6.6
% Moisture	1	%	69	68	64	66

Client Sample ID			OSA SED 05	OSA SED 06	OSA SED 07	OSA SED 08
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			M18-Oc25899	M18-Oc25900	M18-Oc25901	M18-Oc25902
Date Sampled			Oct 17, 2018	Oct 17, 2018	Oct 18, 2018	Oct 18, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	61	50	62	60
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.05	mg/kg	0.25	0.15	0.35	0.26
Benzo(a)pyrene TEQ (medium bound) *	0.05	mg/kg	0.28	0.18	0.37	0.28
Benzo(a)pyrene TEQ (upper bound) *	0.05	mg/kg	0.30	0.20	0.40	0.31
Acenaphthene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05

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Client Sample ID			OSA SED 05	OSA SED 06	OSA SED 07	OSA SED 08
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**M18-Oc25899**	**M18-Oc25900**	**M18-Oc25901**	**M18-Oc25902**
Date Sampled			**Oct 17, 2018**	**Oct 17, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Anthracene	0.05	mg/kg	< 0.05	< 0.05	0.05	< 0.05
Benz(a)anthracene	0.05	mg/kg	0.14	0.10	0.22	0.17
Benzo(a)pyrene	0.05	mg/kg	0.19	0.11	0.26	0.19
Benzo(b&j)fluoranthene[N07]	0.05	mg/kg	0.15	0.11	0.19	0.16
Benzo(g.h.i)perylene	0.05	mg/kg	0.14	0.09	0.20	0.15
Benzo(k)fluoranthene	0.05	mg/kg	0.15	0.10	0.20	0.16
Chrysene	0.05	mg/kg	0.17	0.12	0.26	0.22
Dibenz(a.h)anthracene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	0.05	mg/kg	0.30	0.21	0.42	0.38
Fluorene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1.2.3-cd)pyrene	0.05	mg/kg	0.17	0.11	0.22	0.15
Naphthalene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	0.05	mg/kg	0.07	< 0.05	0.13	0.12
Pyrene	0.05	mg/kg	0.34	0.22	0.49	0.40
Total PAH*	0.05	mg/kg	1.82	1.17	2.64	2.1
2-Fluorobiphenyl (surr.)	1	%	59	70	58	67
p-Terphenyl-d14 (surr.)	1	%	70	76	67	76
Total Organic Carbon	0.1	%	9.1	5.2	2.9	4.3
% Moisture	1	%	66	64	52	56

Client Sample ID			OSA SED 09	OSA SED 10	OSA SED 11	OSA SED 12
Sample Matrix			**Sediment**	**Sediment**	**Sediment**	**Sediment**
Eurofins | mgt Sample No.			**M18-Oc25903**	**M18-Oc25904**	**M18-Oc25905**	**M18-Oc25906**
Date Sampled			**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	56	56	51	51
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100

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Client Sample ID			OSA SED 09	OSA SED 10	OSA SED 11	OSA SED 12
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			M18-Oc25903	M18-Oc25904	M18-Oc25905	M18-Oc25906
Date Sampled			Oct 18, 2018	Oct 18, 2018	Oct 18, 2018	Oct 18, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.05	mg/kg	< 0.05	0.26	0.18	0.54
Benzo(a)pyrene TEQ (medium bound) *	0.05	mg/kg	0.06	0.29	0.20	0.54
Benzo(a)pyrene TEQ (upper bound) *	0.05	mg/kg	0.12	0.31	0.23	0.54
Acenaphthene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Benz(a)anthracene	0.05	mg/kg	< 0.05	0.19	0.11	0.31
Benzo(a)pyrene	0.05	mg/kg	< 0.05	0.20	0.13	0.36
Benzo(b&j)fluoranthene[N07]	0.05	mg/kg	< 0.05	0.13	0.12	0.24
Benzo(g.h.i)perylene	0.05	mg/kg	< 0.05	0.12	0.11	0.27
Benzo(k)fluoranthene	0.05	mg/kg	< 0.05	0.16	0.11	0.30
Chrysene	0.05	mg/kg	< 0.05	0.26	0.13	0.35
Dibenz(a.h)anthracene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.07
Fluoranthene	0.05	mg/kg	< 0.05	0.36	0.23	0.61
Fluorene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1.2.3-cd)pyrene	0.05	mg/kg	< 0.05	0.11	0.11	0.23
Naphthalene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	0.05	mg/kg	< 0.05	0.14	< 0.05	0.28
Pyrene	0.05	mg/kg	0.06	0.49	0.25	0.74
Total PAH*	0.05	mg/kg	0.06	2.16	1.3	3.76
2-Fluorobiphenyl (surr.)	1	%	64	73	65	62
p-Terphenyl-d14 (surr.)	1	%	75	78	56	68
Total Organic Carbon	0.1	%	1.7	3.4	7.9	5.9
% Moisture	1	%	37	53	64	63

Client Sample ID			OSA SED 13	OSA SED 14	OSA SED 15	QC18102018-1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			M18-Oc25907	M18-Oc25908	M18-Oc25909	M18-Oc25910
Date Sampled			Oct 18, 2018	Oct 18, 2018	Oct 18, 2018	Oct 18, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	160	140	480	< 50
TRH C29-C36	50	mg/kg	52	< 50	130	< 50
TRH C10-36 (Total)	50	mg/kg	212	140	610	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	61	63	56	56

Client Sample ID			OSA SED 13	OSA SED 14	OSA SED 15	QC18102018-1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins | mgt Sample No.			M18-Oc25907	M18-Oc25908	M18-Oc25909	M18-Oc25910
Date Sampled			Oct 18, 2018	Oct 18, 2018	Oct 18, 2018	Oct 18, 2018
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	190	160	540	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	190	160	540	< 100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.05	mg/kg	3.2	1.6	20	0.60
Benzo(a)pyrene TEQ (medium bound) *	0.05	mg/kg	3.2	1.6	20	0.60
Benzo(a)pyrene TEQ (upper bound) *	0.05	mg/kg	3.2	1.6	20	0.60
Acenaphthene	0.05	mg/kg	0.12	< 0.05	0.38	< 0.05
Acenaphthylene	0.05	mg/kg	0.07	0.06	0.72	< 0.05
Anthracene	0.05	mg/kg	0.20	0.19	2.3	< 0.05
Benz(a)anthracene	0.05	mg/kg	1.9	1.2	14	0.38
Benzo(a)pyrene	0.05	mg/kg	2.0	1.1	14	0.39
Benzo(b&j)fluoranthene[N07]	0.05	mg/kg	1.8	0.68	9.5	0.32
Benzo(g.h.i)perylene	0.05	mg/kg	1.2	0.53	6.6	0.21
Benzo(k)fluoranthene	0.05	mg/kg	1.8	0.81	9.8	0.29
Chrysene	0.05	mg/kg	2.0	1.1	13	0.38
Dibenz(a.h)anthracene	0.05	mg/kg	0.45	0.19	2.0	0.07
Fluoranthene	0.05	mg/kg	3.7	2.1	20	0.71
Fluorene	0.05	mg/kg	0.14	0.08	0.66	< 0.05
Indeno(1.2.3-cd)pyrene	0.05	mg/kg	1.4	0.72	7.8	0.31
Naphthalene	0.05	mg/kg	< 0.05	0.05	0.72	< 0.05
Phenanthrene	0.05	mg/kg	0.98	0.74	7.8	0.15
Pyrene	0.05	mg/kg	3.7	2.5	23	0.75
Total PAH*	0.05	mg/kg	21.46	12.05	132.28	3.96
2-Fluorobiphenyl (surr.)	1	%	50	55	68	137
p-Terphenyl-d14 (surr.)	1	%	52	55	75	137
Total Organic Carbon	0.1	%	3.5	2.5	2.9	7.3
% Moisture	1	%	51	34	36	65

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 24, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 24, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 24, 2018	14 Day
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 24, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Polycyclic Aromatic Hydrocarbons	Melbourne	Oct 26, 2018	14 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Total Organic Carbon	Melbourne	Oct 26, 2018	28 Day
- Method: APHA 5310B Total Organic Carbon			
% Moisture	Melbourne	Oct 22, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 19, 2018 5:29 PM
Address:	Level 1, 50 Margaret St	**Report #:**	623691	**Due:**	Oct 26, 2018
	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
Perth Laboratory - NATA Site # 23736										
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	OSA SED 01	Oct 17, 2018		Sediment	M18-Oc25895	X	X	X	X	X
2	OSA SED 02	Oct 17, 2018		Sediment	M18-Oc25896	X	X	X	X	X
3	OSA SED 03	Oct 17, 2018		Sediment	M18-Oc25897	X	X	X	X	X
4	OSA SED 04	Oct 17, 2018		Sediment	M18-Oc25898	X	X	X	X	X
5	OSA SED 05	Oct 17, 2018		Sediment	M18-Oc25899	X	X	X	X	X
6	OSA SED 06	Oct 17, 2018		Sediment	M18-Oc25900	X	X	X	X	X
7	OSA SED 07	Oct 18, 2018		Sediment	M18-Oc25901	X	X	X	X	X
8	OSA SED 08	Oct 18, 2018		Sediment	M18-Oc25902	X	X	X	X	X
9	OSA SED 09	Oct 18, 2018		Sediment	M18-Oc25903	X	X	X	X	X

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Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 19, 2018 5:29 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	623691	**Due:**	Oct 26, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
Perth Laboratory - NATA Site # 23736										
10	OSA SED 10	Oct 18, 2018		Sediment	M18-Oc25904	X	X	X	X	X
11	OSA SED 11	Oct 18, 2018		Sediment	M18-Oc25905	X	X	X	X	X
12	OSA SED 12	Oct 18, 2018		Sediment	M18-Oc25906	X	X	X	X	X
13	OSA SED 13	Oct 18, 2018		Sediment	M18-Oc25907	X	X	X	X	X
14	OSA SED 14	Oct 18, 2018		Sediment	M18-Oc25908	X	X	X	X	X
15	OSA SED 15	Oct 18, 2018		Sediment	M18-Oc25909	X	X	X	X	X
16	QC18102018-1	Oct 18, 2018		Sediment	M18-Oc25910	X	X	X	X	X
Test Counts						16	16	16	16	16

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.05			0.05	Pass	
Acenaphthylene	mg/kg	< 0.05			0.05	Pass	
Anthracene	mg/kg	< 0.05			0.05	Pass	
Benz(a)anthracene	mg/kg	< 0.05			0.05	Pass	
Benzo(a)pyrene	mg/kg	< 0.05			0.05	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.05			0.05	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.05			0.05	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.05			0.05	Pass	
Chrysene	mg/kg	< 0.05			0.05	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.05			0.05	Pass	
Fluoranthene	mg/kg	< 0.05			0.05	Pass	
Fluorene	mg/kg	< 0.05			0.05	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.05			0.05	Pass	
Naphthalene	mg/kg	< 0.05			0.05	Pass	
Phenanthrene	mg/kg	< 0.05			0.05	Pass	
Pyrene	mg/kg	< 0.05			0.05	Pass	
Method Blank							
Total Organic Carbon	%	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	88			70-130	Pass	
TRH C10-C14	%	91			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	88			70-130	Pass	
Toluene	%	90			70-130	Pass	
Ethylbenzene	%	88			70-130	Pass	
m&p-Xylenes	%	89			70-130	Pass	
Xylenes - Total	%	91			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			%	98			70-130	Pass	
TRH C6-C10			%	83			70-130	Pass	
TRH >C10-C16			%	92			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons									
Acenaphthene			%	88			70-130	Pass	
Acenaphthylene			%	88			70-130	Pass	
Anthracene			%	72			70-130	Pass	
Benz(a)anthracene			%	83			70-130	Pass	
Benzo(a)pyrene			%	71			70-130	Pass	
Benzo(b&j)fluoranthene			%	85			70-130	Pass	
Benzo(g.h.i)perylene			%	84			70-130	Pass	
Benzo(k)fluoranthene			%	84			70-130	Pass	
Chrysene			%	85			70-130	Pass	
Dibenz(a.h)anthracene			%	77			70-130	Pass	
Fluoranthene			%	92			70-130	Pass	
Fluorene			%	77			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	88			70-130	Pass	
Naphthalene			%	80			70-130	Pass	
Phenanthrene			%	89			70-130	Pass	
Pyrene			%	119			70-130	Pass	
LCS - % Recovery									
Total Organic Carbon			%	100			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M18-Oc26798	NCP	%	116			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M18-Oc26798	NCP	%	109			70-130	Pass	
Toluene	M18-Oc26798	NCP	%	112			70-130	Pass	
Ethylbenzene	M18-Oc26798	NCP	%	115			70-130	Pass	
m&p-Xylenes	M18-Oc26798	NCP	%	117			70-130	Pass	
o-Xylene	M18-Oc26798	NCP	%	120			70-130	Pass	
Xylenes - Total	M18-Oc26798	NCP	%	118			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M18-Oc26798	NCP	%	120			70-130	Pass	
TRH C6-C10	M18-Oc26798	NCP	%	110			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-Oc25900	CP	%	91			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-Oc25900	CP	%	91			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M18-Oc25909	CP	%	84			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M18-Oc25909	CP	%	84			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Total Organic Carbon	M18-Oc25895	CP	%	5.7	6.3	10	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Oc25898	CP	%	66	62	6.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M18-Oc25899	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M18-Oc25899	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M18-Oc25899	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M18-Oc25899	CP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M18-Oc25899	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M18-Oc25899	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M18-Oc25899	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M18-Oc25899	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M18-Oc25899	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M18-Oc25899	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M18-Oc25899	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M18-Oc25899	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M18-Oc25899	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M18-Oc25899	CP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M18-Oc25899	CP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Acenaphthylene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Anthracene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Benz(a)anthracene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Benzo(a)pyrene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Benzo(b&j)fluoranthene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Benzo(g.h.i)perylene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Benzo(k)fluoranthene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Chrysene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dibenz(a.h)anthracene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Fluoranthene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Fluorene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Naphthalene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Phenanthrene	M18-Oc25903	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Pyrene	M18-Oc25903	CP	mg/kg	0.06	0.05	2.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M18-Oc25908	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M18-Oc25908	CP	mg/kg	140	83	54	30%	Fail	Q15
TRH C29-C36	M18-Oc25908	CP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M18-Oc25908	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M18-Oc25908	CP	mg/kg	160	110	40	30%	Fail	Q15
TRH >C34-C40	M18-Oc25908	CP	mg/kg	< 100	< 100	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Oc25908	CP	%	34	34	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Chris Bielby
Project name:	WOOLOOWARE
Project ID:	54083
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Oct 19, 2018 5:29 PM
Eurofins | mgt reference:	**623691**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.1 degrees Celsius.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8415 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Chris Bielby - cbielby@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

016738

0403477209

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54083
PROJECT NAME: Wooloowore
DATE NEEDED BY: STD T/A
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) CBielby @jbsg.com.au; (3) JStaehli @jbsg.com.au

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
LOW LEVEL ANALYSES

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	PAH Low Level	TRH/BTEX	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
OSA SED 01	SED	17/10				✓	✓	✓			
" 02	"	"				✓	✓	✓			
" 03	"	"				✓	✓	✓			
" 04	"	"				✓	✓	✓			
" 05	"	"				✓	✓	✓			
" 06	"	"				✓	✓	✓			
" 07	"	18/10				✓	✓	✓			
" 08	"	"				✓	✓	✓			
" 09	"	"				✓	✓	✓			
" 10	"	"				✓	✓	✓			
" 11	"	"				✓	✓	✓			
" 12	"	"				✓	✓	✓			
" 13	"	"				✓	✓	✓			
" 14	"	"				✓	✓	✓			
" 15	"	"				✓	✓	✓			
QC181018-1	"	"				✓	✓	✓			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: S. TAYLOR DATE: 19/10/18	CONSIGNMENT NOTE NO.	NAME: Ulie D. DATE:	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF: ~~JBS&G~~ Cardno	TRANSPORT CO.	OF: Eurofins MGT 6:14 PM	COOLER TEMP .... deg C 9.1°C
NAME: S. Taylor DATE: -	CONSIGNMENT NOTE NO.	NAME: Sulpa Pa... DATE: 22/10	COOLER SEAL – Yes....... No .... Intact .... Broken ....
OF:	TRANSPORT CO	OF: Eurofins MGT 9:00AM	COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

TOC BY LECO COMBUSTION TECHNIQUE.

623691

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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 203550

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Chris Bielby, Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**54083, Woolooware**
Number of Samples	1 Sediment, 1 Water
Date samples received	19/10/2018
Date completed instructions received	19/10/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	26/10/2018
Date of Issue	26/10/2018

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Jeremy Faircloth, Organics Supervisor
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	24/10/2018
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	89

svTRH (C10-C40) in Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	24/10/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	87

PAHs in Soil - Low Level		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date extracted	-	22/10/2018
Date analysed	-	23/10/2018
Naphthalene	mg/kg	0.05
Acenaphthylene	mg/kg	0.07
Acenaphthene	mg/kg	0.05
Fluorene	mg/kg	0.05
Phenanthrene	mg/kg	0.32
Anthracene	mg/kg	0.07
Fluoranthene	mg/kg	1.4
Pyrene	mg/kg	1.4
Benzo(a)anthracene	mg/kg	0.68
Chrysene	mg/kg	0.76
Benzo(b,j+k)fluoranthene	mg/kg	1.3
Benzo(a)pyrene	mg/kg	0.76
Indeno(1,2,3-c,d)pyrene	mg/kg	0.38
Dibenzo(a,h)anthracene	mg/kg	0.1
Benzo(g,h,i)perylene	mg/kg	0.45
Benzo(a)pyrene TEQ calc (zero)	mg/kg	1.1
Benzo(a)pyrene TEQ calc(half)	mg/kg	1.1
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1.1
Total +ve PAH's	mg/kg	7.9
Surrogate p-Terphenyl-d14	%	107

Misc Inorg - Soil		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date prepared	-	26/10/2018
Date analysed	-	26/10/2018
Total Organic Carbon (Combustion)	mg/kg	75,000

Moisture		
Our Reference		203550-1
Your Reference	UNITS	QA18102018-1
Date Sampled		18/10/2018
Type of sample		Sediment
Date prepared	-	22/10/2018
Date analysed	-	23/10/2018
Moisture	%	45

vTRH(C6-C10)/BTEXN in Water		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	22/10/2018
Date analysed	-	23/10/2018
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	2
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	100
Surrogate toluene-d8	%	95
Surrogate 4-BFB	%	105

svTRH (C10-C40) in Water		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	25/10/2018
Date analysed	-	25/10/2018
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Surrogate o-Terphenyl	%	89

PAHs in Water - Low Level		
Our Reference		203550-2
Your Reference	UNITS	QA19102018-1
Date Sampled		18/10/2018
Type of sample		Water
Date extracted	-	25/10/2018
Date analysed	-	26/10/2018
Naphthalene	µg/L	<0.2
Acenaphthylene	µg/L	<0.1
Acenaphthene	µg/L	<0.1
Fluorene	µg/L	<0.1
Phenanthrene	µg/L	<0.1
Anthracene	µg/L	<0.1
Fluoranthene	µg/L	<0.1
Pyrene	µg/L	<0.1
Benzo(a)anthracene	µg/L	<0.1
Chrysene	µg/L	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2
Benzo(a)pyrene	µg/L	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	70

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-128	Total Carbon or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			24/10/2018	[NT]	[NT]	[NT]	[NT]	24/10/2018	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	93	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	101	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	91	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	117	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	115	[NT]
Surrogate o-Terphenyl	%		Org-003	76	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PAHs in Soil - Low Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
Naphthalene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
Acenaphthylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	106	[NT]
Phenanthrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	111	[NT]
Anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	92	[NT]
Benzo(a)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.02	Org-012	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	111	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	82	[NT]	[NT]	[NT]	[NT]	91	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-6	[NT]
Date prepared	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Date analysed	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	[NT]	[NT]	[NT]	[NT]	74	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			22/10/2018	[NT]	[NT]	[NT]	[NT]	22/10/2018	[NT]
Date analysed	-			23/10/2018	[NT]	[NT]	[NT]	[NT]	23/10/2018	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	103	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	101	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate toluene-d8	%		Org-016	97	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate 4-BFB	%		Org-016	105	[NT]	[NT]	[NT]	[NT]	92	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
Date analysed	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	91	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	88	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	91	[NT]
Surrogate o-Terphenyl	%		Org-003	81	[NT]	[NT]	[NT]	[NT]	127	[NT]

QUALITY CONTROL: PAHs in Water - Low Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			25/10/2018	[NT]	[NT]	[NT]	[NT]	25/10/2018	[NT]
Date analysed	-			26/10/2018	[NT]	[NT]	[NT]	[NT]	26/10/2018	[NT]
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	73	[NT]
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	81	[NT]
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	81	[NT]
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	72	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	79	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	70	[NT]	[NT]	[NT]	[NT]	75	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

0403977209

016741

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 54083	LABORATORY BATCH NO.:
PROJECT NAME: WOOLOOWARE	SAMPLERS:
DATE NEEDED BY: STD T/A	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) CBIELBY @jbsg.com.au; (3) JSTAEHLI @jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
LOW LEVEL ANALYSES
ALLOW WATER SAMPLES TO SETTLE BEFORE SUB-SAMPLING

	SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	PAH LOW	TRH/BTEX	TOC	IDENTIFICATION	NEPM/WA	NOTES:
1)	QA18102018-1	SED	18/10		NIL		✓	✓	✓			
2)	QA19102018-1	WATER	18/10				✓	✓				

TYPE OF ASBESTOS ANALYSIS

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 203550
Date Received: 19/10/18
Time Received: 17:35
Received By: MT
Temp: Cool/Ambient 10.1
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: S.TAYLOR DATE: 19/10/18 ~~OF: JBS&G~~ S.Taylor	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Ming Yan Zo DATE: 19/10/18 17:35 OF: EL	COOLER SEAL – Yes...... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes...... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

IMSO FormsO13 – Chain of Custody - Generic

TOC BY LECO COMBUSTION.

eurofins | mgt

30 years Testing For Life 1987–2017
Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Chris Bielby**

Report **623693-W**
Project name WOOLOOWARE
Project ID 54083
Received Date Oct 19, 2018

Client Sample ID **Sample Matrix** **Eurofins | mgt Sample No.** **Date Sampled** Test/Reference	LOR	Unit	**OSA PW 01** **Water** **M18-Oc25927** **Oct 17, 2018**	**OSA PW 02** **Water** **M18-Oc25928** **Oct 17, 2018**	**OSA PW 03** **Water** **M18-Oc25929** **Oct 17, 2018**	**OSA PW 04** **Water** **M18-Oc25930** **Oct 17, 2018**
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	0.002	0.002	0.001	0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	118	119	100	106
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00002
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	0.00002	0.00004
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	0.00003	0.00005
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	0.00002	0.00004	0.00006
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	0.00001	0.00003	0.00005
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	0.00001	0.00004	0.00006
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	0.00004	0.00005
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	0.00001	0.00006	0.00006
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00001

eurofins | mgt

Client Sample ID			OSA PW 01	OSA PW 02	OSA PW 03	OSA PW 04
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25927**	**M18-Oc25928**	**M18-Oc25929**	**M18-Oc25930**
Date Sampled			**Oct 17, 2018**	**Oct 17, 2018**	**Oct 17, 2018**	**Oct 17, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	0.00003	0.00005
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00002
Pyrene	0.00001	mg/L	0.00002	0.00003	0.00008	0.00010
Total PAH*	0.00001	mg/L	0.00002	0.00008	0.00037	0.00059
2-Fluorobiphenyl (surr.)	1	%	52	62	73	70
p-Terphenyl-d14 (surr.)	1	%	61	76	102	96

Client Sample ID			OSA PW 05	OSA PW 06	OSA PW 07	OSA PW 08
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25931**	**M18-Oc25932**	**M18-Oc25933**	**M18-Oc25934**
Date Sampled			**Oct 17, 2018**	**Oct 17, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.001
Toluene	0.001	mg/L	0.001	0.001	0.001	0.005
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	100	107	107	109
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	0.00001	0.00001
Benzo(a)pyrene	0.00001	mg/L	0.00002	0.00002	0.00003	0.00003
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00003	0.00002	0.00003	0.00004
Benzo(g.h.i)perylene	0.00001	mg/L	0.00002	0.00002	0.00002	0.00003
Benzo(k)fluoranthene	0.00001	mg/L	0.00002	0.00002	0.00003	0.00004
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	0.00002	0.00002
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	0.00001	0.00002	0.00004	0.00004

eurofins | mgt

Client Sample ID			OSA PW 05	OSA PW 06	OSA PW 07	OSA PW 08
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25931**	**M18-Oc25932**	**M18-Oc25933**	**M18-Oc25934**
Date Sampled			**Oct 17, 2018**	**Oct 17, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00003	0.00001	0.00002	0.00002
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	0.00002	0.00003	0.00006	0.00006
Total PAH*	0.00001	mg/L	0.00015	0.00014	0.00026	0.00029
2-Fluorobiphenyl (surr.)	1	%	78	63	87	101
p-Terphenyl-d14 (surr.)	1	%	94	74	126	129

Client Sample ID			OSA PW 09	OSA PW 10	OSA PW 11	OSA PW 12
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25935**	**M18-Oc25936**	**M18-Oc25937**	**M18-Oc25938**
Date Sampled			**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	0.002	0.005	0.003	0.004
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	105	81	108	112
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00001	0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	0.00003	0.00003	0.00002	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00004	0.00004	0.00002	0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	0.00003	0.00003	0.00003	0.00001
Benzo(k)fluoranthene	0.00001	mg/L	0.00004	0.00004	0.00002	0.00001
Chrysene	0.00001	mg/L	0.00002	0.00002	< 0.00001	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Client Sample ID			OSA PW 09	OSA PW 10	OSA PW 11	OSA PW 12
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25935**	**M18-Oc25936**	**M18-Oc25937**	**M18-Oc25938**
Date Sampled			**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Fluoranthene	0.00001	mg/L	0.00004	0.00004	0.00002	0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00003	0.00003	0.00002	0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	0.00005	0.00006	0.00004	0.00002
Total PAH*	0.00001	mg/L	0.00029	0.0003	0.00017	0.00007
2-Fluorobiphenyl (surr.)	1	%	88	106	94	93
p-Terphenyl-d14 (surr.)	1	%	121	137	119	131

Client Sample ID			OSA PW 13	OSA PW 14	OSA PW 15	QC 19102018-1
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25939**	**M18-Oc25940**	**M18-Oc25941**	**M18-Oc25942**
Date Sampled			**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	0.007	0.003	0.002	0.003
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	113	116	116	111
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	0.00001	0.00003	0.00001	0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00001	0.00003	0.00002	0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	0.00002	0.00003	< 0.00001	0.00001
Benzo(k)fluoranthene	0.00001	mg/L	0.00001	0.00003	0.00002	0.00001
Chrysene	0.00001	mg/L	< 0.00001	0.00001	< 0.00001	< 0.00001

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Client Sample ID			OSA PW 13	OSA PW 14	OSA PW 15	QC 19102018-1
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25939**	**M18-Oc25940**	**M18-Oc25941**	**M18-Oc25942**
Date Sampled			**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**	**Oct 18, 2018**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	0.00002	< 0.00001	0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00001	0.00002	< 0.00001	0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	0.00002	0.00005	0.00003	0.00003
Total PAH*	0.00001	mg/L	0.00008	0.00022	0.00008	0.00009
2-Fluorobiphenyl (surr.)	1	%	89	90	90	96
p-Terphenyl-d14 (surr.)	1	%	122	109	135	128

Client Sample ID			TRIP BLANK	[R20]TRIP SPIKE
Sample Matrix			**Water**	**Water**
Eurofins | mgt Sample No.			**M18-Oc25943**	**M18-Oc25944**
Date Sampled			**Oct 19, 2018**	**Oct 19, 2018**
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
Naphthalene[N02]	0.01	mg/L	< 0.01	100
TRH C6-C10	0.02	mg/L	< 0.02	85
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	0.02	mg/L	< 0.02	85
BTEX				
Benzene	0.001	mg/L	< 0.001	110
Toluene	0.001	mg/L	< 0.001	110
Ethylbenzene	0.001	mg/L	< 0.001	110
m&p-Xylenes	0.002	mg/L	< 0.002	110
o-Xylene	0.001	mg/L	< 0.001	120
Xylenes - Total	0.003	mg/L	< 0.003	110
4-Bromofluorobenzene (surr.)	1	%	108	127

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 23, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons	Melbourne	Oct 23, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 24, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 23, 2018	14 Day
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 24, 2018	7 Day
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 24, 2018	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 19, 2018 5:29 PM
Address:	Level 1, 50 Margaret St	**Report #:**	623693	**Due:**	Oct 26, 2018
	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						BTEX	Total Recoverable Hydrocarbons	BTEXN and Volatile TRH	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	OSA PW 01	Oct 17, 2018		Water	M18-Oc25927	X	X		X
2	OSA PW 02	Oct 17, 2018		Water	M18-Oc25928	X	X		X
3	OSA PW 03	Oct 17, 2018		Water	M18-Oc25929	X	X		X
4	OSA PW 04	Oct 17, 2018		Water	M18-Oc25930	X	X		X
5	OSA PW 05	Oct 17, 2018		Water	M18-Oc25931	X	X		X
6	OSA PW 06	Oct 17, 2018		Water	M18-Oc25932	X	X		X
7	OSA PW 07	Oct 18, 2018		Water	M18-Oc25933	X	X		X
8	OSA PW 08	Oct 18, 2018		Water	M18-Oc25934	X	X		X
9	OSA PW 09	Oct 18, 2018		Water	M18-Oc25935	X	X		X

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 19, 2018 5:29 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	623693	**Due:**	Oct 26, 2018
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Chris Bielby
Project Name:	WOOLOOWARE				
Project ID:	54083				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						BTEX	Total Recoverable Hydrocarbons	BTEXN and Volatile TRH	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X
Sydney Laboratory - NATA Site # 18217									
Brisbane Laboratory - NATA Site # 20794									
Perth Laboratory - NATA Site # 23736									
10	OSA PW 10	Oct 18, 2018		Water	M18-Oc25936	X	X		X
11	OSA PW 11	Oct 18, 2018		Water	M18-Oc25937	X	X		X
12	OSA PW 12	Oct 18, 2018		Water	M18-Oc25938	X	X		X
13	OSA PW 13	Oct 18, 2018		Water	M18-Oc25939	X	X		X
14	OSA PW 14	Oct 18, 2018		Water	M18-Oc25940	X	X		X
15	OSA PW 15	Oct 18, 2018		Water	M18-Oc25941	X	X		X
16	QC 19102018-1	Oct 18, 2018		Water	M18-Oc25942	X	X		X
17	TRIP BLANK	Oct 19, 2018		Water	M18-Oc25943			X	
18	TRIP SPIKE	Oct 19, 2018		Water	M18-Oc25944			X	
Test Counts						16	16	2	16

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0			0.00001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	94			70-130	Pass	
TRH C6-C10	%	118			70-130	Pass	
TRH >C10-C16	%	116			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	118			70-130	Pass	
TRH C10-C14	%	128			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	113			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Toluene			%	96			70-130	Pass	
Ethylbenzene			%	88			70-130	Pass	
m&p-Xylenes			%	89			70-130	Pass	
Xylenes - Total			%	90			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene			%	78			70-130	Pass	
Acenaphthylene			%	86			70-130	Pass	
Anthracene			%	90			70-130	Pass	
Benz(a)anthracene			%	102			70-130	Pass	
Benzo(a)pyrene			%	93			70-130	Pass	
Benzo(b&j)fluoranthene			%	76			70-130	Pass	
Benzo(g.h.i)perylene			%	91			70-130	Pass	
Benzo(k)fluoranthene			%	98			70-130	Pass	
Chrysene			%	98			70-130	Pass	
Dibenz(a.h)anthracene			%	84			70-130	Pass	
Fluoranthene			%	96			70-130	Pass	
Fluorene			%	75			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	97			70-130	Pass	
Naphthalene			%	77			70-130	Pass	
Phenanthrene			%	94			70-130	Pass	
Pyrene			%	101			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M18-Oc22543	NCP	%	118			70-130	Pass	
TRH C6-C10	M18-Oc22543	NCP	%	123			70-130	Pass	
TRH >C10-C16	M18-Oc25296	NCP	%	116			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M18-Oc22543	NCP	%	125			70-130	Pass	
TRH C10-C14	M18-Oc25296	NCP	%	126			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M18-Oc22543	NCP	%	99			70-130	Pass	
Toluene	M18-Oc22543	NCP	%	109			70-130	Pass	
Ethylbenzene	M18-Oc22543	NCP	%	110			70-130	Pass	
m&p-Xylenes	M18-Oc22543	NCP	%	114			70-130	Pass	
o-Xylene	M18-Oc22543	NCP	%	112			70-130	Pass	
Xylenes - Total	M18-Oc22543	NCP	%	114			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Acenaphthene	P18-Oc24212	NCP	%	70			70-130	Pass	
Acenaphthylene	P18-Oc24212	NCP	%	87			70-130	Pass	
Anthracene	P18-Oc24212	NCP	%	72			70-130	Pass	
Benz(a)anthracene	P18-Oc24212	NCP	%	86			70-130	Pass	
Benzo(a)pyrene	P18-Oc24212	NCP	%	86			70-130	Pass	
Benzo(b&j)fluoranthene	P18-Oc24212	NCP	%	85			70-130	Pass	
Benzo(g.h.i)perylene	P18-Oc24212	NCP	%	85			70-130	Pass	
Benzo(k)fluoranthene	P18-Oc24212	NCP	%	87			70-130	Pass	
Chrysene	P18-Oc24212	NCP	%	85			70-130	Pass	
Dibenz(a.h)anthracene	P18-Oc24212	NCP	%	80			70-130	Pass	
Fluoranthene	P18-Oc24212	NCP	%	82			70-130	Pass	
Fluorene	P18-Oc24212	NCP	%	72			70-130	Pass	

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Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Indeno(1.2.3-cd)pyrene	P18-Oc24212	NCP	%	91			70-130	Pass	
Naphthalene	P18-Oc24212	NCP	%	77			70-130	Pass	
Phenanthrene	P18-Oc24212	NCP	%	75			70-130	Pass	
Pyrene	P18-Oc24212	NCP	%	85			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	P18-Oc24211	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	P18-Oc24211	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	P18-Oc24211	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	P18-Oc24211	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	P18-Oc24211	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	P18-Oc24211	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(a)pyrene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(b&j)fluoranthene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(g.h.i)perylene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(k)fluoranthene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Chrysene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Dibenz(a.h)anthracene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluorene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Naphthalene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Phenanthrene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Pyrene	P18-Oc24211	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M18-Oc25943	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	M18-Oc25943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M18-Oc25943	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M18-Oc25943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	M18-Oc25943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M18-Oc25943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M18-Oc25943	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M18-Oc25943	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	M18-Oc25943	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Nibha Vaidya	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins | mgt shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins | mgt be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Chris Bielby
Project name:	WOOLOOWARE
Project ID:	54083
COC number:	016739
Turn around time:	5 Day
Date/Time received:	Oct 19, 2018 5:29 PM
Eurofins | mgt reference:	**623693**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 9.1 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Notes

TRIP BLANK & TRIP SPIKE COULD NOT BE LOGGED IN FOR PAHll AS THERE WERE ONLY VIALS PRESENT

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8415 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Chris Bielby - cbielby@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

0403977Ō09

016739

CHAIN OF COUNTODY

JBS&G

PROJECT NO.: 54083
PROJECT NAME: WOOLOOWARE
DATE NEEDED BY: STD T/A
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) C.BIELBY @jbsg.com.au; (3) J.STAEHLI @jbsg.com.au

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
LOW LEVEL ANALYSES
ALLOW WATER TO SETTLE BEFORE SUBSAMPLING

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	PAH LOW LEVEL	TRH/BTEX	IDENTIFICATION (TYPE OF ASBESTOS ANALYSIS)	NEPM/WA	NOTES:
OSA PW 01	WATER	17/10				✓	✓			
" 02	"	"				✓	✓			
" 03	"	"				✓	✓			
" 04	"	"				✓	✓			
" 05	"	"				✓	✓			
" 06	"	"				✓	✓			
" 07	"	18/10				✓	✓			
" 08	"	"				✓	✓			
" 09	"	"				✓	✓			
" 10	"	"				✓	✓			
" 11	"	"				✓	✓			
" 12	"	"				✓	✓			
" 13	"	"				✓	✓			
" 14	"	"				✓	✓			
" 15	"	"				✓	✓			
QC 19102018-1	"	18/10				✓	✓			
TRIP BLANK	"	19/10				✓	✓			
TRIP SPIKE	"	19/10				✓	✓			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: S. TAYLOR DATE: 19/10/18 OF: ~~JBS&G~~ CREGUAN	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: [illegible] D DATE: 19-10-18 OF: Envirolab 6:14 PM	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C 9.1°C
NAME: S. Taylor DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: Cossie DATE: 22/10 OF: eurofins 8:45am	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

Report # 623793

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

REPORT OF ANALYSIS

Report No. RN1220440

Client	: JBS&G (NSW & WA) PTY LTD	**Job No.**	: JBSG01/181116
	UNIT 1	**Quote No.**	: QT-02018
	50 MARGARET ST	**Order No.**	: 54083
		Date Received	: 16-NOV-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N18/032351	OSA-OYS-01	BIOTA 15/11/18
N18/032352	OSA-OYS-02	BIOTA 15/11/18
N18/032353	OSA-OYS-03	BIOTA 15/11/18
N18/032354	OSA-OYS-04	BIOTA 15/11/18

Lab Reg No.		**N18/032351**	**N18/032352**	**N18/032353**	**N18/032354**	
Date Sampled		**15-NOV-2018**	**15-NOV-2018**	**15-NOV-2018**	**15-NOV-2018**	
Sample Reference	**Units**	**OSA-OYS-01**	**OSA-OYS-02**	**OSA-OYS-03**	**OSA-OYS-04**	**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluorene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Phenanthrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluoranthene	mg/kg	0.011	0.022	0.017	0.011	NGCMS_1111
Pyrene	mg/kg	0.016	0.027	0.022	0.015	NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Chrysene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02	<0.02	<0.02	<0.02	NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Surrogate: TER-D14	%REC	110	123	117	122	NGCMS_1111
Dates						
Date extracted		26-NOV-2018	26-NOV-2018	26-NOV-2018	26-NOV-2018	
Date analysed		27-NOV-2018	27-NOV-2018	27-NOV-2018	27-NOV-2018	

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

25-JAN-2019

REPORT OF ANALYSIS

Report No. RN1220440

Client	: JBS&G (NSW & WA) PTY LTD UNIT 1 50 MARGARET ST	**Job No.**	: JBSG01/181116
		Quote No.	: QT-02018
		Order No.	: 54083
		Date Received	: 16-NOV-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N18/032355	OSA-OYS-05	BIOTA 15/11/18
N18/032356	OSA-OYS-06	BIOTA 15/11/18
N18/032357	OSA-OYS-07	BIOTA 16/11/18
N18/032358	OSA-OYS-08	BIOTA 16/11/18

Lab Reg No.		**N18/032355**	**N18/032356**	**N18/032357**	**N18/032358**	
Date Sampled		**15-NOV-2018**	**15-NOV-2018**	**16-NOV-2018**	**16-NOV-2018**	
Sample Reference	**Units**	**OSA-OYS-05**	**OSA-OYS-06**	**OSA-OYS-07**	**OSA-OYS-08**	**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluorene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Phenanthrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluoranthene	mg/kg	0.015	0.011	0.013	0.026	NGCMS_1111
Pyrene	mg/kg	0.020	0.015	0.015	0.027	NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Chrysene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02	<0.02	<0.02	<0.02	NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Surrogate: TER-D14	%REC	122	126	124	135	NGCMS_1111
Dates						
Date extracted		26-NOV-2018	26-NOV-2018	26-NOV-2018	26-NOV-2018	
Date analysed		27-NOV-2018	27-NOV-2018	27-NOV-2018	27-NOV-2018	

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

25-JAN-2019

REPORT OF ANALYSIS

Report No. RN1220440

Client	: JBS&G (NSW & WA) PTY LTD	**Job No.**	: JBSG01/181116
	UNIT 1	**Quote No.**	: QT-02018
	50 MARGARET ST	**Order No.**	: 54083
		Date Received	: 16-NOV-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	**Sample Ref**	**Sample Description**
N18/032359	OSA-OYS-09	BIOTA 16/11/18
N18/032360	OSA-OYS-10	BIOTA 16/11/18
N18/032361	OSA-OYS-11	BIOTA 15/11/18
N18/032362	OSA-OYS-12	BIOTA 16/11/18

Lab Reg No.		**N18/032359**	**N18/032360**	**N18/032361**	**N18/032362**	
Date Sampled		**16-NOV-2018**	**16-NOV-2018**	**15-NOV-2018**	**16-NOV-2018**	
Sample Reference	**Units**	**OSA-OYS-09**	**OSA-OYS-10**	**OSA-OYS-11**	**OSA-OYS-12**	**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluorene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Phenanthrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluoranthene	mg/kg	0.019	0.012	0.011	0.014	NGCMS_1111
Pyrene	mg/kg	0.019	0.013	0.016	0.017	NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Chrysene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02	<0.02	<0.02	<0.02	NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Surrogate: TER-D14	%REC	130	138	140	120	NGCMS_1111
Dates						
Date extracted		26-NOV-2018	26-NOV-2018	26-NOV-2018	26-NOV-2018	
Date analysed		27-NOV-2018	27-NOV-2018	27-NOV-2018	27-NOV-2018	

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

25-JAN-2019

REPORT OF ANALYSIS

Report No. RN1220440

Client	: JBS&G (NSW & WA) PTY LTD UNIT 1 50 MARGARET ST	**Job No.**	: JBSG01/181116
		Quote No.	: QT-02018
		Order No.	: 54083
		Date Received	: 16-NOV-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N18/032363	OSA-OYS-13	BIOTA 16/11/18
N18/032364	OSA-OYS-14	BIOTA 16/11/18
N18/032365	OSA-OYS-15	BIOTA 16/11/18
N18/032366	QC-16112018-1	BIOTA 15/11/18

Lab Reg No.		**N18/032363**	**N18/032364**	**N18/032365**	**N18/032366**	
Date Sampled		**16-NOV-2018**	**16-NOV-2018**	**16-NOV-2018**	**15-NOV-2018**	
Sample Reference	**Units**	**OSA-OYS-13**	**OSA-OYS-14**	**OSA-OYS-15**	**QC-16112018-**	**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Acenaphthene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluorene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Phenanthrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Fluoranthene	mg/kg	0.015	0.012	0.023	<0.01	NGCMS_1111
Pyrene	mg/kg	0.017	0.015	0.027	0.012	NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Chrysene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02	<0.02	<0.02	<0.02	NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01	<0.01	NGCMS_1111
Surrogate: TER-D14	%REC	131	132	133	135	NGCMS_1111
Dates						
Date extracted		26-NOV-2018	26-NOV-2018	26-NOV-2018	26-NOV-2018	
Date analysed		27-NOV-2018	27-NOV-2018	27-NOV-2018	27-NOV-2018	

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

25-JAN-2019

REPORT OF ANALYSIS

Report No. RN1220440

Client	: JBS&G (NSW & WA) PTY LTD UNIT 1 50 MARGARET ST	**Job No.**	: JBSG01/181116
		Quote No.	: QT-02018
		Order No.	: 54083
		Date Received	: 16-NOV-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N18/032367	QC-16112018-2	BIOTA 15/11/18

Lab Reg No.		**N18/032367**				
Date Sampled		**15-NOV-2018**				
Sample Reference	**Units**	**QC-16112018-**				**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01				NGCMS_1111
Acenaphthylene	mg/kg	<0.01				NGCMS_1111
Acenaphthene	mg/kg	<0.01				NGCMS_1111
Fluorene	mg/kg	<0.01				NGCMS_1111
Phenanthrene	mg/kg	<0.01				NGCMS_1111
Anthracene	mg/kg	<0.01				NGCMS_1111
Fluoranthene	mg/kg	0.011				NGCMS_1111
Pyrene	mg/kg	0.016				NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01				NGCMS_1111
Chrysene	mg/kg	<0.01				NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02				NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01				NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01				NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01				NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01				NGCMS_1111
Surrogate: TER-D14	%REC	137				NGCMS_1111
Dates						
Date extracted		26-NOV-2018				
Date analysed		27-NOV-2018				

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

25-JAN-2019

REPORT OF ANALYSIS

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1216209*
RN1216243

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government
National Measurement Institute

QUALITY ASSURANCE REPORT

Client: JBS&G (NSW & WA) PTY LTD

NMI QA Report No: JBSG01/181116 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
Organics Section								
PAH				**N18/032351**				**N18/032351**
Naphthalene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	100	113
Acenaphthylene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Acenaphthene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Fluorene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	95	106
Phenanthrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	109	120
Anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Fluoranthene	NGCMS_1111	0.01	<0.01	0.011	0.013	17	-	-
Pyrene	NGCMS_1111	0.01	<0.01	0.016	0.018	12	-	-
Benz[a]anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Chrysene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	112	127
Benzo[b]&[k]fluoranthene	NGCMS_1111	0.02	<0.02	<0.02	<0.02	-	-	-
Benzo[a]pyrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	100	103
Indeno[1_2_3-cd]pyrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Dibenz[ah]anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	104	114
Benzo[ghi]perylene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Surrogate: TER-D14	NGCMS_1111	-	-	110	124	11	86	90

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150% (PAH).
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **6/12/2018**

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

REPORT OF ANALYSIS

Report No. RN1212592

Client	: JBS&G (NSW & WA) PTY LTD	**Job No.**	: JBSG01/181022
	UNIT 1	**Quote No.**	: QT-02018
	50 MARGARET ST	**Order No.**	: 54083
		Date Received	: 22-OCT-2018
Attention	: JESSICA STAEHLI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N18/029729	OSA-OYS-01	BIOTA 18/10/18, 3PM
N18/029730	OSA-OYS-02	BIOTA 18/10/18, 3.20PM
N18/029731	OSA-OYS-03	BIOTA 18/10/18, 3.50PM

Lab Reg No.		**N18/029729**	**N18/029730**	**N18/029731**		
Date Sampled		**18-OCT-2018**	**18-OCT-2018**	**18-OCT-2018**		
Sample Reference	**Units**	**OSA-OYS-01**	**OSA-OYS-02**	**OSA-OYS-03**		**Method**
Polycyclic Aromatic Hydrocarbons						
Naphthalene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Acenaphthylene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Acenaphthene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Fluorene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Phenanthrene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Anthracene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Fluoranthene	mg/kg	0.011	<0.01	<0.01		NGCMS_1111
Pyrene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Benz(a)anthracene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Chrysene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Benzo(b)&(k)fluoranthene	mg/kg	<0.02	<0.02	<0.02		NGCMS_1111
Benzo(a)pyrene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Indeno(1,2,3-cd)pyrene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Dibenzo(a,h)anthracene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Benzo(g,h,i)perylene	mg/kg	<0.01	<0.01	<0.01		NGCMS_1111
Surrogate: TER-D14	%REC	88	72	82		NGCMS_1111
Dates						
Date extracted		25-OCT-2018	25-OCT-2018	25-OCT-2018		
Date analysed		29-OCT-2018	29-OCT-2018	29-OCT-2018		

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

31-OCT-2018

REPORT OF ANALYSIS

Report No. RN1212592

All results are reported on 'as received' basis.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

ACCREDITED FOR TECHNICAL COMPETENCE

This Report supersedes reports: *RN1212591*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government
National Measurement Institute

QUALITY ASSURANCE REPORT

Client: JBS&G (NSW & WA) PTY LTD

NMI QA Report No: JBSG01/181022 **Sample Matrix:** Biota

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
Organics Section								
PAH								
Naphthalene	NGCMS_1111	0.01	<0.01	NA	NA	NA	135	NA
Acenaphthylene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Acenaphthene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Fluorene	NGCMS_1111	0.01	<0.01	NA	NA	NA	133	NA
Phenanthrene	NGCMS_1111	0.01	<0.01	NA	NA	NA	137	NA
Anthracene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Fluoranthene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Pyrene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Benz[a]anthracene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Chrysene	NGCMS_1111	0.01	<0.01	NA	NA	NA	133	NA
Benzo[b]&[k]fluoranthene	NGCMS_1111	0.02	<0.02	NA	NA	NA	-	NA
Benzo[a]pyrene	NGCMS_1111	0.01	<0.01	NA	NA	NA	133	NA
Indeno[1_2_3-cd]pyrene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Dibenz[ah]anthracene	NGCMS_1111	0.01	<0.01	NA	NA	NA	141	NA
Benzo[ghi]perylene	NGCMS_1111	0.01	<0.01	NA	NA	NA	-	NA
Surrogate: TER-D14	NGCMS_1111	-	-	NA	NA	NA	89	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150% (PAH).
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **30/10/2018**

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CERTIFICATE OF ANALYSIS 228610

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**51163, Woolooware**
Number of Samples	2 Sediment, 2 Water
Date samples received	17/10/2019
Date completed instructions received	17/10/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	24/10/2019
Date of Issue	23/10/2019

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Results Approved By
Josh Williams, Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water			
Our Reference		228610-3	228610-4
Your Reference	UNITS	QA15102019-PW1	QA15102019-SW1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Water	Water
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	19/10/2019	19/10/2019
TRH C_6 - C_9	µg/L	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Naphthalene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	104	105
Surrogate toluene-d8	%	98	98
Surrogate 4-BFB	%	105	105

svTRH (C10-C40) in Water			
Our Reference		228610-3	228610-4
Your Reference	UNITS	QA15102019-PW1	QA15102019-SW1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Water	Water
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	19/10/2019	19/10/2019
TRH C_{10} - C_{14}	µg/L	<50	<50
TRH C_{15} - C_{28}	µg/L	120	<100
TRH C_{29} - C_{36}	µg/L	140	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50
TRH >C_{16} - C_{34}	µg/L	210	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100
Surrogate o-Terphenyl	%	79	90

PAHs in Water - Trace Level			
Our Reference		228610-3	228610-4
Your Reference	UNITS	QA15102019-PW1	QA15102019-SW1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Water	Water
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	20/10/2019	20/10/2019
Naphthalene	µg/L	0.03	<0.02
Acenaphthylene	µg/L	0.15	0.02
Acenaphthene	µg/L	0.12	0.08
Fluorene	µg/L	0.12	0.02
Phenanthrene	µg/L	0.92	0.10
Anthracene	µg/L	0.18	0.02
Fluoranthene	µg/L	4.9	0.48
Pyrene	µg/L	4.4	0.40
Benzo(a)anthracene	µg/L	3.1	0.26
Chrysene	µg/L	2.4	0.14
Benzo(b,j+k)fluoranthene	µg/L	5.5	0.36
Benzo(a)pyrene	µg/L	2.6	0.16
Dibenzo(a,h)anthracene	µg/L	0.34	0.02
Indeno(1,2,3-c,d)pyrene	µg/L	1.4	0.08
Benzo(g,h,i)perylene	µg/L	2.0	0.12
Benzo(a)pyrene TEQ	µg/L	4.0	0.25
Total +ve PAH's	µg/L	28	2.3
Surrogate p-Terphenyl-d14	%	133	78

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		228610-1	228610-2
Your Reference	UNITS	QA15102019-SED1	QA16102019-SED1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Sediment	Sediment
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	18/10/2019	18/10/2019
TRH C_6 - C_9	mg/kg	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25
Benzene	mg/kg	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1
m+p-xylene	mg/kg	<2	<2
o-Xylene	mg/kg	<1	<1
naphthalene	mg/kg	<1	<1
Total +ve Xylenes	mg/kg	<3	<3
Surrogate aaa-Trifluorotoluene	%	87	70

svTRH (C10-C40) in Soil			
Our Reference		228610-1	228610-2
Your Reference	UNITS	QA15102019-SED1	QA16102019-SED1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Sediment	Sediment
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	19/10/2019	19/10/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	1,100	<100
TRH C_{29} - C_{36}	mg/kg	900	150
TRH >C_{10} -C_{16}	mg/kg	180	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	180	<50
TRH >C_{16} -C_{34}	mg/kg	1,700	220
TRH >C_{34} -C_{40}	mg/kg	310	<100
Total +ve TRH (>C10-C40)	mg/kg	2,200	220
Surrogate o-Terphenyl	%	#	88

PAHs in Soil - Low Level			
Our Reference		228610-1	228610-2
Your Reference	UNITS	QA15102019-SED1	QA16102019-SED1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Sediment	Sediment
Date extracted	-	18/10/2019	18/10/2019
Date analysed	-	20/10/2019	20/10/2019
Naphthalene	mg/kg	6.2	0.03
Acenaphthylene	mg/kg	19	0.40
Acenaphthene	mg/kg	3.1	0.37
Fluorene	mg/kg	5.3	0.53
Phenanthrene	mg/kg	55	3.2
Anthracene	mg/kg	11	0.70
Fluoranthene	mg/kg	91	7.6
Pyrene	mg/kg	150	6.4
Benzo(a)anthracene	mg/kg	43	3.2
Chrysene	mg/kg	48	3.1
Benzo(b,j+k)fluoranthene	mg/kg	50	2.8
Benzo(a)pyrene	mg/kg	47	3.4
Indeno(1,2,3-c,d)pyrene	mg/kg	20	1.6
Dibenzo(a,h)anthracene	mg/kg	5.3	0.4
Benzo(g,h,i)perylene	mg/kg	30	2.5
Benzo(a)pyrene TEQ calc (zero)	mg/kg	64	4.6
Benzo(a)pyrene TEQ calc(half)	mg/kg	64	4.6
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	64	4.6
Total +ve PAH's	mg/kg	580	36
Surrogate p-Terphenyl-d14	%	103	96

Moisture			
Our Reference		228610-1	228610-2
Your Reference	UNITS	QA15102019-SED1	QA16102019-SED1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Sediment	Sediment
Date prepared	-	18/10/2019	18/10/2019
Date analysed	-	21/10/2019	21/10/2019
Moisture	%	76	72

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.

Method ID	Methodology Summary
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			19/10/2019	[NT]	[NT]	[NT]	[NT]	19/10/2019	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	98	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	103	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate toluene-d8	%		Org-016	97	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate 4-BFB	%		Org-016	105	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			19/10/2019	[NT]	[NT]	[NT]	[NT]	19/10/2019	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	129	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	106	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	129	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	106	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate o-Terphenyl	%		Org-003	130	[NT]	[NT]	[NT]	[NT]	130	[NT]

QUALITY CONTROL: PAHs in Water - Trace Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			20/10/2019	[NT]	[NT]	[NT]	[NT]	20/10/2019	[NT]
Naphthalene	µg/L	0.02	Org-012/017	<0.02	[NT]	[NT]	[NT]	[NT]	100	[NT]
Acenaphthylene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Phenanthrene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	72	[NT]
Anthracene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	76	[NT]
Pyrene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	84	[NT]
Benzo(a)anthracene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	70	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.02	Org-012/017	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	78	[NT]
Dibenzo(a,h)anthracene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.01	Org-012/017	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	85	[NT]	[NT]	[NT]	[NT]	81	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	126	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	126	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	132	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	129	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	124	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	123	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	125	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	87	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-4	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			19/10/2019	[NT]	[NT]	[NT]	[NT]	19/10/2019	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	119	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	81	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	119	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	81	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate o-Terphenyl	%		Org-003	77	[NT]	[NT]	[NT]	[NT]	115	[NT]

QUALITY CONTROL: PAHs in Soil - Low Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			18/10/2019	[NT]	[NT]	[NT]	[NT]	18/10/2019	[NT]
Date analysed	-			20/10/2019	[NT]	[NT]	[NT]	[NT]	20/10/2019	[NT]
Naphthalene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Acenaphthylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
Phenanthrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	110	[NT]
Anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	104	[NT]
Benzo(a)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	100	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.02	Org-012	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	106	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.01	Org-012	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	87	[NT]	[NT]	[NT]	[NT]	85	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Report Comments

TRH Soil C10-C40 NEPM - # Percent recovery for the surrogate is not possible to report as the high concentration of analytes in sample 228610-1 have caused interference.

Ken Nguyen

From:	Jessica Staehli <JStaehli@jbsg.com.au>
Sent:	Wednesday, 23 October 2019 3:01 PM
To:	Ken Nguyen
Subject:	RE: Results for Registration 228610 51163, Woolooware
Follow Up Flag:	Follow up
Flag Status:	Flagged

228610-A
Due: 28/10/19
3 day TAT.

Hi Ken,

1,2.

Can I please get total organic carbon analysed on the two sediment samples submitted for analysis on a 3 day turnaround.

Also, would you mind checking if the water samples were allowed to settle prior to sampling (to eliminate potential sediment particles interfering with the water results)? Apologies I forgot to specify on the COC.

Thanks,

Jessica Staehli | Environmental Consultant | JBS&G
Sydney | Melbourne | Adelaide | Bunbury | Brisbane | Canberra | Darwin | Wollongong
Level 1, 50 Margaret Street Sydney NSW 2000
T: 02 8245 0300 | M: 0410 187 644 E: jstaehli@jbsg.com.au | W: www.jbsg.com.au
Contaminated Land | Groundwater Remediation | Environmental Approvals | Auditing and Compliance | Hygiene and Hazardous Materials | Due Diligence and Liability | Stakeholder and Risk Management

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immediately. Use, disclosure or reproduction of this email by anyone other than the intended recipient(s) is strictly prohibited. No representation is made that this email or any attachments
are free of viruses and the recipient is responsible for undertaking appropriate virus scanning. Any advice provided in or attached to this email is subject to limitations.

From: Ken Nguyen <KNguyen@envirolab.com.au>
Sent: Wednesday, 23 October 2019 2:48 PM
To: AdminNSW <adminNSW@jbsg.com.au>; Jessica Staehli <JStaehli@jbsg.com.au>; j.stainlay@jbsg.com.au
Subject: Results for Registration 228610 51163, Woolooware

Please refer to attached for:
a copy of the Certificate of Analysis
a copy of the COC/paperwork received from you
ESDAT Extracts
an Excel or .csv file containing the results
a copy of the Invoice

Please note that a hard copy will not be posted.

Enquiries should be made directly to:
customerservice@envirolab.com.au

How did we do? Send Feedback

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 228610-A

Client Details

Client	JBS & G (NSW & WA) Pty Ltd
Attention	Jessica Staehli
Address	Level 1, 50 Margaret St, Sydney, NSW, 2000

Sample Details

Your Reference	**51163, Woolooware**
Number of Samples	2 Sediment, 2 Water
Date samples received	17/10/2019
Date completed instructions received	23/10/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	28/10/2019
Date of Issue	28/10/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil			
Our Reference		228610-A-1	228610-A-2
Your Reference	UNITS	QA15102019-SED1	QA16102019-SED1
Date Sampled		15/10/2019	16/10/2019
Type of sample		Sediment	Sediment
Date prepared	-	25/10/2019	25/10/2019
Date analysed	-	25/10/2019	25/10/2019
Total Organic Carbon (Combustion)	mg/kg	57,000	39,000

Method ID	Methodology Summary
Inorg-128	Dissolved or Total Carbon or Dissolved or Total Organic/Inorganic Carbon using the combustion method, high temperature catalytic combustion with NDIR.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			25/10/2019	[NT]	[NT]	[NT]	[NT]	25/10/2019	[NT]
Date analysed	-			25/10/2019	[NT]	[NT]	[NT]	[NT]	25/10/2019	[NT]
Total Organic Carbon (Combustion)	mg/kg	100	Inorg-128	<100	[NT]	[NT]	[NT]	[NT]	89	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

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Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

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Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

017031

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 51163	LABORATORY BATCH NO.:
PROJECT NAME: Wolloowave	SAMPLERS: JS
DATE NEEDED BY: STD TIA	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) JStaehli@jbsg.com.au; (3) JStainlay@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
Please allow water samples to settle prior to sampling
Low level detection - 0.0001mg/L in water

SAMPLE ID		MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAH (trace low level)	IDENTIFICATION	NEPM/WA	NOTES:
QA15102019-SED1	1	Sediment	15/10/19	-	Soil Jar + ice		X	X			
QA16102019-SED1	2	↓	16/10/19		↓		X	X			
QA15102019-PW1	3	water	15/10/19		2x200mL amber, 2x vials + ice		X	X			
↓ -SW1	4	↓	↓		↓		X	X			

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 228610
Date Received: 17/10/19
Time Received: 15:28
Received by: CM
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: CLAIRE McKenzie DATE: 17/10/19 15:28 OF: ELS Sydney	COOLER SEAL – Yes...... No .... Intact .... Broken .... COOLER TEMP 6.7 deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes...... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

pg 1 of 7

017024

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: 51163
PROJECT NAME: Wooloowane
DATE NEEDED BY: STD T/A
PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688
SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) jstaehli@jbsg.com.au; (3) jstainlay@jbsg.com.au
COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL: Please let water samples settle upright prior to sampling.

LABORATORY BATCH NO.:
SAMPLERS: JS + JS
QC LEVEL: NEPM (2013)

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAH (low level)	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
OSA2-SED01-0-0.1	sediment	15/10/19	-	Soil Jar + ice		X	X	X			
OSA2-SED01-0.3-0.4											
OSA2-SED01-0.5-0.6						X	X	X			
OSA2-SED01-0.8-0.9											
OSA2-SED01-1.0-1.1											
OSA2-SED01-1.2-1.3											
OSA2-SED02-0-0.1						X	X	X			
0.3-0.4											
0.5-0.6						X	X	X			
0.8-0.9											
1.1-1.2											
1.5-1.6											
OSA2-SED03-0-0.1						X	X	X			
0.3-0.4											
0.6-0.7											
0.9-1.0						X	X	X			
1.2-1.3											
OSA2-SED04-0-0.1						X	X	X			
0.3-0.4											

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Lara D DATE: 17/10/19 OF: Eurofins 18:05 pm	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C 6.95°C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

683343 17/10/19. 6:05pm Joanne

017025

2 of 7

CHAIN OF COUSTODY

JBS&G

PROJECT NO.: as page 1
PROJECT NAME:
DATE NEEDED BY:

LABORATORY BATCH NO.:
SAMPLERS: JS
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) JStaehli@jbsg.com.au; (3) JStainlay@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs (trace level)	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
OSA2-SE004-0.7-0.8	sediment	15/10/19		Soil Jar + ice		X	X	X			
0.9-1.0											
1.4-1.5						X	X	X			
OSA2-SE005-0-0.1											
0.3-0.4											
0.7-0.8											
1.0-1.1						X	X	X			
1.5-1.6											
OSA2-SE006-0-0.1						X	X	X			
0.3-0.4											
0.9-1.0						X	X	X			
1.1-1.2											
1.5-1.6											
OSA2-SE007-0-0.1		16/10/19				X	X	X			
0.3-0.4											
0.7-0.8											
1.0-1.1											
1.5-1.6											
1.8-1.9						X	X	X			

RELINQUISHED BY:
NAME: J.Staehli DATE: 17/10/19
OF: JBS&G
NAME: DATE:
OF:

METHOD OF SHIPMENT:
CONSIGNMENT NOTE NO.
TRANSPORT CO.
CONSIGNMENT NOTE NO.
TRANSPORT CO

RECEIVED BY:
NAME:
DATE:
OF:
NAME: DATE:
OF:

FOR RECEIVING LAB USE ONLY:
COOLER SEAL – Yes....... No .... Intact .... Broken ....
COOLER TEMP .... deg C
COOLER SEAL – Yes....... No .... Intact .... Broken ....
COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

683343 17/10/19 6:05pm Joanne

017026

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: as pg 1	LABORATORY BATCH NO.:
PROJECT NAME:	SAMPLERS:
DATE NEEDED BY:	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs(trace level)	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
OSA2-SED08-0-0.1	Sediment	16/10/19		Soil Jar + ice		X	X	X			
0.3-0.4											
0.8-0.9						X	X	X			
1.5-1.6											
OSA2-SE009-0-0.1						X	X	X			
0.3-0.4											
0.8-0.9						X	X	X			
1.1-1.2											
1.7-1.8											
OSA2-SED10-0-0.1						X	X	X			
0.3-0.4						X	X	X			
0.8-0.9											
1.1-1.2											
1.5-1.6											
1.8-1.9											
OSA2-SED11-0-0.1						X	X	X			
0.3-0.4											
0.8-0.9											
1.0-1.1						X	X	X			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehl DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

*683343 17/10/19 6:05pm Doanne

017027

JBS&G

CHAIN OF CUSTODY

PROJECT NO.: as page 1	LABORATORY BATCH NO.:
PROJECT NAME:	SAMPLERS:
DATE NEEDED BY:	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAH (low level)	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
OSA2-SE012-0-0.1	Sediment	16/10/19		Soil Jar, Ice		X	X	X			
0.3-0.4											
0.7-0.8											
1.0-1.1											
1.2-1.3											
OSA2-SE013-0-0.1						~~X~~	~~X~~	~~X~~			
0.3-0.4											
0.5-0.6											
1.0-1.1											
1.2-1.3											
OSA2-SE014-0-0.1											
0.5-0.6											
0.7-0.8											
1.0-1.1											
1.4-1.5											
1.7-1.8											
OSA2-SE015-0-0.1		17/10/19				X	X	X			
0.3-0.4											
0.7-0.8											

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

683343 17/10/19 6:05pm Joanne

017028

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: as page 1	LABORATORY BATCH NO.:
PROJECT NAME:	SAMPLERS:
DATE NEEDED BY:	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/Btex	PAHs(trace)	TOC	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	NEPM/WA	NOTES:
OSA2-SE015- 1.0-1.1	sediment	17/10/19		Soil Jar + ice		X	X	X			
1.3-1.4											
OSA2-SE016- 0-0.1						X	X	X			
0.4-0.5											
0.7-0.8											
1.0-1.1											
1.6-1.7											
OSA2-SED17-0-0.1						X	X	X			
0.4-0.5						X	X	X			
0.7-0.8											
1.0-1.1											
1.7-1.8											
OSA2-SED18-0-0.1						X	X	X			
0.5-0.6											
1.0-1.1											
1.5-1.6											
OSA2-SE019-0-0.1						X	X	X			
0.4-0.5											
0.8-0.9											

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

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683343 17/10/19 6:05pm Joanne

017029

CHAIN OF CUSTODY

JBS&G

PROJECT NO.: as pg 1
PROJECT NAME:
DATE NEEDED BY:

LABORATORY BATCH NO.:
SAMPLERS:
QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
low level PAH in water
0.0001mg/L detection

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAH (trace)	TOC																	IDENTIFICATION	NEPM/WA	NOTES:
OSA2-SED19-1.0-1.1	sediment	17/10/19		Soil Jar rice																							
1.5-1.6																											
OSA2-PW-01	water	15/10/19		2x200ml amber xvials rice		X	X																				
02				2x200ml amber, 2 xvials rice																							
03																											
04																											
05																											
06																											
07																											
08		16/10/19																									
09																											
10																											
11																											
14																											
15																											
16																											
17																											
18																											
19																											

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J Staehli DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

683343 17/10/19 6:05pm Joanne

017030

CHAIN OF CUSTODY

JBS&G

PROJECT NO.:	LABORATORY BATCH NO.:
PROJECT NAME:	SAMPLERS:
DATE NEEDED BY:	QC LEVEL: NEPM (2013)

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs (trace low)	TOC	BTEX	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
OSA2-SW-02	water	15/10/19		2x100mL amber, 2x vials HCl		X	X					
04												
07		16/10/19										
10												
11												
15		17/10/19										
17												
19												
QC15102019-SED01	sediment	15/10/19		Soil Jar ice		X	X	X				
QC16101019-SED1		16/10/19				X	X	X				
QC15102019-PW1	water	15/10/19		2x200mL amber, 2x vials HCl		X	X					
QC15102019-SW1						X	X					
RINS-1		17/10/19				X	X					
TS		14/10/19		2x vials ice					X			
TB									X			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Sraeldi DATE: 17/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

683343 17/10/19 6:05pm Joanne

Enviro Sample Vic

From: Jessica Staehli <JStaehli@jbsg.com.au>
Sent: Monday, 21 October 2019 1:34 PM
To: Enviro Sample Vic
Subject: RE: Eurofins Sample Receipt Advice - Report 683343 : Site WOOLOOWARE (51163)

Hi Joanne,

Can you also please cancel PAH analysis on OSA2_SW_07 – I'm getting this location re-collected and will send through tomorrow.

Thanks,

Jessica Staehli | Environmental Consultant | JBS&G
Sydney | Melbourne | Adelaide | Bunbury | Brisbane | Canberra | Darwin | Wollongong
Level 1, 50 Margaret Street Sydney NSW 2000
T: 02 8245 0300 | M: 0410 187 644 E: jstaehli@jbsg.com.au | W: www.jbsg.com.au
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From: EnviroSampleVic@eurofins.com <EnviroSampleVic@eurofins.com>
Sent: Friday, 18 October 2019 4:51 PM
To: AdminNSW <adminNSW@jbsg.com.au>
Cc: Jessica Staehli <JStaehli@jbsg.com.au>; Joshua Stainlay <jstainlay@jbsg.com.au>
Subject: Eurofins Sample Receipt Advice - Report 683343 : Site WOOLOOWARE (51163)

Sample not received OSA2_PW_11.
Unable to test TRH/BTEX on sample OSA2_SW_07 as vials not received.
Extra sample received OSA2_PW_07(16/10/19) placed on hold.
Dear Valued Client,

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins Analytical Services Manager as soon as possible to make certain that they get changed.

Regards

Joanne Devine
Sample Receipt

Eurofins | mgt
6 Monterey Road
Dandenong South VIC 3175
AUSTRALIA
Phone:+61 3 8564 5022
Email: Envirosamplevic@eurofins.com
Website:environment.eurofins.com.au

EnviroNote 1079 - PFAS Fingerprinting
EnviroNote 1080 - Total Organofluorine Analysis & PFAS Investigations

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Enviro Sample Vic

From: Jessica Staehli <JStaehli@jbsg.com.au>
Sent: Monday, 21 October 2019 8:54 AM
To: Enviro Sample Vic
Subject: RE: Eurofins Sample Receipt Advice - Report 683343 : Site WOOLOOWARE (51163)

Hi Joanne,

Can you please change the label on sample OSA2_PW_07 taken on 15/10/2019 to OSA2_PW_11 (missing sample), the sample labelled OSA2_PW_07 from 16/10/2019 is the correct one.

Thanks,

Jessica Staehli | Environmental Consultant | JBS&G
Sydney | Melbourne | Adelaide | Bunbury | Brisbane | Canberra | Darwin | Wollongong
Level 1, 50 Margaret Street Sydney NSW 2000
T: 02 8245 0300 | M: 0410 187 644 E: jstaehli@jbsg.com.au | W: www.jbsg.com.au
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From: EnviroSampleVic@eurofins.com <EnviroSampleVic@eurofins.com>
Sent: Friday, 18 October 2019 4:51 PM
To: AdminNSW <adminNSW@jbsg.com.au>
Cc: Jessica Staehli <JStaehli@jbsg.com.au>; Joshua Stainlay <jstainlay@jbsg.com.au>
Subject: Eurofins Sample Receipt Advice - Report 683343 : Site WOOLOOWARE (51163)

Sample not received OSA2_PW_11.
Unable to test TRH/BTEX on sample OSA2_SW_07 as vials not received.
Extra sample received OSA2_PW_07(16/10/19) placed on hold.
Dear Valued Client,

Please find attached a Sample Receipt Advice (SRA), a Summary Sheet and a scanned copy of your Chain-of-Custody (COC). It is important that you check this documentation to ensure that the details are correct such as the Client Job Number, Turn Around Time, any comments in the Notes section and sample numbers as well as the requested analysis. If there are any irregularities then please contact your Eurofins Analytical Services Manager as soon as possible to make certain that they get changed.

Regards

Joanne Devine
Sample Receipt

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AUSTRALIA
Phone:+61 3 8564 5022
Email: Envirosamplevic@eurofins.com
Website:environment.eurofins.com.au

EnviroNote 1079 - PFAS Fingerprinting
EnviroNote 1080 - Total Organofluorine Analysis & PFAS Investigations

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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Jessica Staehli
Project name:	WOOLOOWARE
Project ID:	51163
COC number:	017024-017030
Turn around time:	5 Day
Date/Time received:	Oct 17, 2019 6:05 PM
Eurofins reference:	**683343**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins Sample Receipt : 7 degrees Celsius.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Sample not received OSA2_PW_11. Unable to test TRH/BTEX on sample OSA2_SW_07 as vials not received.
Extra sample received OSA2_PW_07(16/10/19) placed on hold.

Contact notes

If you have any questions with respect to these samples please contact:

Ursula Long on Phone : or by e.mail: UrsulaLong@eurofins.com

Results will be delivered electronically via e.mail to Jessica Staehli - JStaehli@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

eurofins
Environment Testing

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	OSA2_SED01_0-0.1	Oct 15, 2019		Soil	M19-Oc28295			X	X	X	X	X
2	OSA2_SED01_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28296			X	X	X	X	X
3	OSA2_SED02_0-0.1	Oct 15, 2019		Soil	M19-Oc28297			X	X	X	X	X
4	OSA2_SED02_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28298			X	X	X	X	X
5	OSA2_SED03_0-0.1	Oct 15, 2019		Soil	M19-Oc28299			X	X	X	X	X
6	OSA2_SED03	Oct 15, 2019		Soil	M19-Oc28300			X	X	X	X	X

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Melbourne
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NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.9-1.0											
7	OSA2_SED04_0-0.1	Oct 15, 2019		Soil	M19-Oc28301			X	X	X	X	X
8	OSA2_SED04_0.7-0.8	Oct 15, 2019		Soil	M19-Oc28302			X	X	X	X	X
9	OSA2_SED04_1.4-1.5	Oct 15, 2019		Soil	M19-Oc28303			X	X	X	X	X
10	OSA2_SED05_1.0-1.1	Oct 15, 2019		Soil	M19-Oc28304			X	X	X	X	X
11	OSA2_SED06_0-0.1	Oct 15, 2019		Soil	M19-Oc28305			X	X	X	X	X
12	OSA2_SED06_0.9-1.0	Oct 15, 2019		Soil	M19-Oc28306			X	X	X	X	X
13	OSA2_SED07	Oct 16, 2019		Soil	M19-Oc28307			X	X	X	X	X

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Environment Testing

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NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 17, 2019 6:05 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	683343	**Due:**	Oct 24, 2019
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
14	OSA2_SED07_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28308			X	X	X	X	X
15	OSA2_SED08_0-0.1	Oct 16, 2019		Soil	M19-Oc28309			X	X	X	X	X
16	OSA2_SED08_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28310			X	X	X	X	X
17	OSA2_SED09_0-0.1	Oct 16, 2019		Soil	M19-Oc28311			X	X	X	X	X
18	OSA2_SED09_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28312			X	X	X	X	X
19	OSA2_SED10_0-0.1	Oct 16, 2019		Soil	M19-Oc28313			X	X	X	X	X
20	OSA2_SED10	Oct 16, 2019		Soil	M19-Oc28314			X	X	X	X	X

ABN – 50 005 085 521
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NATA # 1261 Site # 20794

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Project Name: WOOLOOWARE
Project ID: 51163

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.3-0.4											
21	OSA2_SED11_0-0.1	Oct 16, 2019		Soil	M19-Oc28315			X	X	X	X	X
22	OSA2_SED11_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28316			X	X	X	X	X
23	OSA2_SED12_0-0.1	Oct 16, 2019		Soil	M19-Oc28317			X	X	X	X	X
24	OSA2_SED15_0-0.1	Oct 17, 2019		Soil	M19-Oc28318			X	X	X	X	X
25	OSA2_SED15_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28319			X	X	X	X	X
26	OSA2_SED16_0-0.1	Oct 17, 2019		Soil	M19-Oc28320			X	X	X	X	X
27	OSA2_SED17	Oct 17, 2019		Soil	M19-Oc28321			X	X	X	X	X

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Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
28	OSA2_SED17 _0.4-0.5	Oct 17, 2019		Soil	M19-Oc28322			X	X	X	X	X
29	OSA2_SED18 _0-0.1	Oct 17, 2019		Soil	M19-Oc28323			X	X	X	X	X
30	OSA2_SED19 _0-0.1	Oct 17, 2019		Soil	M19-Oc28324			X	X	X	X	X
31	OSA2_PW_01	Oct 15, 2019		Water	M19-Oc28325				X		X	X
32	OSA2_PW_02	Oct 15, 2019		Water	M19-Oc28326				X		X	X
33	OSA2_PW_03	Oct 15, 2019		Water	M19-Oc28327				X		X	X
34	OSA2_PW_04	Oct 15, 2019		Water	M19-Oc28328				X		X	X
35	OSA2_PW_05	Oct 15, 2019		Water	M19-Oc28329				X		X	X
36	OSA2_PW_06	Oct 15, 2019		Water	M19-Oc28330				X		X	X

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Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**	
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	683343
		Phone:	02 8245 0300
		Fax:	
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Eurofins Analytical Services Manager : Ursula Long

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
37	OSA2_PW_11	Oct 15, 2019		Water	M19-Oc28331				X		X	X
38	OSA2_PW_08	Oct 16, 2019		Water	M19-Oc28332				X		X	X
39	OSA2_PW_09	Oct 16, 2019		Water	M19-Oc28333				X		X	X
40	OSA2_PW_10	Oct 16, 2019		Water	M19-Oc28334				X		X	X
41	OSA2_PW_14	Oct 16, 2019		Water	M19-Oc28335				X		X	X
42	OSA2_PW_15	Oct 16, 2019		Water	M19-Oc28336				X		X	X
43	OSA2_PW_16	Oct 16, 2019		Water	M19-Oc28337				X		X	X
44	OSA2_PW_17	Oct 16, 2019		Water	M19-Oc28338				X		X	X
45	OSA2_PW_18	Oct 16, 2019		Water	M19-Oc28339				X		X	X
46	OSA2_PW_19	Oct 16, 2019		Water	M19-Oc28340				X		X	X
47	OSA2_SW_02	Oct 15, 2019		Water	M19-Oc28341				X		X	X
48	OSA2_SW_04	Oct 15, 2019		Water	M19-Oc28342				X		X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
49	OSA2_SW_07	Oct 16, 2019		Water	M19-Oc28343	X						
50	OSA2_SW_10	Oct 16, 2019		Water	M19-Oc28344				X		X	X
51	OSA2_SW_11	Oct 16, 2019		Water	M19-Oc28345				X		X	X
52	OSA2_SW_15	Oct 17, 2019		Water	M19-Oc28346				X		X	X
53	OSA2_SW_17	Oct 17, 2019		Water	M19-Oc28347				X		X	X
54	OSA2_SW_19	Oct 17, 2019		Water	M19-Oc28348				X		X	X
55	QC15102019_SED01	Oct 15, 2019		Soil	M19-Oc28349			X	X	X	X	X
56	QC16102019_SED01	Oct 16, 2019		Soil	M19-Oc28350			X	X	X	X	X
57	QC15102019_PW1	Oct 15, 2019		Water	M19-Oc28351				X		X	X
58	QC15102019_	Oct 15, 2019		Water	M19-Oc28352				X		X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	SW1											
59	RINS_1	Oct 17, 2019		Water	M19-Oc28353				X		X	X
60	TS	Oct 17, 2019		Water	M19-Oc28354				X			
61	TB	Oct 17, 2019		Water	M19-Oc28355				X			
62	OSA2_SED01 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28356		X					
63	OSA2_SED01 _0.8-0.9	Oct 15, 2019		Soil	M19-Oc28357		X					
64	OSA2_SED01 _1.0-1.1	Oct 15, 2019		Soil	M19-Oc28358		X					
65	OSA2_SED01 _1.2-1.3	Oct 15, 2019		Soil	M19-Oc28359		X					
66	OSA2_SED02 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28360		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
67	OSA2_SED02_0.8-0.9	Oct 15, 2019		Soil	M19-Oc28361		X					
68	OSA2_SED02_1.1-1.2	Oct 15, 2019		Soil	M19-Oc28362		X					
69	OSA2_SED02_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28363		X					
70	OSA2_SED03_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28364		X					
71	OSA2_SED03_0.6-0.7	Oct 15, 2019		Soil	M19-Oc28365		X					
72	OSA2_SED03_1.2-1.3	Oct 15, 2019		Soil	M19-Oc28366		X					
73	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28367		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
74	OSA2_SED04_0.9-1.0	Oct 15, 2019		Soil	M19-Oc28368		X					
75	OSA2_SED05_0-0.1	Oct 15, 2019		Soil	M19-Oc28369		X					
76	OSA2_SED05_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28370		X					
77	OSA2_SED05_0.7-0.8	Oct 15, 2019		Soil	M19-Oc28371		X					
78	OSA2_SED05_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28372		X					
79	OSA2_SED06_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28373		X					
80	OSA2_SED06_1.1-1.2	Oct 15, 2019		Soil	M19-Oc28374		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
81	OSA2_SED06_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28375		X					
82	OSA2_SED07_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28376		X					
83	OSA2_SED07_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28377		X					
84	OSA2_SED07_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28378		X					
85	OSA2_SED07_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28379		X					
86	OSA2_SED08_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28380		X					
87	OSA2_SED08_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28381		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
88	OSA2_SED09_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28382		X					
89	OSA2_SED09_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28383		X					
90	OSA2_SED09_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28384		X					
91	OSA2_SED10_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28385		X					
92	OSA2_SED10_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28386		X					
93	OSA2_SED10_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28387		X					
94	OSA2_SED10_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28388		X					

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Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
95	OSA2_SED11_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28389		X					
96	OSA2_SED11_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28390		X					
97	OSA2_SED12_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28391		X					
98	OSA2_SED12_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28392		X					
99	OSA2_SED12_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28393		X					
100	OSA2_SED12_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28394		X					
101	OSA2_SED13_0-0.1	Oct 16, 2019		Soil	M19-Oc28395		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
102	OSA2_SED13_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28396		X					
103	OSA2_SED13_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28397		X					
104	OSA2_SED13_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28398		X					
105	OSA2_SED13_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28399		X					
106	OSA2_SED14_0-0.1	Oct 16, 2019		Soil	M19-Oc28400		X					
107	OSA2_SED14_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28401		X					
108	OSA2_SED14_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28402		X					

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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Murarrie QLD 4172
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NATA # 1261 Site # 20794

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NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 17, 2019 6:05 PM
Address:	Level 1, 50 Margaret St	**Report #:**	683343	**Due:**	Oct 24, 2019
	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
109	OSA2_SED14_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28403		X					
110	OSA2_SED14_1.4-1.5	Oct 16, 2019		Soil	M19-Oc28404		X					
111	OSA2_SED14_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28405		X					
112	OSA2_SED15_0.3-0.4	Oct 17, 2019		Soil	M19-Oc28406		X					
113	OSA2_SED15_0.7-0.8	Oct 17, 2019		Soil	M19-Oc28407		X					
114	OSA2_SED15_1.3-1.4	Oct 17, 2019		Soil	M19-Oc28408		X					
115	OSA2_SED16_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28409		X					

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Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Project Name: WOOLOOWARE
Project ID: 51163

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
116	OSA2_SED16 _0.7-0.8	Oct 17, 2019		Soil	M19-Oc28410		X					
117	OSA2_SED16 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28411		X					
118	OSA2_SED16 _1.6-1.7	Oct 17, 2019		Soil	M19-Oc28412		X					
119	OSA2_SED17 _0.7-0.8	Oct 17, 2019		Soil	M19-Oc28413		X					
120	OSA2_SED17 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28414		X					
121	OSA2_SED17 _1.7-1.8	Oct 17, 2019		Soil	M19-Oc28415		X					
122	OSA2_SED18 _0.5-0.6	Oct 17, 2019		Soil	M19-Oc28416		X					

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 17, 2019 6:05 PM
Address:	Level 1, 50 Margaret St	**Report #:**	683343	**Due:**	Oct 24, 2019
	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
123	OSA2_SED18 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28417		X					
124	OSA2_SED18 _1.5-1.6	Oct 17, 2019		Soil	M19-Oc28418		X					
125	OSA2_SED19 _0.4-0.5	Oct 17, 2019		Soil	M19-Oc28419		X					
126	OSA2_SED19 _0.8-0.9	Oct 17, 2019		Soil	M19-Oc28420		X					
127	OSA2_SED19 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28421		X					
128	OSA2_SED19 _1.5-1.6	Oct 17, 2019		Soil	M19-Oc28422		X					
129	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc28423		X					
Test Counts						1	68	32	60	32	58	58

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Environment Testing

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Jessica Staehli**

Report **683343-S**
Project name WOOLOOWARE
Project ID 51163
Received Date Oct 17, 2019

Client Sample ID			**OSA2_SED01_ 0-0.1**	**OSA2_SED01_ 0.5-0.6**	**OSA2_SED02_ 0-0.1**	**OSA2_SED02_ 0.5-0.6**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc28295**	**M19-Oc28296**	**M19-Oc28297**	**M19-Oc28298**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	460	< 50	140	< 50
TRH C29-C36	50	mg/kg	260	< 50	92	< 50
TRH C10-C36 (Total)	50	mg/kg	720	< 50	232	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	102	92	80	73
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	620	< 100	190	< 100
TRH >C34-C40	100	mg/kg	110	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	730	< 100	190	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	0.91	< 0.005	0.090	< 0.005
Acenaphthylene	0.005	mg/kg	0.79	< 0.005	0.22	< 0.005
Anthracene	0.005	mg/kg	1.8	< 0.005	0.23	< 0.005
Benz(a)anthracene	0.005	mg/kg	12	< 0.005	1.4	< 0.005
Benzo(a)pyrene	0.005	mg/kg	13	< 0.005	1.5	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	11	< 0.005	1.1	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	12	< 0.005	1.2	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	9.9	< 0.005	1.1	< 0.005
Chrysene	0.005	mg/kg	12	< 0.005	1.5	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	5.1	< 0.005	0.37	< 0.005
Fluoranthene	0.005	mg/kg	26	< 0.005	2.7	< 0.005
Fluorene	0.005	mg/kg	1.3	< 0.005	0.13	< 0.005

Client Sample ID			OSA2_SED01_ 0-0.1	OSA2_SED01_ 0.5-0.6	OSA2_SED02_ 0-0.1	OSA2_SED02_ 0.5-0.6
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc28295**	**M19-Oc28296**	**M19-Oc28297**	**M19-Oc28298**
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	9.4	< 0.005	0.73	< 0.005
Naphthalene	0.005	mg/kg	0.12	< 0.005	0.10	< 0.005
Phenanthrene	0.005	mg/kg	9.2	< 0.005	0.82	< 0.005
Pyrene	0.005	mg/kg	23	< 0.005	3.4	< 0.005
Total PAH*	0.005	mg/kg	147.52	< 0.005	16.59	< 0.005
2-Fluorobiphenyl (surr.)	1	%	90	98	95	99
p-Terphenyl-d14 (surr.)	1	%	116	99	113	97
Total Organic Carbon	0.1	%	13	6.9	15	6.9
% Moisture	1	%	69	67	74	67

Client Sample ID			OSA2_SED03_ 0-0.1	OSA2_SED03_ 0.9-1.0	OSA2_SED04_ 0-0.1	OSA2_SED04_ 0.7-0.8
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc28299**	**M19-Oc28300**	**M19-Oc28301**	**M19-Oc28302**
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	160	< 50	53	< 50
TRH C29-C36	50	mg/kg	87	< 50	54	< 50
TRH C10-C36 (Total)	50	mg/kg	247	< 50	107	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	109	96	107	107
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	210	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	210	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	0.15	< 0.005	0.010	< 0.005
Acenaphthylene	0.005	mg/kg	0.31	< 0.005	0.060	< 0.005
Anthracene	0.005	mg/kg	0.41	< 0.005	0.040	< 0.005
Benz(a)anthracene	0.005	mg/kg	1.9	< 0.005	0.19	< 0.005
Benzo(a)pyrene	0.005	mg/kg	2.2	< 0.005	0.18	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	1.3	< 0.005	0.070	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	1.8	< 0.005	0.11	< 0.005

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Client Sample ID			OSA2_SED03_ 0-0.1	OSA2_SED03_ 0.9-1.0	OSA2_SED04_ 0-0.1	OSA2_SED04_ 0.7-0.8
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28299	M19-Oc28300	M19-Oc28301	M19-Oc28302
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Benzo(k)fluoranthene	0.005	mg/kg	1.7	< 0.005	0.22	< 0.005
Chrysene	0.005	mg/kg	2.1	< 0.005	0.21	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	0.38	< 0.005	0.010	< 0.005
Fluoranthene	0.005	mg/kg	4.4	< 0.005	0.32	< 0.005
Fluorene	0.005	mg/kg	0.19	< 0.005	0.020	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	2.1	< 0.005	0.090	< 0.005
Naphthalene	0.005	mg/kg	0.11	< 0.005	0.040	< 0.005
Phenanthrene	0.005	mg/kg	1.8	< 0.005	0.17	< 0.005
Pyrene	0.005	mg/kg	5.5	< 0.005	0.57	< 0.005
Total PAH*	0.005	mg/kg	26.35	< 0.005	2.31	< 0.005
2-Fluorobiphenyl (surr.)	1	%	90	93	95	68
p-Terphenyl-d14 (surr.)	1	%	105	83	103	69
Total Organic Carbon	0.1	%	16	6.1	17	5.6
% Moisture	1	%	69	62	75	64

Client Sample ID			OSA2_SED04_ 1.4-1.5	OSA2_SED05_ 1.0-1.1	OSA2_SED06_ 0-0.1	OSA2_SED06_ 0.9-1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28303	M19-Oc28304	M19-Oc28305	M19-Oc28306
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	< 50	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	116	100	89	114
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	< 100

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Client Sample ID			OSA2_SED04_ 1.4-1.5	OSA2_SED05_ 1.0-1.1	OSA2_SED06_ 0-0.1	OSA2_SED06_ 0.9-1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28303	M19-Oc28304	M19-Oc28305	M19-Oc28306
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	< 0.005	< 0.005	0.030	< 0.005
Acenaphthylene	0.005	mg/kg	< 0.005	< 0.005	0.090	< 0.005
Anthracene	0.005	mg/kg	< 0.005	< 0.005	0.090	< 0.005
Benz(a)anthracene	0.005	mg/kg	< 0.005	< 0.005	0.72	< 0.005
Benzo(a)pyrene	0.005	mg/kg	< 0.005	< 0.005	0.82	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	0.65	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	< 0.005	0.56	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	0.76	< 0.005
Chrysene	0.005	mg/kg	< 0.005	< 0.005	0.87	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	< 0.005	0.060	< 0.005
Fluoranthene	0.005	mg/kg	< 0.005	< 0.005	1.3	< 0.005
Fluorene	0.005	mg/kg	< 0.005	< 0.005	0.040	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	< 0.005	0.66	< 0.005
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	0.040	< 0.005
Phenanthrene	0.005	mg/kg	< 0.005	< 0.005	0.37	< 0.005
Pyrene	0.005	mg/kg	< 0.005	< 0.005	1.5	< 0.005
Total PAH*	0.005	mg/kg	< 0.005	< 0.005	8.56	< 0.005
2-Fluorobiphenyl (surr.)	1	%	90	85	98	92
p-Terphenyl-d14 (surr.)	1	%	80	77	105	86
Total Organic Carbon	0.1	%	4.4	9.9	13	6.3
% Moisture	1	%	57	71	70	54

Client Sample ID			OSA2_SED07_ 0-0.1	OSA2_SED07_ 1.5-1.6	OSA2_SED08_ 0-0.1	OSA2_SED08_ 0.8-0.9
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28307	M19-Oc28308	M19-Oc28309	M19-Oc28310
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	69	< 50	140	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	68	< 50
TRH C10-C36 (Total)	50	mg/kg	69	< 50	208	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	80	100	115	123
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50

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Client Sample ID			OSA2_SED07_ 0-0.1	OSA2_SED07_ 1.5-1.6	OSA2_SED08_ 0-0.1	OSA2_SED08_ 0.8-0.9
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28307	M19-Oc28308	M19-Oc28309	M19-Oc28310
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16 less Naphthalene (F2)N01	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	180	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	180	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	0.20	< 0.005	0.15	< 0.005
Acenaphthylene	0.005	mg/kg	0.13	< 0.005	0.18	< 0.005
Anthracene	0.005	mg/kg	0.31	< 0.005	0.34	< 0.005
Benz(a)anthracene	0.005	mg/kg	1.9	< 0.005	3.3	< 0.005
Benzo(a)pyrene	0.005	mg/kg	1.9	< 0.005	3.7	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	1.7	< 0.005	3.0	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	1.4	< 0.005	3.2	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	1.8	< 0.005	3.2	< 0.005
Chrysene	0.005	mg/kg	2.2	< 0.005	3.8	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	0.37	< 0.005	0.92	< 0.005
Fluoranthene	0.005	mg/kg	5.4	< 0.005	7.1	< 0.005
Fluorene	0.005	mg/kg	0.28	< 0.005	0.18	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	1.7	< 0.005	4.5	< 0.005
Naphthalene	0.005	mg/kg	0.020	< 0.005	0.060	< 0.005
Phenanthrene	0.005	mg/kg	2.0	< 0.005	1.5	< 0.005
Pyrene	0.005	mg/kg	4.6	< 0.005	7.1	< 0.005
Total PAH*	0.005	mg/kg	25.91	< 0.005	42.23	< 0.005
2-Fluorobiphenyl (surr.)	1	%	91	88	97	97
p-Terphenyl-d14 (surr.)	1	%	101	84	117	89
Total Organic Carbon	0.1	%	8.9	6.8	13	2.6
% Moisture	1	%	69	68	71	67

Client Sample ID			OSA2_SED09_ 0-0.1	OSA2_SED09_ 0.8-0.9	OSA2_SED10_ 0-0.1	OSA2_SED10_ 0.3-0.4
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28311	M19-Oc28312	M19-Oc28313	M19-Oc28314
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	100	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	54	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	154	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	104	71	88	89

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Client Sample ID			OSA2_SED09_ 0-0.1	OSA2_SED09_ 0.8-0.9	OSA2_SED10_ 0-0.1	OSA2_SED10_ 0.3-0.4
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28311	M19-Oc28312	M19-Oc28313	M19-Oc28314
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	130	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	130	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	0.020	< 0.005	0.29	< 0.005
Acenaphthylene	0.005	mg/kg	0.080	< 0.005	0.14	< 0.005
Anthracene	0.005	mg/kg	0.060	< 0.005	0.49	< 0.005
Benz(a)anthracene	0.005	mg/kg	0.37	< 0.005	2.5	< 0.005
Benzo(a)pyrene	0.005	mg/kg	0.35	< 0.005	2.6	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	0.19	< 0.005	2.2	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	0.25	< 0.005	2.1	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	0.30	< 0.005	2.5	< 0.005
Chrysene	0.005	mg/kg	0.38	< 0.005	2.7	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	0.050	< 0.005	0.14	< 0.005
Fluoranthene	0.005	mg/kg	0.62	< 0.005	6.1	< 0.005
Fluorene	0.005	mg/kg	0.040	< 0.005	0.27	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	0.23	< 0.005	2.6	< 0.005
Naphthalene	0.005	mg/kg	0.070	< 0.005	0.030	< 0.005
Phenanthrene	0.005	mg/kg	0.30	< 0.005	2.0	< 0.005
Pyrene	0.005	mg/kg	0.94	< 0.005	5.2	< 0.005
Total PAH*	0.005	mg/kg	4.25	< 0.005	31.86	< 0.005
2-Fluorobiphenyl (surr.)	1	%	97	82	59	92
p-Terphenyl-d14 (surr.)	1	%	107	71	69	86
Total Organic Carbon	0.1	%	6.4	8.2	14	17
% Moisture	1	%	62	69	70	78

Client Sample ID			OSA2_SED11_ 0-0.1	OSA2_SED11_ 1.0-1.1	OSA2_SED12_ 0-0.1	OSA2_SED15_ 0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28315	M19-Oc28316	M19-Oc28317	M19-Oc28318
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 17, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50	630
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	190
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	< 50	820

Client Sample ID			OSA2_SED11_ 0-0.1	OSA2_SED11_ 1.0-1.1	OSA2_SED12_ 0-0.1	OSA2_SED15_ 0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M19-Oc28315	M19-Oc28316	M19-Oc28317	M19-Oc28318
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 17, 2019
Test/Reference	LOR	Unit				
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	101	96	75	86
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100	720
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100	720
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	< 0.005	< 0.005	0.023	0.19
Acenaphthylene	0.005	mg/kg	< 0.005	< 0.005	0.027	1.1
Anthracene	0.005	mg/kg	< 0.005	< 0.005	0.052	3.9
Benz(a)anthracene	0.005	mg/kg	0.080	< 0.005	0.49	10
Benzo(a)pyrene	0.005	mg/kg	0.060	< 0.005	0.46	7.1
Benzo(b&j)fluoranthene	0.005	mg/kg	0.040	< 0.005	0.40	6.6
Benzo(g.h.i)perylene	0.005	mg/kg	0.030	< 0.005	0.24	4.7
Benzo(k)fluoranthene	0.005	mg/kg	0.060	< 0.005	0.39	6.1
Chrysene	0.005	mg/kg	0.11	< 0.005	0.61	7.1
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	< 0.005	0.073	2.0
Fluoranthene	0.005	mg/kg	0.21	< 0.005	1.00	26
Fluorene	0.005	mg/kg	< 0.005	< 0.005	0.028	3.7
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	0.020	< 0.005	0.44	3.7
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	0.005	0.13
Phenanthrene	0.005	mg/kg	0.070	< 0.005	0.24	20
Pyrene	0.005	mg/kg	0.31	< 0.005	0.91	18
Total PAH*	0.005	mg/kg	0.99	< 0.005	5.388	120.32
2-Fluorobiphenyl (surr.)	1	%	82	87	78	96
p-Terphenyl-d14 (surr.)	1	%	81	76	78	117
Total Organic Carbon	0.1	%	15	6.7	1.5	32
% Moisture	1	%	77	69	28	86

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Client Sample ID			OSA2_SED15_ 1.0-1.1	OSA2_SED16_ 0-0.1	OSA2_SED17_ 0-0.1	OSA2_SED17_ 0.4-0.5
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc28319**	**M19-Oc28320**	**M19-Oc28321**	**M19-Oc28322**
Date Sampled			Oct 17, 2019	Oct 17, 2019	Oct 17, 2019	Oct 17, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	60	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	110	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	170	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	82	77	110	62
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	130	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	130	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	0.010	< 0.005	0.010	< 0.005
Acenaphthylene	0.005	mg/kg	0.030	< 0.005	0.060	< 0.005
Anthracene	0.005	mg/kg	0.050	< 0.005	0.060	< 0.005
Benz(a)anthracene	0.005	mg/kg	0.15	< 0.005	0.24	< 0.005
Benzo(a)pyrene	0.005	mg/kg	0.12	< 0.005	0.21	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	0.14	< 0.005	0.16	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	0.070	< 0.005	0.12	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	0.12	< 0.005	0.17	< 0.005
Chrysene	0.005	mg/kg	0.16	< 0.005	0.25	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	0.010	< 0.005	0.020	< 0.005
Fluoranthene	0.005	mg/kg	0.45	< 0.005	0.56	< 0.005
Fluorene	0.005	mg/kg	0.020	< 0.005	0.040	< 0.005
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	0.080	< 0.005	0.10	< 0.005
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	0.060	< 0.005
Phenanthrene	0.005	mg/kg	0.23	< 0.005	0.34	< 0.005
Pyrene	0.005	mg/kg	0.30	< 0.005	0.64	< 0.005
Total PAH*	0.005	mg/kg	1.94	< 0.005	3.04	< 0.005
2-Fluorobiphenyl (surr.)	1	%	98	98	92	88
p-Terphenyl-d14 (surr.)	1	%	96	92	100	78
Total Organic Carbon	0.1	%	3.8	16	21	13
% Moisture	1	%	60	77	75	75

Client Sample ID			OSA2_SED18_ 0-0.1	OSA2_SED19_ 0-0.1	QC15102019_S ED01	QC16102019_S ED01
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc28323**	**M19-Oc28324**	**M19-Oc28349**	**M19-Oc28350**
Date Sampled			**Oct 17, 2019**	**Oct 17, 2019**	**Oct 15, 2019**	**Oct 16, 2019**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	< 20	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	450	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-C36 (Total)	50	mg/kg	< 50	< 50	450	< 50
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	98	77	85	99
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	500	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	500	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.005	mg/kg	< 0.005	0.018	0.30	0.17
Acenaphthylene	0.005	mg/kg	< 0.005	0.007	0.86	0.18
Anthracene	0.005	mg/kg	< 0.005	0.015	1.1	0.21
Benz(a)anthracene	0.005	mg/kg	< 0.005	0.090	5.5	1.7
Benzo(a)pyrene	0.005	mg/kg	< 0.005	0.078	4.9	1.6
Benzo(b&j)fluoranthene	0.005	mg/kg	< 0.005	0.055	2.8	1.4
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	0.043	3.0	1.0
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	0.065	3.2	1.2
Chrysene	0.005	mg/kg	< 0.005	0.091	5.3	1.9
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	0.007	1.3	0.47
Fluoranthene	0.005	mg/kg	< 0.005	0.22	10.0	4.1
Fluorene	0.005	mg/kg	< 0.005	0.006	0.57	0.24
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	0.061	4.1	1.3
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	0.25	0.051
Phenanthrene	0.005	mg/kg	< 0.005	0.042	3.8	1.7
Pyrene	0.005	mg/kg	< 0.005	0.19	12	3.6
Total PAH*	0.005	mg/kg	< 0.005	0.988	58.98	20.821
2-Fluorobiphenyl (surr.)	1	%	78	78	81	74
p-Terphenyl-d14 (surr.)	1	%	82	78	87	77
Total Organic Carbon	0.1	%	7.3	12	14	8.4
% Moisture	1	%	67	73	74	71

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 21, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 21, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 21, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 21, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 21, 2019	0 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			
Total Organic Carbon	Melbourne	Oct 24, 2019	28 Days
- Method: LTM-INO-4060 Total Organic Carbon in water and soil			
% Moisture	Melbourne	Oct 18, 2019	14 Days
- Method: LTM-GEN-7080 Moisture			

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Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	OSA2_SED01_0-0.1	Oct 15, 2019		Soil	M19-Oc28295			X	X	X	X	X
2	OSA2_SED01_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28296			X	X	X	X	X
3	OSA2_SED02_0-0.1	Oct 15, 2019		Soil	M19-Oc28297			X	X	X	X	X
4	OSA2_SED02_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28298			X	X	X	X	X
5	OSA2_SED03_0-0.1	Oct 15, 2019		Soil	M19-Oc28299			X	X	X	X	X
6	OSA2_SED03	Oct 15, 2019		Soil	M19-Oc28300			X	X	X	X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.9-1.0											
7	OSA2_SED04_0-0.1	Oct 15, 2019		Soil	M19-Oc28301			X	X	X	X	X
8	OSA2_SED04_0.7-0.8	Oct 15, 2019		Soil	M19-Oc28302			X	X	X	X	X
9	OSA2_SED04_1.4-1.5	Oct 15, 2019		Soil	M19-Oc28303			X	X	X	X	X
10	OSA2_SED05_1.0-1.1	Oct 15, 2019		Soil	M19-Oc28304			X	X	X	X	X
11	OSA2_SED06_0-0.1	Oct 15, 2019		Soil	M19-Oc28305			X	X	X	X	X
12	OSA2_SED06_0.9-1.0	Oct 15, 2019		Soil	M19-Oc28306			X	X	X	X	X
13	OSA2_SED07	Oct 16, 2019		Soil	M19-Oc28307			X	X	X	X	X

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	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
14	OSA2_SED07 _1.5-1.6	Oct 16, 2019		Soil	M19-Oc28308			X	X	X	X	X
15	OSA2_SED08 _0-0.1	Oct 16, 2019		Soil	M19-Oc28309			X	X	X	X	X
16	OSA2_SED08 _0.8-0.9	Oct 16, 2019		Soil	M19-Oc28310			X	X	X	X	X
17	OSA2_SED09 _0-0.1	Oct 16, 2019		Soil	M19-Oc28311			X	X	X	X	X
18	OSA2_SED09 _0.8-0.9	Oct 16, 2019		Soil	M19-Oc28312			X	X	X	X	X
19	OSA2_SED10 _0-0.1	Oct 16, 2019		Soil	M19-Oc28313			X	X	X	X	X
20	OSA2_SED10	Oct 16, 2019		Soil	M19-Oc28314			X	X	X	X	X

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Project Name:	WOOLOOWARE				
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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.3-0.4											
21	OSA2_SED11 _0-0.1	Oct 16, 2019		Soil	M19-Oc28315			X	X	X	X	X
22	OSA2_SED11 _1.0-1.1	Oct 16, 2019		Soil	M19-Oc28316			X	X	X	X	X
23	OSA2_SED12 _0-0.1	Oct 16, 2019		Soil	M19-Oc28317			X	X	X	X	X
24	OSA2_SED15 _0-0.1	Oct 17, 2019		Soil	M19-Oc28318			X	X	X	X	X
25	OSA2_SED15 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28319			X	X	X	X	X
26	OSA2_SED16 _0-0.1	Oct 17, 2019		Soil	M19-Oc28320			X	X	X	X	X
27	OSA2_SED17	Oct 17, 2019		Soil	M19-Oc28321			X	X	X	X	X

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
28	OSA2_SED17 _0.4-0.5	Oct 17, 2019		Soil	M19-Oc28322			X	X	X	X	X
29	OSA2_SED18 _0-0.1	Oct 17, 2019		Soil	M19-Oc28323			X	X	X	X	X
30	OSA2_SED19 _0-0.1	Oct 17, 2019		Soil	M19-Oc28324			X	X	X	X	X
31	OSA2_PW_01	Oct 15, 2019		Water	M19-Oc28325				X		X	X
32	OSA2_PW_02	Oct 15, 2019		Water	M19-Oc28326				X		X	X
33	OSA2_PW_03	Oct 15, 2019		Water	M19-Oc28327				X		X	X
34	OSA2_PW_04	Oct 15, 2019		Water	M19-Oc28328				X		X	X
35	OSA2_PW_05	Oct 15, 2019		Water	M19-Oc28329				X		X	X
36	OSA2_PW_06	Oct 15, 2019		Water	M19-Oc28330				X		X	X

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
37	OSA2_PW_11	Oct 15, 2019		Water	M19-Oc28331				X		X	X
38	OSA2_PW_08	Oct 16, 2019		Water	M19-Oc28332				X		X	X
39	OSA2_PW_09	Oct 16, 2019		Water	M19-Oc28333				X		X	X
40	OSA2_PW_10	Oct 16, 2019		Water	M19-Oc28334				X		X	X
41	OSA2_PW_14	Oct 16, 2019		Water	M19-Oc28335				X		X	X
42	OSA2_PW_15	Oct 16, 2019		Water	M19-Oc28336				X		X	X
43	OSA2_PW_16	Oct 16, 2019		Water	M19-Oc28337				X		X	X
44	OSA2_PW_17	Oct 16, 2019		Water	M19-Oc28338				X		X	X
45	OSA2_PW_18	Oct 16, 2019		Water	M19-Oc28339				X		X	X
46	OSA2_PW_19	Oct 16, 2019		Water	M19-Oc28340				X		X	X
47	OSA2_SW_02	Oct 15, 2019		Water	M19-Oc28341				X		X	X
48	OSA2_SW_04	Oct 15, 2019		Water	M19-Oc28342				X		X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
49	OSA2_SW_07	Oct 16, 2019		Water	M19-Oc28343	X						
50	OSA2_SW_10	Oct 16, 2019		Water	M19-Oc28344				X		X	X
51	OSA2_SW_11	Oct 16, 2019		Water	M19-Oc28345				X		X	X
52	OSA2_SW_15	Oct 17, 2019		Water	M19-Oc28346				X		X	X
53	OSA2_SW_17	Oct 17, 2019		Water	M19-Oc28347				X		X	X
54	OSA2_SW_19	Oct 17, 2019		Water	M19-Oc28348				X		X	X
55	QC15102019_SED01	Oct 15, 2019		Soil	M19-Oc28349			X	X	X	X	X
56	QC16102019_SED01	Oct 16, 2019		Soil	M19-Oc28350			X	X	X	X	X
57	QC15102019_PW1	Oct 15, 2019		Water	M19-Oc28351				X		X	X
58	QC15102019_	Oct 15, 2019		Water	M19-Oc28352				X		X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	SW1											
59	RINS_1	Oct 17, 2019		Water	M19-Oc28353				X		X	X
60	TS	Oct 17, 2019		Water	M19-Oc28354				X			
61	TB	Oct 17, 2019		Water	M19-Oc28355				X			
62	OSA2_SED01_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28356		X					
63	OSA2_SED01_0.8-0.9	Oct 15, 2019		Soil	M19-Oc28357		X					
64	OSA2_SED01_1.0-1.1	Oct 15, 2019		Soil	M19-Oc28358		X					
65	OSA2_SED01_1.2-1.3	Oct 15, 2019		Soil	M19-Oc28359		X					
66	OSA2_SED02_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28360		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
67	OSA2_SED02_0.8-0.9	Oct 15, 2019		Soil	M19-Oc28361		X					
68	OSA2_SED02_1.1-1.2	Oct 15, 2019		Soil	M19-Oc28362		X					
69	OSA2_SED02_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28363		X					
70	OSA2_SED03_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28364		X					
71	OSA2_SED03_0.6-0.7	Oct 15, 2019		Soil	M19-Oc28365		X					
72	OSA2_SED03_1.2-1.3	Oct 15, 2019		Soil	M19-Oc28366		X					
73	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28367		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
74	OSA2_SED04_0.9-1.0	Oct 15, 2019		Soil	M19-Oc28368		X					
75	OSA2_SED05_0-0.1	Oct 15, 2019		Soil	M19-Oc28369		X					
76	OSA2_SED05_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28370		X					
77	OSA2_SED05_0.7-0.8	Oct 15, 2019		Soil	M19-Oc28371		X					
78	OSA2_SED05_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28372		X					
79	OSA2_SED06_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28373		X					
80	OSA2_SED06_1.1-1.2	Oct 15, 2019		Soil	M19-Oc28374		X					

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Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
81	OSA2_SED06_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28375		X					
82	OSA2_SED07_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28376		X					
83	OSA2_SED07_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28377		X					
84	OSA2_SED07_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28378		X					
85	OSA2_SED07_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28379		X					
86	OSA2_SED08_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28380		X					
87	OSA2_SED08_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28381		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
88	OSA2_SED09_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28382		X					
89	OSA2_SED09_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28383		X					
90	OSA2_SED09_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28384		X					
91	OSA2_SED10_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28385		X					
92	OSA2_SED10_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28386		X					
93	OSA2_SED10_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28387		X					
94	OSA2_SED10_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28388		X					

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Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
95	OSA2_SED11_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28389		X					
96	OSA2_SED11_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28390		X					
97	OSA2_SED12_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28391		X					
98	OSA2_SED12_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28392		X					
99	OSA2_SED12_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28393		X					
100	OSA2_SED12_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28394		X					
101	OSA2_SED13_0-0.1	Oct 16, 2019		Soil	M19-Oc28395		X					

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Received: Oct 17, 2019 6:05 PM
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Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
102	OSA2_SED13_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28396		X					
103	OSA2_SED13_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28397		X					
104	OSA2_SED13_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28398		X					
105	OSA2_SED13_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28399		X					
106	OSA2_SED14_0-0.1	Oct 16, 2019		Soil	M19-Oc28400		X					
107	OSA2_SED14_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28401		X					
108	OSA2_SED14_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28402		X					

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		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
109	OSA2_SED14_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28403		X					
110	OSA2_SED14_1.4-1.5	Oct 16, 2019		Soil	M19-Oc28404		X					
111	OSA2_SED14_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28405		X					
112	OSA2_SED15_0.3-0.4	Oct 17, 2019		Soil	M19-Oc28406		X					
113	OSA2_SED15_0.7-0.8	Oct 17, 2019		Soil	M19-Oc28407		X					
114	OSA2_SED15_1.3-1.4	Oct 17, 2019		Soil	M19-Oc28408		X					
115	OSA2_SED16_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28409		X					

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		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
116	OSA2_SED16_0.7-0.8	Oct 17, 2019		Soil	M19-Oc28410		X					
117	OSA2_SED16_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28411		X					
118	OSA2_SED16_1.6-1.7	Oct 17, 2019		Soil	M19-Oc28412		X					
119	OSA2_SED17_0.7-0.8	Oct 17, 2019		Soil	M19-Oc28413		X					
120	OSA2_SED17_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28414		X					
121	OSA2_SED17_1.7-1.8	Oct 17, 2019		Soil	M19-Oc28415		X					
122	OSA2_SED18_0.5-0.6	Oct 17, 2019		Soil	M19-Oc28416		X					

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Contact Name: Jessica Staehli

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
123	OSA2_SED18_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28417		X					
124	OSA2_SED18_1.5-1.6	Oct 17, 2019		Soil	M19-Oc28418		X					
125	OSA2_SED19_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28419		X					
126	OSA2_SED19_0.8-0.9	Oct 17, 2019		Soil	M19-Oc28420		X					
127	OSA2_SED19_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28421		X					
128	OSA2_SED19_1.5-1.6	Oct 17, 2019		Soil	M19-Oc28422		X					
129	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc28423		X					
Test Counts						1	68	32	60	32	58	58

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/kg	< 0.005			0.005	Pass	
Acenaphthylene	mg/kg	< 0.005			0.005	Pass	
Anthracene	mg/kg	< 0.005			0.005	Pass	
Benz(a)anthracene	mg/kg	< 0.005			0.005	Pass	
Benzo(a)pyrene	mg/kg	< 0.005			0.005	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.005			0.005	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.005			0.005	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.005			0.005	Pass	
Chrysene	mg/kg	< 0.005			0.005	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.005			0.005	Pass	
Fluoranthene	mg/kg	< 0.005			0.005	Pass	
Fluorene	mg/kg	< 0.005			0.005	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.005			0.005	Pass	
Naphthalene	mg/kg	< 0.005			0.005	Pass	
Phenanthrene	mg/kg	< 0.005			0.005	Pass	
Pyrene	mg/kg	< 0.005			0.005	Pass	
Total PAH*	mg/kg	< 0			0.005	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	105			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	106			70-130	Pass	
Toluene	%	116			70-130	Pass	
Ethylbenzene	%	121			70-130	Pass	
m&p-Xylenes	%	115			70-130	Pass	
Xylenes - Total	%	115			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	121			70-130	Pass	
TRH C6-C10	%	104			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	%	112			70-130	Pass	
Acenaphthylene	%	113			70-130	Pass	

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Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Anthracene			%	116			70-130	Pass	
Benz(a)anthracene			%	106			70-130	Pass	
Benzo(a)pyrene			%	130			70-130	Pass	
Benzo(b&j)fluoranthene			%	119			70-130	Pass	
Benzo(g.h.i)perylene			%	104			70-130	Pass	
Benzo(k)fluoranthene			%	128			70-130	Pass	
Chrysene			%	118			70-130	Pass	
Dibenz(a.h)anthracene			%	98			70-130	Pass	
Fluoranthene			%	117			70-130	Pass	
Fluorene			%	117			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	104			70-130	Pass	
Naphthalene			%	119			70-130	Pass	
Phenanthrene			%	115			70-130	Pass	
Pyrene			%	117			70-130	Pass	
LCS - % Recovery									
Total Organic Carbon			%	104			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc28297	CP	%	90			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M19-Oc28297	CP	%	103			70-130	Pass	
Toluene	M19-Oc28297	CP	%	101			70-130	Pass	
Ethylbenzene	M19-Oc28297	CP	%	100			70-130	Pass	
m&p-Xylenes	M19-Oc28297	CP	%	95			70-130	Pass	
o-Xylene	M19-Oc28297	CP	%	99			70-130	Pass	
Xylenes - Total	M19-Oc28297	CP	%	97			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc28297	CP	%	103			70-130	Pass	
TRH C6-C10	M19-Oc28297	CP	%	89			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M19-Oc28304	CP	%	85			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M19-Oc28304	CP	%	81			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc28307	CP	%	89			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M19-Oc28307	CP	%	80			70-130	Pass	
Toluene	M19-Oc28307	CP	%	86			70-130	Pass	
Ethylbenzene	M19-Oc28307	CP	%	89			70-130	Pass	
m&p-Xylenes	M19-Oc28307	CP	%	89			70-130	Pass	
o-Xylene	M19-Oc28307	CP	%	84			70-130	Pass	
Xylenes - Total	M19-Oc28307	CP	%	87			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc28307	CP	%	98			70-130	Pass	
TRH C6-C10	M19-Oc28307	CP	%	90			70-130	Pass	
Spike - % Recovery									

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Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc28317	CP	%	90			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M19-Oc28317	CP	%	78			70-130	Pass	
Toluene	M19-Oc28317	CP	%	84			70-130	Pass	
Ethylbenzene	M19-Oc28317	CP	%	90			70-130	Pass	
m&p-Xylenes	M19-Oc28317	CP	%	84			70-130	Pass	
o-Xylene	M19-Oc28317	CP	%	96			70-130	Pass	
Xylenes - Total	M19-Oc28317	CP	%	88			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc28317	CP	%	84			70-130	Pass	
TRH C6-C10	M19-Oc28317	CP	%	90			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M19-Oc28324	CP	%	93			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M19-Oc28324	CP	%	88			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M19-Oc28305	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M19-Oc28305	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M19-Oc28305	CP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M19-Oc28305	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M19-Oc28305	CP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M19-Oc28305	CP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc28306	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc28306	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M19-Oc28306	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M19-Oc28306	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M19-Oc28306	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M19-Oc28306	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M19-Oc28306	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc28306	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M19-Oc28306	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Organic Carbon	M19-Oc28306	CP	%	6.3	5.6	13	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M19-Oc28313	CP	mg/kg	< 20	< 20	<1	30%	Pass	

Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	M19-Oc28313	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C34-C40	M19-Oc28313	CP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc28316	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc28316	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M19-Oc28316	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M19-Oc28316	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M19-Oc28316	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M19-Oc28316	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M19-Oc28316	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc28316	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M19-Oc28316	CP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc28323	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M19-Oc28323	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M19-Oc28323	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M19-Oc28323	CP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc28323	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M19-Oc28323	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M19-Oc28323	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M19-Oc28323	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M19-Oc28323	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M19-Oc28323	CP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc28323	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M19-Oc28323	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M19-Oc28323	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M19-Oc28323	CP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M19-Oc28323	CP	mg/kg	< 100	< 100	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Certificate of Analysis

Environment Testing

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Jessica Staehli**

Report **683343-W-V2**
Project name WOOLOOWARE
Project ID 51163
Received Date Oct 17, 2019

Client Sample ID			**OSA2_PW_01**	**OSA2_PW_02**	**OSA2_PW_03**	**OSA2_PW_04**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M19-Oc28325**	**M19-Oc28326**	**M19-Oc28327**	**M19-Oc28328**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	0.11	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	0.2	< 0.1	0.1
TRH C29-C36	0.1	mg/L	< 0.1	0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	0.41	< 0.1	0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	0.003	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	91	94	106	95
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	0.18	< 0.05	0.08
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	0.18	< 0.05	0.08
TRH >C16-C34	0.1	mg/L	< 0.1	0.2	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	0.38	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	0.00009	0.00003	0.00003	< 0.00001
Acenaphthylene	0.00001	mg/L	0.00015	0.00003	0.00002	< 0.00001
Anthracene	0.00001	mg/L	0.00016	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.0020	0.00008	0.00009	0.00001
Benzo(a)pyrene	0.00001	mg/L	0.0022	0.00011	0.00012	0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	0.0025	0.00010	0.00008	0.00002
Benzo(g.h.i)perylene	0.00001	mg/L	0.0019	0.00011	0.00009	0.00002
Benzo(k)fluoranthene	0.00001	mg/L	0.0023	0.00010	0.00010	0.00001
Chrysene	0.00001	mg/L	0.0030	0.00010	0.00014	0.00002
Dibenz(a.h)anthracene	0.00001	mg/L	0.00024	0.00002	0.00002	< 0.00001
Fluoranthene	0.00001	mg/L	0.0031	0.00013	0.00016	0.00002
Fluorene	0.00001	mg/L	0.00009	0.00001	0.00001	< 0.00001

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Client Sample ID			OSA2_PW_01	OSA2_PW_02	OSA2_PW_03	OSA2_PW_04
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28325	M19-Oc28326	M19-Oc28327	M19-Oc28328
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.0020	0.00011	0.00010	0.00002
Naphthalene	0.00001	mg/L	0.00005	0.00002	0.00003	0.00001
Phenanthrene	0.00001	mg/L	0.00059	0.00003	0.00004	0.00001
Pyrene	0.00001	mg/L	0.0029	0.00022	0.00021	0.00003
Total PAH*	0.00001	mg/L	0.02327	0.0012	0.00124	0.00018
2-Fluorobiphenyl (surr.)	1	%	85	76	58	68
p-Terphenyl-d14 (surr.)	1	%	110	117	53	99

Client Sample ID			G01 OSA2_PW_05	OSA2_PW_06	OSA2_PW_11	OSA2_PW_08
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28329	M19-Oc28330	M19-Oc28331	M19-Oc28332
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.08	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	0.14	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	0.2	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	0.34	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.004	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.004	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.004	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.008	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.004	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.012	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	119	93	95	91
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene N02	0.01	mg/L	< 0.04	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.08	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) N04	0.02	mg/L	< 0.08	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	0.22	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) N01	0.05	mg/L	< 0.05	0.22	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	0.32	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	0.00010	0.00006	0.00002	0.00002
Acenaphthylene	0.00001	mg/L	0.00003	0.00001	0.00002	0.00002
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00035	0.00005	0.00006	0.00015
Benzo(a)pyrene	0.00001	mg/L	0.00043	0.00005	0.00008	0.00023
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00043	0.00004	0.00008	0.00016
Benzo(g.h.i)perylene	0.00001	mg/L	0.00037	0.00005	0.00011	0.00015
Benzo(k)fluoranthene	0.00001	mg/L	0.00048	0.00004	0.00008	0.00019
Chrysene	0.00001	mg/L	0.00062	0.00005	0.00007	0.00024
Dibenz(a.h)anthracene	0.00001	mg/L	0.00012	0.00001	0.00002	0.00001

Client Sample ID			G01 OSA2_PW_05	OSA2_PW_06	OSA2_PW_11	OSA2_PW_08
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28329	M19-Oc28330	M19-Oc28331	M19-Oc28332
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Fluoranthene	0.00001	mg/L	0.00065	0.00007	0.00010	0.00021
Fluorene	0.00001	mg/L	0.00003	0.00003	0.00001	0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00042	0.00004	0.00008	0.00015
Naphthalene	0.00001	mg/L	0.00005	0.00003	0.00002	0.00002
Phenanthrene	0.00001	mg/L	0.00018	0.00006	0.00003	0.00002
Pyrene	0.00001	mg/L	0.00068	0.00011	0.00012	0.00021
Total PAH*	0.00001	mg/L	0.00494	0.0007	0.0009	0.00179
2-Fluorobiphenyl (surr.)	1	%	53	70	64	73
p-Terphenyl-d14 (surr.)	1	%	52	70	60	66

Client Sample ID			OSA2_PW_09	OSA2_PW_10	OSA2_PW_12	G01 OSA2_PW_15
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28333	M19-Oc28334	M19-Oc28335	M19-Oc28336
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.08
TRH C10-C14	0.05	mg/L	< 0.05	0.05	0.14	0.08
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	0.2	0.2
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	0.2	0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	0.54	0.38
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.004
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.004
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.004
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.008
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.004
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.012
4-Bromofluorobenzene (surr.)	1	%	87	89	86	107
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene N02	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.04
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.08
TRH C6-C10 less BTEX (F1) N04	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.08
TRH >C10-C16	0.05	mg/L	< 0.05	0.05	0.14	0.10
TRH >C10-C16 less Naphthalene (F2) N01	0.05	mg/L	< 0.05	0.05	0.14	0.1
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	0.3	0.2
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	0.44	0.3
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	0.00002	0.00004	0.00031
Acenaphthylene	0.00001	mg/L	< 0.00001	0.00003	0.00002	0.00039
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00028
Benz(a)anthracene	0.00001	mg/L	< 0.00001	0.00026	0.00013	0.0030
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	0.00031	0.00020	0.0026
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	0.00030	0.00017	0.0026
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	0.00030	0.00021	0.0021
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	0.00028	0.00016	0.0021

Client Sample ID			OSA2_PW_09	OSA2_PW_10	OSA2_PW_12	G01 OSA2_PW_15
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28333	M19-Oc28334	M19-Oc28335	M19-Oc28336
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Chrysene	0.00001	mg/L	< 0.00001	0.00037	0.00016	0.0029
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	0.00007	0.00005	0.00074
Fluoranthene	0.00001	mg/L	0.00002	0.00036	0.00018	0.0072
Fluorene	0.00001	mg/L	< 0.00001	0.00003	0.00001	0.00066
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	0.00033	0.00024	0.0026
Naphthalene	0.00001	mg/L	< 0.00001	0.00004	0.00002	0.00008
Phenanthrene	0.00001	mg/L	< 0.00001	0.00016	0.00005	0.0035
Pyrene	0.00001	mg/L	0.00002	0.00044	0.00021	0.0051
Total PAH*	0.00001	mg/L	4E-05	0.0033	0.00185	0.03616
2-Fluorobiphenyl (surr.)	1	%	53	73	81	72
p-Terphenyl-d14 (surr.)	1	%	75	72	122	67

Client Sample ID			OSA2_PW_16	OSA2_PW_17	OSA2_PW_18	OSA2_PW_19
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28337	M19-Oc28338	M19-Oc28339	M19-Oc28340
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	92	93	84	91
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene N02	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) N04	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) N01	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	0.00004	< 0.00001	0.00003
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00004
Anthracene	0.00001	mg/L	< 0.00001	0.00003	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00017	0.00036	< 0.00001	0.00019
Benzo(a)pyrene	0.00001	mg/L	0.00020	0.00041	< 0.00001	0.00015
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00022	0.00041	< 0.00001	0.00032

Environment Testing

Client Sample ID			OSA2_PW_16	OSA2_PW_17	OSA2_PW_18	OSA2_PW_19
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28337	M19-Oc28338	M19-Oc28339	M19-Oc28340
Date Sampled			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Benzo(g.h.i)perylene	0.00001	mg/L	0.00018	0.00032	< 0.00001	0.00029
Benzo(k)fluoranthene	0.00001	mg/L	0.00021	0.00041	< 0.00001	0.00031
Chrysene	0.00001	mg/L	0.00019	0.00058	< 0.00001	0.00033
Dibenz(a.h)anthracene	0.00001	mg/L	0.00004	0.00008	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	0.00021	0.00050	< 0.00001	0.00049
Fluorene	0.00001	mg/L	< 0.00001	0.00002	< 0.00001	0.00002
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00021	0.00035	< 0.00001	0.00003
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00002
Phenanthrene	0.00001	mg/L	0.00003	0.00014	< 0.00001	0.00010
Pyrene	0.00001	mg/L	0.00019	0.00051	< 0.00001	0.00052
Total PAH*	0.00001	mg/L	0.00185	0.00416	< 0.00001	0.00284
2-Fluorobiphenyl (surr.)	1	%	68	75	52	115
p-Terphenyl-d14 (surr.)	1	%	96	50	60	85

Client Sample ID			OSA2_SW_02	OSA2_SW_04	OSA2_SW_10	OSA2_SW_11
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28341	M19-Oc28342	M19-Oc28344	M19-Oc28345
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	0.08	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	90	86	95	91
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	0.07	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.07	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	0.00004
Benzo(a)pyrene	0.00001	mg/L	0.00001	< 0.00001	< 0.00001	0.00004

Client Sample ID			OSA2_SW_02	OSA2_SW_04	OSA2_SW_10	OSA2_SW_11
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28341	M19-Oc28342	M19-Oc28344	M19-Oc28345
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 16, 2019	Oct 16, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00003	< 0.00001	< 0.00001	0.00004
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	0.00002	< 0.00001	< 0.00001	0.00005
Chrysene	0.00001	mg/L	0.00003	< 0.00001	< 0.00001	0.00005
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	0.00004	< 0.00001	< 0.00001	0.00006
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	0.00002	0.00003	0.00005	0.00004
Phenanthrene	0.00001	mg/L	0.00001	< 0.00001	< 0.00001	0.00002
Pyrene	0.00001	mg/L	0.00006	< 0.00001	< 0.00001	0.00007
Total PAH*	0.00001	mg/L	0.00024	3E-05	5E-05	0.00041
2-Fluorobiphenyl (surr.)	1	%	71	82	91	74
p-Terphenyl-d14 (surr.)	1	%	53	66	79	75

Client Sample ID			OSA2_SW_15	OSA2_SW_17	OSA2_SW_19	QC15102019_PW1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28346	M19-Oc28347	M19-Oc28348	M19-Oc28351
Date Sampled			Oct 17, 2019	Oct 17, 2019	Oct 17, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	0.2
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	0.3
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	90	82	70	86
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	0.3
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	0.3

Environment Testing

Client Sample ID			OSA2_SW_15	OSA2_SW_17	OSA2_SW_19	QC15102019_PW1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28346	M19-Oc28347	M19-Oc28348	M19-Oc28351
Date Sampled			Oct 17, 2019	Oct 17, 2019	Oct 17, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00071
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00029
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00099
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.0088
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.011
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.0095
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.0047
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.012
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.010
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.0023
Fluoranthene	0.00001	mg/L	< 0.00001	0.00001	0.00001	0.022
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00076
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.0067
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00005
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	0.00002	0.0060
Pyrene	0.00001	mg/L	< 0.00001	0.00002	0.00002	0.020
Total PAH*	0.00001	mg/L	< 0.00001	3E-05	5E-05	0.1158
2-Fluorobiphenyl (surr.)	1	%	52	98	116	76
p-Terphenyl-d14 (surr.)	1	%	63	92	116	86

Client Sample ID			QC15102019_SW1	RINS_1	R20TS	TB
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-Oc28352	M19-Oc28353	M19-Oc28354	M19-Oc28355
Date Sampled			Oct 15, 2019	Oct 17, 2019	Oct 17, 2019	Oct 17, 2019
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	-	-
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	-	-
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	-	-
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	-	-
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	-	-
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	110	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	110	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	110	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	110	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	120	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	110	< 0.003
4-Bromofluorobenzene (surr.)	1	%	84	84	101	81
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene N02	0.01	mg/L	< 0.01	< 0.01	-	-
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	-	-
TRH C6-C10 less BTEX (F1) N04	0.02	mg/L	< 0.02	< 0.02	-	-
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	-	-
TRH >C10-C16 less Naphthalene (F2) N01	0.05	mg/L	< 0.05	< 0.05	-	-
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	-	-
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	-	-
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	-	-

Client Sample ID			QC15102019_SW1	RINS_1	[R20]TS	TB
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M19-Oc28352**	**M19-Oc28353**	**M19-Oc28354**	**M19-Oc28355**
Date Sampled			**Oct 15, 2019**	**Oct 17, 2019**	**Oct 17, 2019**	**Oct 17, 2019**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	0.00004	< 0.00001	-	-
Acenaphthylene	0.00001	mg/L	0.00001	< 0.00001	-	-
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benz(a)anthracene	0.00001	mg/L	0.00002	< 0.00001	-	-
Benzo(a)pyrene	0.00001	mg/L	0.00002	< 0.00001	-	-
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00002	< 0.00001	-	-
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Benzo(k)fluoranthene	0.00001	mg/L	0.00003	< 0.00001	-	-
Chrysene	0.00001	mg/L	0.00004	< 0.00001	-	-
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Fluoranthene	0.00001	mg/L	0.00005	< 0.00001	-	-
Fluorene	0.00001	mg/L	0.00001	< 0.00001	-	-
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	-	-
Phenanthrene	0.00001	mg/L	0.00003	< 0.00001	-	-
Pyrene	0.00001	mg/L	0.00007	< 0.00001	-	-
Total PAH*	0.00001	mg/L	0.00034	< 0.00001	-	-
2-Fluorobiphenyl (surr.)	1	%	91	75	-	-
p-Terphenyl-d14 (surr.)	1	%	98	61	-	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 21, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 21, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 21, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 21, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 21, 2019	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			

eurofins Environment Testing

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Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	OSA2_SED01_0-0.1	Oct 15, 2019		Soil	M19-Oc28295			X	X	X	X	X
2	OSA2_SED01_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28296			X	X	X	X	X
3	OSA2_SED02_0-0.1	Oct 15, 2019		Soil	M19-Oc28297			X	X	X	X	X
4	OSA2_SED02_0.5-0.6	Oct 15, 2019		Soil	M19-Oc28298			X	X	X	X	X
5	OSA2_SED03_0-0.1	Oct 15, 2019		Soil	M19-Oc28299			X	X	X	X	X
6	OSA2_SED03	Oct 15, 2019		Soil	M19-Oc28300			X	X	X	X	X

eurofins Environment Testing

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NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 683343
Phone: 02 8245 0300
Fax:

Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.9-1.0											
7	OSA2_SED04_0-0.1	Oct 15, 2019		Soil	M19-Oc28301			X	X	X	X	X
8	OSA2_SED04_0.7-0.8	Oct 15, 2019		Soil	M19-Oc28302			X	X	X	X	X
9	OSA2_SED04_1.4-1.5	Oct 15, 2019		Soil	M19-Oc28303			X	X	X	X	X
10	OSA2_SED05_1.0-1.1	Oct 15, 2019		Soil	M19-Oc28304			X	X	X	X	X
11	OSA2_SED06_0-0.1	Oct 15, 2019		Soil	M19-Oc28305			X	X	X	X	X
12	OSA2_SED06_0.9-1.0	Oct 15, 2019		Soil	M19-Oc28306			X	X	X	X	X
13	OSA2_SED07	Oct 16, 2019		Soil	M19-Oc28307			X	X	X	X	X

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	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
14	OSA2_SED07_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28308			X	X	X	X	X
15	OSA2_SED08_0-0.1	Oct 16, 2019		Soil	M19-Oc28309			X	X	X	X	X
16	OSA2_SED08_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28310			X	X	X	X	X
17	OSA2_SED09_0-0.1	Oct 16, 2019		Soil	M19-Oc28311			X	X	X	X	X
18	OSA2_SED09_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28312			X	X	X	X	X
19	OSA2_SED10_0-0.1	Oct 16, 2019		Soil	M19-Oc28313			X	X	X	X	X
20	OSA2_SED10	Oct 16, 2019		Soil	M19-Oc28314			X	X	X	X	X

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Project Name:	WOOLOOWARE				
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Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0.3-0.4											
21	OSA2_SED11_0-0.1	Oct 16, 2019		Soil	M19-Oc28315			X	X	X	X	X
22	OSA2_SED11_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28316			X	X	X	X	X
23	OSA2_SED12_0-0.1	Oct 16, 2019		Soil	M19-Oc28317			X	X	X	X	X
24	OSA2_SED15_0-0.1	Oct 17, 2019		Soil	M19-Oc28318			X	X	X	X	X
25	OSA2_SED15_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28319			X	X	X	X	X
26	OSA2_SED16_0-0.1	Oct 17, 2019		Soil	M19-Oc28320			X	X	X	X	X
27	OSA2_SED17	Oct 17, 2019		Soil	M19-Oc28321			X	X	X	X	X

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	_0-0.1											
28	OSA2_SED17_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28322			X	X	X	X	X
29	OSA2_SED18_0-0.1	Oct 17, 2019		Soil	M19-Oc28323			X	X	X	X	X
30	OSA2_SED19_0-0.1	Oct 17, 2019		Soil	M19-Oc28324			X	X	X	X	X
31	OSA2_PW_01	Oct 15, 2019		Water	M19-Oc28325				X		X	X
32	OSA2_PW_02	Oct 15, 2019		Water	M19-Oc28326				X		X	X
33	OSA2_PW_03	Oct 15, 2019		Water	M19-Oc28327				X		X	X
34	OSA2_PW_04	Oct 15, 2019		Water	M19-Oc28328				X		X	X
35	OSA2_PW_05	Oct 15, 2019		Water	M19-Oc28329				X		X	X
36	OSA2_PW_06	Oct 15, 2019		Water	M19-Oc28330				X		X	X

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Project ID:	51163				

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
37	OSA2_PW_11	Oct 15, 2019		Water	M19-Oc28331				X		X	X
38	OSA2_PW_08	Oct 16, 2019		Water	M19-Oc28332				X		X	X
39	OSA2_PW_09	Oct 16, 2019		Water	M19-Oc28333				X		X	X
40	OSA2_PW_10	Oct 16, 2019		Water	M19-Oc28334				X		X	X
41	OSA2_PW_12	Oct 16, 2019		Water	M19-Oc28335				X		X	X
42	OSA2_PW_15	Oct 16, 2019		Water	M19-Oc28336				X		X	X
43	OSA2_PW_16	Oct 16, 2019		Water	M19-Oc28337				X		X	X
44	OSA2_PW_17	Oct 16, 2019		Water	M19-Oc28338				X		X	X
45	OSA2_PW_18	Oct 16, 2019		Water	M19-Oc28339				X		X	X
46	OSA2_PW_19	Oct 16, 2019		Water	M19-Oc28340				X		X	X
47	OSA2_SW_02	Oct 15, 2019		Water	M19-Oc28341				X		X	X
48	OSA2_SW_04	Oct 15, 2019		Water	M19-Oc28342				X		X	X

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
49	OSA2_SW_07	Oct 16, 2019		Water	M19-Oc28343	X						
50	OSA2_SW_10	Oct 16, 2019		Water	M19-Oc28344				X		X	X
51	OSA2_SW_11	Oct 16, 2019		Water	M19-Oc28345				X		X	X
52	OSA2_SW_15	Oct 17, 2019		Water	M19-Oc28346				X		X	X
53	OSA2_SW_17	Oct 17, 2019		Water	M19-Oc28347				X		X	X
54	OSA2_SW_19	Oct 17, 2019		Water	M19-Oc28348				X		X	X
55	QC15102019_SED01	Oct 15, 2019		Soil	M19-Oc28349			X	X	X	X	X
56	QC16102019_SED01	Oct 16, 2019		Soil	M19-Oc28350			X	X	X	X	X
57	QC15102019_PW1	Oct 15, 2019		Water	M19-Oc28351				X		X	X
58	QC15102019_	Oct 15, 2019		Water	M19-Oc28352				X		X	X

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
	SW1											
59	RINS_1	Oct 17, 2019		Water	M19-Oc28353				X		X	X
60	TS	Oct 17, 2019		Water	M19-Oc28354				X			
61	TB	Oct 17, 2019		Water	M19-Oc28355				X			
62	OSA2_SED01 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28356		X					
63	OSA2_SED01 _0.8-0.9	Oct 15, 2019		Soil	M19-Oc28357		X					
64	OSA2_SED01 _1.0-1.1	Oct 15, 2019		Soil	M19-Oc28358		X					
65	OSA2_SED01 _1.2-1.3	Oct 15, 2019		Soil	M19-Oc28359		X					
66	OSA2_SED02 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28360		X					

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
67	OSA2_SED02_0.8-0.9	Oct 15, 2019		Soil	M19-Oc28361		X					
68	OSA2_SED02_1.1-1.2	Oct 15, 2019		Soil	M19-Oc28362		X					
69	OSA2_SED02_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28363		X					
70	OSA2_SED03_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28364		X					
71	OSA2_SED03_0.6-0.7	Oct 15, 2019		Soil	M19-Oc28365		X					
72	OSA2_SED03_1.2-1.3	Oct 15, 2019		Soil	M19-Oc28366		X					
73	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc28367		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
74	OSA2_SED04 _0.9-1.0	Oct 15, 2019		Soil	M19-Oc28368		X					
75	OSA2_SED05 _0-0.1	Oct 15, 2019		Soil	M19-Oc28369		X					
76	OSA2_SED05 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28370		X					
77	OSA2_SED05 _0.7-0.8	Oct 15, 2019		Soil	M19-Oc28371		X					
78	OSA2_SED05 _1.5-1.6	Oct 15, 2019		Soil	M19-Oc28372		X					
79	OSA2_SED06 _0.3-0.4	Oct 15, 2019		Soil	M19-Oc28373		X					
80	OSA2_SED06 _1.1-1.2	Oct 15, 2019		Soil	M19-Oc28374		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
81	OSA2_SED06_1.5-1.6	Oct 15, 2019		Soil	M19-Oc28375		X					
82	OSA2_SED07_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28376		X					
83	OSA2_SED07_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28377		X					
84	OSA2_SED07_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28378		X					
85	OSA2_SED07_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28379		X					
86	OSA2_SED08_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28380		X					
87	OSA2_SED08_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28381		X					

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
88	OSA2_SED09_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28382		X					
89	OSA2_SED09_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28383		X					
90	OSA2_SED09_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28384		X					
91	OSA2_SED10_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28385		X					
92	OSA2_SED10_1.1-1.2	Oct 16, 2019		Soil	M19-Oc28386		X					
93	OSA2_SED10_1.5-1.6	Oct 16, 2019		Soil	M19-Oc28387		X					
94	OSA2_SED10_1.8-1.9	Oct 16, 2019		Soil	M19-Oc28388		X					

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	Sydney	**Phone:**	02 8245 0300	**Priority:**	5 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
95	OSA2_SED11_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28389		X					
96	OSA2_SED11_0.8-0.9	Oct 16, 2019		Soil	M19-Oc28390		X					
97	OSA2_SED12_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28391		X					
98	OSA2_SED12_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28392		X					
99	OSA2_SED12_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28393		X					
100	OSA2_SED12_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28394		X					
101	OSA2_SED13_0-0.1	Oct 16, 2019		Soil	M19-Oc28395		X					

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Site # 1254 & 14271

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NATA # 1261 Site # 20794

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NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
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NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
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Received: Oct 17, 2019 6:05 PM
Due: Oct 24, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
102	OSA2_SED13_0.3-0.4	Oct 16, 2019		Soil	M19-Oc28396		X					
103	OSA2_SED13_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28397		X					
104	OSA2_SED13_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28398		X					
105	OSA2_SED13_1.2-1.3	Oct 16, 2019		Soil	M19-Oc28399		X					
106	OSA2_SED14_0-0.1	Oct 16, 2019		Soil	M19-Oc28400		X					
107	OSA2_SED14_0.5-0.6	Oct 16, 2019		Soil	M19-Oc28401		X					
108	OSA2_SED14_0.7-0.8	Oct 16, 2019		Soil	M19-Oc28402		X					

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		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
109	OSA2_SED14_1.0-1.1	Oct 16, 2019		Soil	M19-Oc28403		X					
110	OSA2_SED14_1.4-1.5	Oct 16, 2019		Soil	M19-Oc28404		X					
111	OSA2_SED14_1.7-1.8	Oct 16, 2019		Soil	M19-Oc28405		X					
112	OSA2_SED15_0.3-0.4	Oct 17, 2019		Soil	M19-Oc28406		X					
113	OSA2_SED15_0.7-0.8	Oct 17, 2019		Soil	M19-Oc28407		X					
114	OSA2_SED15_1.3-1.4	Oct 17, 2019		Soil	M19-Oc28408		X					
115	OSA2_SED16_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28409		X					

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
116	OSA2_SED16 _0.7-0.8	Oct 17, 2019		Soil	M19-Oc28410		X					
117	OSA2_SED16 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28411		X					
118	OSA2_SED16 _1.6-1.7	Oct 17, 2019		Soil	M19-Oc28412		X					
119	OSA2_SED17 _0.7-0.8	Oct 17, 2019		Soil	M19-Oc28413		X					
120	OSA2_SED17 _1.0-1.1	Oct 17, 2019		Soil	M19-Oc28414		X					
121	OSA2_SED17 _1.7-1.8	Oct 17, 2019		Soil	M19-Oc28415		X					
122	OSA2_SED18 _0.5-0.6	Oct 17, 2019		Soil	M19-Oc28416		X					

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Sample Detail						CANCELLED	HOLD	Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
123	OSA2_SED18_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28417		X					
124	OSA2_SED18_1.5-1.6	Oct 17, 2019		Soil	M19-Oc28418		X					
125	OSA2_SED19_0.4-0.5	Oct 17, 2019		Soil	M19-Oc28419		X					
126	OSA2_SED19_0.8-0.9	Oct 17, 2019		Soil	M19-Oc28420		X					
127	OSA2_SED19_1.0-1.1	Oct 17, 2019		Soil	M19-Oc28421		X					
128	OSA2_SED19_1.5-1.6	Oct 17, 2019		Soil	M19-Oc28422		X					
129	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc28423		X					
Test Counts						1	68	32	60	32	58	58

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0			0.00001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	107			70-130	Pass	
TRH C10-C14	%	90			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	104			70-130	Pass	
Toluene	%	104			70-130	Pass	
Ethylbenzene	%	107			70-130	Pass	
m&p-Xylenes	%	103			70-130	Pass	
Xylenes - Total	%	104			70-130	Pass	
LCS - % Recovery							

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Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			%	105			70-130	Pass	
TRH C6-C10			%	111			70-130	Pass	
TRH >C10-C16			%	81			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene			%	101			70-130	Pass	
Acenaphthylene			%	105			70-130	Pass	
Anthracene			%	83			70-130	Pass	
Benz(a)anthracene			%	98			70-130	Pass	
Benzo(a)pyrene			%	94			70-130	Pass	
Benzo(b&j)fluoranthene			%	107			70-130	Pass	
Benzo(g.h.i)perylene			%	93			70-130	Pass	
Benzo(k)fluoranthene			%	110			70-130	Pass	
Chrysene			%	99			70-130	Pass	
Dibenz(a.h)anthracene			%	83			70-130	Pass	
Fluoranthene			%	83			70-130	Pass	
Fluorene			%	98			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	99			70-130	Pass	
Naphthalene			%	95			70-130	Pass	
Phenanthrene			%	82			70-130	Pass	
Pyrene			%	80			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	W19-Oc23769	NCP	%	106			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	W19-Oc23769	NCP	%	98			70-130	Pass	
Toluene	W19-Oc23769	NCP	%	101			70-130	Pass	
Ethylbenzene	W19-Oc23769	NCP	%	106			70-130	Pass	
m&p-Xylenes	W19-Oc23769	NCP	%	98			70-130	Pass	
o-Xylene	W19-Oc23769	NCP	%	101			70-130	Pass	
Xylenes - Total	W19-Oc23769	NCP	%	103			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	W19-Oc23769	NCP	%	98			70-130	Pass	
TRH C6-C10	W19-Oc23769	NCP	%	109			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Acenaphthene	S19-Oc23118	NCP	%	82			70-130	Pass	
Acenaphthylene	S19-Oc23118	NCP	%	84			70-130	Pass	
Anthracene	S19-Oc23118	NCP	%	86			70-130	Pass	
Benz(a)anthracene	S19-Oc23118	NCP	%	94			70-130	Pass	
Benzo(a)pyrene	S19-Oc23118	NCP	%	96			70-130	Pass	
Benzo(b&j)fluoranthene	S19-Oc23118	NCP	%	98			70-130	Pass	
Benzo(g.h.i)perylene	S19-Oc23118	NCP	%	76			70-130	Pass	
Benzo(k)fluoranthene	S19-Oc23118	NCP	%	75			70-130	Pass	
Chrysene	S19-Oc23118	NCP	%	75			70-130	Pass	
Dibenz(a.h)anthracene	S19-Oc23118	NCP	%	75			70-130	Pass	
Fluoranthene	S19-Oc23118	NCP	%	85			70-130	Pass	
Fluorene	S19-Oc23118	NCP	%	79			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S19-Oc23118	NCP	%	87			70-130	Pass	
Naphthalene	S19-Oc23118	NCP	%	102			70-130	Pass	

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Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	S19-Oc23118	NCP	%	91			70-130	Pass	
Pyrene	S19-Oc23118	NCP	%	86			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	M19-Oc28329	CP	%	121			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	M19-Oc28329	CP	%	116			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	S19-Oc28806	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S19-Oc28806	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S19-Oc28806	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	S19-Oc28806	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	M19-Oc28328	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	M19-Oc28328	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	M19-Oc28328	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	M19-Oc28328	CP	mg/L	0.00001	0.00009	150	30%	Fail	Q02
Benzo(a)pyrene	M19-Oc28328	CP	mg/L	0.00001	0.00005	120	30%	Fail	Q02
Benzo(b&j)fluoranthene	M19-Oc28328	CP	mg/L	0.00002	0.00004	83	30%	Fail	Q02
Benzo(g.h.i)perylene	M19-Oc28328	CP	mg/L	0.00002	0.00003	41	30%	Fail	Q15
Benzo(k)fluoranthene	M19-Oc28328	CP	mg/L	0.00001	0.00003	100	30%	Fail	Q02
Chrysene	M19-Oc28328	CP	mg/L	0.00002	0.00008	120	30%	Fail	Q02
Dibenz(a.h)anthracene	M19-Oc28328	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	M19-Oc28328	CP	mg/L	0.00002	0.00006	91	30%	Fail	Q02
Fluorene	M19-Oc28328	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M19-Oc28328	CP	mg/L	0.00002	0.00002	14	30%	Pass	
Naphthalene	M19-Oc28328	CP	mg/L	0.00001	0.00001	2.0	30%	Pass	
Phenanthrene	M19-Oc28328	CP	mg/L	0.00001	0.00002	33	30%	Fail	Q02
Pyrene	M19-Oc28328	CP	mg/L	0.00003	0.00006	83	30%	Fail	Q02
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc28353	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc28353	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	M19-Oc28353	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M19-Oc28353	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M19-Oc28353	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M19-Oc28353	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	M19-Oc28353	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc28353	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	M19-Oc28353	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

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Comments

This report has been revised (V2) to amend sample name for M19-Oc28335.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q02	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

09698

JBS&G

CHAIN OF CUSTODY

PROJECT NO.:	51163	LABORATORY BATCH NO.:	683945
PROJECT NAME:	Wooloowane	SAMPLERS:	JS
DATE NEEDED BY:	STD T/A	QC LEVEL: NEPM (2013)	

PHONE: Sydney: 02 8245 0300 | Perth: 08 9488 0100 | Brisbane: 07 3112 2688

SEND REPORT & INVOICE TO: (1) adminnsw@jbsg.com.au; (2) ....JStaehli..........@jbsg.com.au; (3) ....@jbsg.com.au

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	pH	TRH/BTEX	PAHs (low level)	TYPE OF ASBESTOS ANALYSIS: IDENTIFICATION	TYPE OF ASBESTOS ANALYSIS: NEPM/WA	NOTES:
OSA2-SW-07	Water	21/10/19	-	2x vials, 1x1L amber		X	X			

RELINQUISHED BY:	METHOD OF SHIPMENT:	RECEIVED BY:	FOR RECEIVING LAB USE ONLY:
NAME: J.Staehli DATE: 21/10/19 OF: JBS&G	CONSIGNMENT NOTE NO. TRANSPORT CO.	NAME: Grace DATE: 22/10 OF: Eurofins	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP 9.8 deg C
NAME: DATE: OF:	CONSIGNMENT NOTE NO. TRANSPORT CO	NAME: DATE: OF:	COOLER SEAL – Yes....... No .... Intact .... Broken .... COOLER TEMP .... deg C

Container & Preservative Codes: P = Plastic; J = Soil Jar; B = Glass Bottle; N = Nitric Acid Prsvd.; C = Sodium Hydroxide Prsvd; VC = Hydrochloric Acid Prsvd Vial; VS = Sulfuric Acid Prsvd Vial; S = Sulfuric Acid Prsvd; Z = Zinc Prsvd; E = EDTA Prsvd; ST = Sterile Bottle; O = Other

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Jessica Staehli
Project name:	WOOLOOWARE
Project ID:	51163
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Oct 22, 2019 5:38 PM
Eurofins reference:	**683945**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins Sample Receipt : 9.8 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ursula Long on Phone : or by e.mail: UrsulaLong@eurofins.com

Results will be delivered electronically via e.mail to Jessica Staehli - JStaehli@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

eurofins Environment Testing

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e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
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NATA # 1261
Site # 1254 & 14271

Sydney
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16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Order No.:
Report #: 683945
Phone: 02 8245 0300
Fax:

Received: Oct 22, 2019 5:38 PM
Due: Oct 29, 2019
Priority: 5 Day
Contact Name: Jessica Staehli

Project Name: WOOLOOWARE
Project ID: 51163

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Eurofins | mgt Suite B1	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	OSA2-SW-07	Oct 21, 2019		Water	S19-Oc33991	X	X
Test Counts						1	1

Certificate of Analysis

Environment Testing

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Jessica Staehli**

Report	**683945-W**
Project name	WOOLOOWARE
Project ID	51163
Received Date	Oct 22, 2019

Client Sample ID			**OSA2-SW-07**
Sample Matrix			**Water**
Eurofins Sample No.			**S19-Oc33991**
Date Sampled			**Oct 21, 2019**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	97
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.01	mg/L	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)			
Acenaphthene	0.00001	mg/L	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001

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Client Sample ID			OSA2-SW-07
Sample Matrix			Water
Eurofins Sample No.			S19-Oc33991
Date Sampled			Oct 21, 2019
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons (Trace level)			
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	70
p-Terphenyl-d14 (surr.)	1	%	60

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B1			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 28, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 24, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 24, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 28, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 28, 2019	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			

eurofins Environment Testing

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 22, 2019 5:38 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	683945	**Due:**	Oct 29, 2019
		Phone:	02 8245 0300	**Priority:**	5 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Eurofins | mgt Suite B1	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	OSA2-SW-07	Oct 21, 2019		Water	S19-Oc33991	X	X
Test Counts						1	1

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Environment Testing

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	112			70-130	Pass	
TRH C10-C14	%	102			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	104			70-130	Pass	
Toluene	%	107			70-130	Pass	
Ethylbenzene	%	111			70-130	Pass	
m&p-Xylenes	%	104			70-130	Pass	
Xylenes - Total	%	104			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene			%	102			70-130	Pass	
TRH C6-C10			%	117			70-130	Pass	
TRH >C10-C16			%	91			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene			%	108			70-130	Pass	
Acenaphthylene			%	106			70-130	Pass	
Anthracene			%	80			70-130	Pass	
Benz(a)anthracene			%	90			70-130	Pass	
Benzo(a)pyrene			%	87			70-130	Pass	
Benzo(b&j)fluoranthene			%	97			70-130	Pass	
Benzo(g.h.i)perylene			%	100			70-130	Pass	
Benzo(k)fluoranthene			%	97			70-130	Pass	
Chrysene			%	99			70-130	Pass	
Dibenz(a.h)anthracene			%	111			70-130	Pass	
Fluoranthene			%	83			70-130	Pass	
Fluorene			%	103			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	82			70-130	Pass	
Naphthalene			%	97			70-130	Pass	
Phenanthrene			%	81			70-130	Pass	
Pyrene			%	82			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc35593	NCP	%	105			70-130	Pass	
TRH C10-C14	M19-Oc37002	NCP	%	104			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M19-Oc35593	NCP	%	107			70-130	Pass	
Toluene	M19-Oc35593	NCP	%	96			70-130	Pass	
Ethylbenzene	M19-Oc35593	NCP	%	97			70-130	Pass	
m&p-Xylenes	M19-Oc35593	NCP	%	87			70-130	Pass	
o-Xylene	M19-Oc35593	NCP	%	90			70-130	Pass	
Xylenes - Total	M19-Oc35593	NCP	%	88			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc35593	NCP	%	115			70-130	Pass	
TRH C6-C10	M19-Oc35593	NCP	%	103			70-130	Pass	
TRH >C10-C16	M19-Oc37002	NCP	%	94			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Acenaphthene	S19-Oc23118	NCP	%	82			70-130	Pass	
Acenaphthylene	S19-Oc23118	NCP	%	84			70-130	Pass	
Anthracene	S19-Oc23118	NCP	%	86			70-130	Pass	
Benz(a)anthracene	S19-Oc23118	NCP	%	94			70-130	Pass	
Benzo(a)pyrene	S19-Oc23118	NCP	%	96			70-130	Pass	
Benzo(b&j)fluoranthene	S19-Oc23118	NCP	%	98			70-130	Pass	
Benzo(g.h.i)perylene	S19-Oc23118	NCP	%	76			70-130	Pass	
Benzo(k)fluoranthene	S19-Oc23118	NCP	%	75			70-130	Pass	
Chrysene	S19-Oc23118	NCP	%	75			70-130	Pass	
Dibenz(a.h)anthracene	S19-Oc23118	NCP	%	75			70-130	Pass	
Fluoranthene	S19-Oc23118	NCP	%	85			70-130	Pass	
Fluorene	S19-Oc23118	NCP	%	79			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S19-Oc23118	NCP	%	87			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Naphthalene	S19-Oc23118	NCP	%	102			70-130	Pass	
Phenanthrene	S19-Oc23118	NCP	%	91			70-130	Pass	
Pyrene	S19-Oc23118	NCP	%	86			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc35586	NCP	mg/L	0.29	0.46	44	30%	Fail	Q15
TRH C10-C14	S19-Oc33991	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S19-Oc33991	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S19-Oc33991	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc35586	NCP	mg/L	0.017	0.021	23	30%	Pass	
Toluene	M19-Oc35586	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M19-Oc35586	NCP	mg/L	0.005	0.006	22	30%	Pass	
m&p-Xylenes	M19-Oc35586	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M19-Oc35586	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	M19-Oc35586	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc35586	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	M19-Oc35586	NCP	mg/L	0.40	0.61	41	30%	Fail	Q15
TRH >C10-C16	S19-Oc33991	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	S19-Oc33991	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	S19-Oc33991	CP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(a)pyrene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(b&j)fluoranthene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(g.h.i)perylene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(k)fluoranthene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Chrysene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Dibenz(a.h)anthracene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluorene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Naphthalene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Phenanthrene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Pyrene	S19-Oc33991	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Enviro Sample Vic

From:	Ursula Long
Sent:	Monday, 28 October 2019 3:29 PM
To:	Enviro Sample Vic Transit; Enviro Sample Vic; Catherine Wilson
Subject:	2 DAY ADDITIONAL: FW: Eurofins Final Test Results - Report 683343 : Site WOOLOOWARE (51163)
Attachments:	Eurofins Sample Receipt Advice - Report 683343 : Site WOOLOOWARE (51163)

2 day TAT additional please on report 683343

Oc28423 for Trace PAH, TRH & Btex – previously on Hold

D.S 15/10

OC28423-HOLD 3AC
4VV

Kind regards,

Ursula Long

Eurofins | Environment Testing
Unit F3, Parkview Building
16 Mars Road
LANE COVE WEST NSW 2066
AUSTRALIA
Phone : +61 2 9900 8420
Mobile: +61 428 845 495

Email : UrsulaLong@eurofins.com
Website: www.eurofins.com.au/environmental-testing

From: Jessica Staehli [mailto:JStaehli@jbsg.com.au]
Sent: Monday, 28 October 2019 3:12 PM
To: Ursula Long
Subject: RE: Eurofins Final Test Results - Report 683343 : Site WOOLOOWARE (51163)

684897
Adl'n EF)
28/10/19 :3:12 pm

EXTERNAL EMAIL*

Hi Ursula,

I'm missing results for OSA-PW-07, I sent the VIC sample receipt team an email asking for sample names to be changed but I don't think she understood to run the water sample OSA-PW-07, she just changed the name and placed on hold however it should've been analysed for TRH/BTEX and PAHs (low level) as per my COC. I missed that on the re-sent SRA.

Can I please get this sample analysed on a 3 day t/a?

Thanks,

Jessica Staehli | Environmental Consultant | JBS&G
Sydney | Melbourne | Adelaide | Bunbury | Brisbane | Canberra | Darwin | Wollongong
Level 1, 50 Margaret Street Sydney NSW 2000
T: 02 8245 0300 | M: 0410 187 644 E: jstaehli@jbsg.com.au | W: www.jbsg.com.au
Contaminated Land | Groundwater Remediation | Environmental Approvals | Auditing and Compliance | Hygiene and Hazardous Materials | Due Diligence and Liability | Stakeholder and Risk Management

Enviro Sample Vic

From:	Ursula Long
Sent:	Monday, 28 October 2019 5:48 PM
To:	Enviro Sample Vic Transit; Enviro Sample Vic; Catherine Wilson
Subject:	RE: 2 DAY ADDITIONAL: FW: Eurofins Final Test Results - Report 683343 : Site WOOLOOWARE (51163)
Importance:	High

This has been logged as 684897

Can you please add on the below samples for TRH, Btex, PAH trace & TOC (all previously on Hold):

- **OSA2-SED04_0.3-0.4 - Oc28367**
- **OSA2-SED05-0-0.1 - Oc28369**
- **OSA2-SED12-1.0-1.1 Oc28393**

0.5 15/10
HOLD.
1677
1678.

Kind regards,

Ursula Long

Eurofins | Environment Testing
Unit F3, Parkview Building
16 Mars Road
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AUSTRALIA
Phone : +61 2 9900 8420
Mobile: +61 428 845 495

Email : UrsulaLong@eurofins.com
Website: www.eurofins.com.au/environmental-testing

G.Grath 28/10 684897

From: Ursula Long
Sent: Monday, 28 October 2019 3:29 PM
To: 'Enviro Sample Vic Transit'; Enviro Sample Vic; Catherine Wilson
Subject: 2 DAY ADDITIONAL: FW: Eurofins Final Test Results - Report 683343 : Site WOOLOOWARE (51163)

2 day TAT additional please on report 683343

Oc28423 for Trace PAH, TRH & Btex – previously on Hold

Kind regards,

Ursula Long

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Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Jessica Staehli
Project name:	WOOLOOWARE
Project ID:	51163
COC number:	Not provided
Turn around time:	2 Day
Date/Time received:	Oct 28, 2019 5:48 PM
Eurofins reference:	**684897**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ursula Long on Phone : or by e.mail: UrsulaLong@eurofins.com

Results will be delivered electronically via e.mail to Jessica Staehli - JStaehli@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

eurofins
Environment Testing

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

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6 Monterey Road
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Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 28, 2019 5:48 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	684897	**Due:**	Oct 31, 2019
		Phone:	02 8245 0300	**Priority:**	2 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
Perth Laboratory - NATA Site # 23736										
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc42704		X		X	X
2	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc43728	X	X	X	X	X
3	OSA2_SED05_0-0.1	Oct 15, 2019		Soil	M19-Oc43729	X	X	X	X	X
4	OSA2_SED12_1.0-1.1	Oct 15, 2019		Soil	M19-Oc43730	X	X	X	X	X
Test Counts						3	4	3	4	4

eurofins Environment Testing

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Jessica Staehli**

Report **684897-S**
Project name WOOLOOWARE
Project ID 51163
Received Date Oct 28, 2019

Client Sample ID			**OSA2_SED04_ 0.3-0.4**	**OSA2_SED05_ 0-0.1**	**OSA2_SED12_ 1.0-1.1**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc43728**	**M19-Oc43729**	**M19-Oc43730**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	20	mg/kg	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	38	55	31
TRH C15-C28	50	mg/kg	57	82	< 50
TRH C29-C36	50	mg/kg	< 50	< 50	< 50
TRH C10-C36 (Total)	50	mg/kg	95	137	< 50
BTEX					
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Xylenes - Total	0.3	mg/kg	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	78	67	100
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene[N02]	0.5	mg/kg	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	59	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	59	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100
TRH >C10-C40 (total)*	100	mg/kg	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons (Trace level)					
Acenaphthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Acenaphthylene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Benz(a)anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Benzo(a)pyrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Benzo(b&j)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Benzo(g.h.i)perylene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Benzo(k)fluoranthene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Chrysene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Dibenz(a.h)anthracene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Fluoranthene	0.005	mg/kg	0.019	0.041	0.022
Fluorene	0.005	mg/kg	< 0.005	< 0.005	< 0.005

Client Sample ID			OSA2_SED04_ 0.3-0.4	OSA2_SED05_ 0-0.1	OSA2_SED12_ 1.0-1.1
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M19-Oc43728**	**M19-Oc43729**	**M19-Oc43730**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit			
Polycyclic Aromatic Hydrocarbons (Trace level)					
Indeno(1.2.3-cd)pyrene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Naphthalene	0.005	mg/kg	< 0.005	< 0.005	< 0.005
Phenanthrene	0.005	mg/kg	0.007	0.018	0.031
Pyrene	0.005	mg/kg	0.023	0.055	0.039
Total PAH*	0.005	mg/kg	0.049	0.114	0.092
2-Fluorobiphenyl (surr.)	1	%	78	79	79
p-Terphenyl-d14 (surr.)	1	%	75	74	78
Total Organic Carbon	0.1	%	11	14	5.6
% Moisture	1	%	74	79	62

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 29, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 29, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 29, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 29, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 29, 2019	0 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			
Total Organic Carbon	Melbourne	Oct 31, 2019	28 Days
- Method: LTM-INO-4060 Total Organic Carbon in water and soil			
% Moisture	Melbourne	Oct 29, 2019	14 Days
- Method: LTM-GEN-7080 Moisture			

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Order No.:
Report #: 684897
Phone: 02 8245 0300
Fax:

Received: Oct 28, 2019 5:48 PM
Due: Oct 31, 2019
Priority: 2 Day
Contact Name: Jessica Staehli

Project Name: WOOLOOWARE
Project ID: 51163

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
Perth Laboratory - NATA Site # 23736										
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc42704		X		X	X
2	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc43728	X	X	X	X	X
3	OSA2_SED05_0-0.1	Oct 15, 2019		Soil	M19-Oc43729	X	X	X	X	X
4	OSA2_SED12_1.0-1.1	Oct 15, 2019		Soil	M19-Oc43730	X	X	X	X	X
Test Counts						3	4	3	4	4

Internal Quality Control Review and Glossary

General

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2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
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For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
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SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
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RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

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5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Total PAH*	mg/kg	< 0			0.005	Pass	
Method Blank							
Total Organic Carbon	%	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	115			70-130	Pass	
TRH C10-C14	%	82			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	97			70-130	Pass	
Toluene	%	103			70-130	Pass	
Ethylbenzene	%	105			70-130	Pass	
m&p-Xylenes	%	100			70-130	Pass	
Xylenes - Total	%	102			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	129			70-130	Pass	
TRH C6-C10	%	113			70-130	Pass	
TRH >C10-C16	%	80			70-130	Pass	
LCS - % Recovery							
Total Organic Carbon	%	107			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc43818	NCP	%	114			70-130	Pass	
TRH C10-C14	W19-Oc31007	NCP	%	77			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					

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Environment Testing

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzene	M19-Oc43818	NCP	%	124			70-130	Pass	
Toluene	M19-Oc43818	NCP	%	102			70-130	Pass	
Ethylbenzene	M19-Oc43818	NCP	%	105			70-130	Pass	
m&p-Xylenes	M19-Oc43818	NCP	%	103			70-130	Pass	
o-Xylene	M19-Oc43818	NCP	%	104			70-130	Pass	
Xylenes - Total	M19-Oc43818	NCP	%	103			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc43818	NCP	%	104			70-130	Pass	
TRH C6-C10	M19-Oc43818	NCP	%	113			70-130	Pass	
TRH >C10-C16	W19-Oc31007	NCP	%	73			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc43817	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	W19-Oc31004	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	W19-Oc31004	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	W19-Oc31004	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc43817	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M19-Oc43817	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M19-Oc43817	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M19-Oc43817	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M19-Oc43817	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total	M19-Oc43817	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc43817	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M19-Oc43817	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	W19-Oc31004	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Organic Carbon	M19-Oc38820	NCP	%	0.2	0.2	10	30%	Pass	
% Moisture	M19-Oc43804	NCP	%	20	21	<1	30%	Pass	

Environment Testing

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

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Certificate of Analysis

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Jessica Staehli**

Report **684897-W**
Project name WOOLOOWARE
Project ID 51163
Received Date Oct 28, 2019

Client Sample ID			**OSA2_PW_07**
Sample Matrix			**Water**
Eurofins Sample No.			**M19-Oc42704**
Date Sampled			**Oct 16, 2019**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	0.002
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	100
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.01	mg/L	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)			
Acenaphthene	0.00001	mg/L	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001

Client Sample ID			OSA2_PW_07
Sample Matrix			Water
Eurofins Sample No.			M19-Oc42704
Date Sampled			Oct 16, 2019
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons (Trace level)			
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	67
p-Terphenyl-d14 (surr.)	1	%	60

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Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 28, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 28, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Oct 28, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 28, 2019	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Oct 28, 2019	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Oct 28, 2019 5:48 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	684897	**Due:**	Oct 31, 2019
		Phone:	02 8245 0300	**Priority:**	2 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Total Organic Carbon	BTEX	Moisture Set	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
Perth Laboratory - NATA Site # 23736										
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	OSA2_PW_07	Oct 16, 2019		Water	M19-Oc42704		X		X	X
2	OSA2_SED04_0.3-0.4	Oct 15, 2019		Soil	M19-Oc43728	X	X	X	X	X
3	OSA2_SED05_0-0.1	Oct 15, 2019		Soil	M19-Oc43729	X	X	X	X	X
4	OSA2_SED12_1.0-1.1	Oct 15, 2019		Soil	M19-Oc43730	X	X	X	X	X
Test Counts						3	4	3	4	4

Environment Testing

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10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0			0.00001	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	103			70-130	Pass	
TRH C10-C14	%	102			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	92			70-130	Pass	
Toluene	%	107			70-130	Pass	
Ethylbenzene	%	118			70-130	Pass	
m&p-Xylenes	%	101			70-130	Pass	
Xylenes - Total	%	102			70-130	Pass	
LCS - % Recovery							

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			%	110			70-130	Pass	
TRH C6-C10			%	108			70-130	Pass	
TRH >C10-C16			%	91			70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene			%	106			70-130	Pass	
Acenaphthylene			%	107			70-130	Pass	
Anthracene			%	102			70-130	Pass	
Benz(a)anthracene			%	109			70-130	Pass	
Benzo(a)pyrene			%	94			70-130	Pass	
Benzo(b&j)fluoranthene			%	94			70-130	Pass	
Benzo(g.h.i)perylene			%	87			70-130	Pass	
Benzo(k)fluoranthene			%	102			70-130	Pass	
Chrysene			%	118			70-130	Pass	
Dibenz(a.h)anthracene			%	80			70-130	Pass	
Fluoranthene			%	105			70-130	Pass	
Fluorene			%	110			70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	80			70-130	Pass	
Naphthalene			%	101			70-130	Pass	
Phenanthrene			%	109			70-130	Pass	
Pyrene			%	103			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-Oc41652	NCP	%	95			70-130	Pass	
TRH C10-C14	M19-Oc37002	NCP	%	104			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M19-Oc41652	NCP	%	101			70-130	Pass	
Toluene	M19-Oc41652	NCP	%	95			70-130	Pass	
Ethylbenzene	M19-Oc41652	NCP	%	101			70-130	Pass	
m&p-Xylenes	M19-Oc41652	NCP	%	98			70-130	Pass	
o-Xylene	M19-Oc41652	NCP	%	100			70-130	Pass	
Xylenes - Total	M19-Oc41652	NCP	%	99			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-Oc41652	NCP	%	108			70-130	Pass	
TRH C6-C10	M19-Oc41652	NCP	%	102			70-130	Pass	
TRH >C10-C16	M19-Oc37002	NCP	%	94			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M19-Oc41910	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	S19-Oc36546	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S19-Oc36546	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S19-Oc36546	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M19-Oc41910	NCP	mg/L	0.002	0.002	7.0	30%	Pass	
Toluene	M19-Oc41910	NCP	mg/L	0.007	0.007	2.0	30%	Pass	
Ethylbenzene	M19-Oc41910	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M19-Oc41910	NCP	mg/L	0.002	0.002	1.0	30%	Pass	

Duplicate									
BTEX				Result 1	Result 2	RPD			
o-Xylene	M19-Oc41910	NCP	mg/L	0.001	0.001	2.0	30%	Pass	
Xylenes - Total	M19-Oc41910	NCP	mg/L	0.003	0.003	1.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-Oc41910	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	M19-Oc41910	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	S19-Oc36546	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(a)pyrene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(b&j)fluoranthene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(g.h.i)perylene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(k)fluoranthene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Chrysene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Dibenz(a.h)anthracene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluorene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Naphthalene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Phenanthrene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Pyrene	S19-Oc36546	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Enviro Sample Vic

From: Ursula Long
Sent: Thursday, 7 November 2019 3:56 PM
To: Enviro Sample Vic; Enviro Sample Vic Transit; Catherine Wilson
Cc: Mary Makarios
Subject: 1 DAY ADDITIONAL: FW: Eurofins Amended Test Results - Report 683343 : Site WOOLOOWARE (51163)

Importance: High

1 day TAT additional please on report 683343 for SilGel & TRH

- QC15102019-PW1 - Oc28351 - ACx2
- OSA2-PW-02 - Oc28326 - ACx2
- OSA2-PW-06 - Oc28330 -
- OAS2-PW-10 - Oc28334 -
- OSA2-PW-12 - Oc28335 -
- OSA2-PW15 - Oc28336 -
- OSA2-SW-02 - Oc28341 -

Kind regards,

Ursula Long

Eurofins | Environment Testing
Unit F3, Parkview Building
16 Mars Road
LANE COVE WEST NSW 2066
AUSTRALIA
Phone : +61 2 9900 8420
Mobile: +61 428 845 495

Email : UrsulaLong@eurofins.com
Website: www.eurofins.com.au/environmental-testing

From: Jessica Staehli [mailto:JStaehli@jbsg.com.au]
Sent: Thursday, 7 November 2019 3:51 PM
To: Ursula Long
Subject: RE: Eurofins Amended Test Results - Report 683343 : Site WOOLOOWARE (51163)

EXTERNAL EMAIL*

Hi Ursula,

Can I please request additional silica gel clean up and TRHs re-analysed for the following water samples:

- QC15102019-PW1
- OSA2-PW-02
- OSA2-PW-06
- OAS2-PW-10
- OSA2-PW-12
- OSA2-PW15 and
- OSA2-SW-02

686891
7/11/19
3:56pm
Joanne

Melbourne
6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**JBS & G Australia (NSW) P/L**
Contact name:	Jessica Staehli
Project name:	WOOLOOWARE
Project ID:	51163
COC number:	Not provided
Turn around time:	1 Day
Date/Time received:	Nov 7, 2019 3:56 PM
Eurofins reference:	**686881**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ursula Long on Phone : or by e.mail: UrsulaLong@eurofins.com

Results will be delivered electronically via e.mail to Jessica Staehli - JStaehli@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

eurofins Environment Testing

ABN – 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

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6 Monterey Road
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Site # 1254 & 14271

Sydney
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16 Mars Road
Lane Cove West NSW 2066
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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 7, 2019 3:56 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	686881	**Due:**	Nov 8, 2019
		Phone:	02 8245 0300	**Priority:**	1 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						TRH (after Silica Gel cleanup)	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	QC15102019_PW1	Oct 15, 2019		Water	M19-No09745	X	X	X
2	OSA2-PW-02	Oct 15, 2019		Water	M19-No09746	X	X	
3	OSA2-PW-06	Oct 15, 2019		Water	M19-No09747	X	X	
4	OSA2-PW-10	Oct 15, 2019		Water	M19-No09748	X	X	
5	OSA2-PW-12	Oct 15, 2019		Water	M19-No09749	X	X	
6	OSA2-PW-15	Oct 15, 2019		Water	M19-No09750	X	X	
7	OSA2-SW-02	Oct 15, 2019		Water	M19-No09751	X	X	
Test Counts						7	7	1

Certificate of Analysis

Environment Testing

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Jessica Staehli**

Report **686881-W**
Project name WOOLOOWARE
Project ID 51163
Received Date Nov 07, 2019

Client Sample ID			**QC15102019_PW1**	[G01]**OSA2-PW-02**	**OSA2-PW-06**	**OSA2-PW-10**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M19-No09745**	**M19-No09746**	**M19-No09747**	**M19-No09748**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.08	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	0.06	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	0.2	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	0.26	< 0.1	< 0.1
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.04	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.08	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.08	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	0.13	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	0.13	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	0.23	< 0.1	< 0.1
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C36 (Total) (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C14 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	0.00001	-	-	-
Acenaphthylene	0.00001	mg/L	0.00001	-	-	-
Anthracene	0.00001	mg/L	< 0.00001	-	-	-
Benz(a)anthracene	0.00001	mg/L	0.00005	-	-	-
Benzo(a)pyrene	0.00001	mg/L	0.00005	-	-	-
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00005	-	-	-
Benzo(g.h.i)perylene	0.00001	mg/L	0.00002	-	-	-
Benzo(k)fluoranthene	0.00001	mg/L	0.00005	-	-	-
Chrysene	0.00001	mg/L	0.00009	-	-	-
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001	-	-	-

Client Sample ID			QC15102019_PW1	G01 OSA2-PW-02	OSA2-PW-06	OSA2-PW-10
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-No09745	M19-No09746	M19-No09747	M19-No09748
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Fluoranthene	0.00001	mg/L	0.00010	-	-	-
Fluorene	0.00001	mg/L	< 0.00001	-	-	-
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00002	-	-	-
Naphthalene	0.00001	mg/L	< 0.00001	-	-	-
Phenanthrene	0.00001	mg/L	0.00002	-	-	-
Pyrene	0.00001	mg/L	0.00010	-	-	-
Total PAH*	0.00001	mg/L	0.00057	-	-	-
2-Fluorobiphenyl (surr.)	1	%	88	-	-	-
p-Terphenyl-d14 (surr.)	1	%	97	-	-	-

Client Sample ID			G01 OSA2-PW-12	G01 OSA2-PW-15	OSA2-SW-02
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M19-No09749	M19-No09750	M19-No09751
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	< 0.08	< 0.08	< 0.02
TRH C10-C14	0.05	mg/L	0.05	0.09	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	0.9	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	0.9	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	1.89	< 0.1
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene N02	0.01	mg/L	< 0.04	< 0.04	< 0.01
TRH C6-C10	0.02	mg/L	< 0.08	< 0.08	< 0.02
TRH C6-C10 less BTEX (F1) N04	0.02	mg/L	< 0.08	< 0.08	< 0.02
TRH >C10-C16	0.05	mg/L	0.08	0.16	< 0.05
TRH >C10-C16 less Naphthalene (F2) N01	0.05	mg/L	0.08	0.16	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	1.5	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	0.3	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	1.96	< 0.1
TRH - 2013 NEPM Fractions (after silica gel clean-up)					
TRH >C10-C16 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05
TRH >C16-C34 (after silica gel clean-up)	0.1	mg/L	< 0.1	0.1	< 0.1
TRH >C34-C40 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1
TRH - 1999 NEPM Fractions (after silica gel clean-up)					
TRH C10-C36 (Total) (after silica gel clean-up)	0.1	mg/L	< 0.1	0.1	< 0.1
TRH C10-C14 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05
TRH C15-C28 (after silica gel clean-up)	0.1	mg/L	< 0.1	0.1	< 0.1
TRH C29-C36 (after silica gel clean-up)	0.1	mg/L	< 0.1	< 0.1	< 0.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Nov 07, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 07, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Nov 07, 2019	
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Melbourne	Nov 07, 2019	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Melbourne	Nov 07, 2019	7 Days
- Method: TRH C6-C36 (Silica Gel Cleanup) - MGT 100A			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Nov 08, 2019	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			

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NATA # 1261 Site # 20794

Perth
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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 7, 2019 3:56 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	686881	**Due:**	Nov 8, 2019
		Phone:	02 8245 0300	**Priority:**	1 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						TRH (after Silica Gel cleanup)	Total Recoverable Hydrocarbons	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	QC15102019_PW1	Oct 15, 2019		Water	M19-No09745	X	X	X
2	OSA2-PW-02	Oct 15, 2019		Water	M19-No09746	X	X	
3	OSA2-PW-06	Oct 15, 2019		Water	M19-No09747	X	X	
4	OSA2-PW-10	Oct 15, 2019		Water	M19-No09748	X	X	
5	OSA2-PW-12	Oct 15, 2019		Water	M19-No09749	X	X	
6	OSA2-PW-15	Oct 15, 2019		Water	M19-No09750	X	X	
7	OSA2-SW-02	Oct 15, 2019		Water	M19-No09751	X	X	
Test Counts						7	7	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions									
TRH C6-C9			mg/L	< 0.02			0.02	Pass	
TRH C10-C14			mg/L	< 0.05			0.05	Pass	
TRH C15-C28			mg/L	< 0.1			0.1	Pass	
TRH C29-C36			mg/L	< 0.1			0.1	Pass	
Method Blank									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			mg/L	< 0.01			0.01	Pass	
TRH C6-C10			mg/L	< 0.02			0.02	Pass	
TRH >C10-C16			mg/L	< 0.05			0.05	Pass	
TRH >C16-C34			mg/L	< 0.1			0.1	Pass	
TRH >C34-C40			mg/L	< 0.1			0.1	Pass	
Method Blank									
TRH - 2013 NEPM Fractions (after silica gel clean-up)									
TRH >C10-C16 (after silica gel clean-up)			mg/L	< 0.05			0.05	Pass	
TRH >C16-C34 (after silica gel clean-up)			mg/L	< 0.1			0.1	Pass	
TRH >C34-C40 (after silica gel clean-up)			mg/L	< 0.1			0.1	Pass	
Method Blank									
TRH - 1999 NEPM Fractions (after silica gel clean-up)									
TRH C10-C14 (after silica gel clean-up)			mg/L	< 0.05			0.05	Pass	
TRH C15-C28 (after silica gel clean-up)			mg/L	< 0.1			0.1	Pass	
TRH C29-C36 (after silica gel clean-up)			mg/L	< 0.1			0.1	Pass	
LCS - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions									
TRH C6-C9			%	107			70-130	Pass	
TRH C10-C14			%	92			70-130	Pass	
LCS - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions									
Naphthalene			%	98			70-130	Pass	
TRH C6-C10			%	112			70-130	Pass	
TRH >C10-C16			%	86			70-130	Pass	
LCS - % Recovery									
TRH - 2013 NEPM Fractions (after silica gel clean-up)									
TRH >C10-C16 (after silica gel clean-up)			%	85			70-130	Pass	
LCS - % Recovery									
TRH - 1999 NEPM Fractions (after silica gel clean-up)									
TRH C10-C14 (after silica gel clean-up)			%	90			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M19-No03157	NCP	%	113			70-130	Pass	
TRH C10-C14	B19-No00767	NCP	%	90			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M19-No03157	NCP	%	99			70-130	Pass	
TRH C6-C10	M19-No03157	NCP	%	118			70-130	Pass	
TRH >C10-C16	B19-No00767	NCP	%	87			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	M19-No00537	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M19-No00537	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	M19-No00537	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M19-No04905	NCP	mg/L	0.04	0.04	5.0	30%	Pass	
TRH >C10-C16	M19-No00537	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	M19-No00537	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	M19-No00537	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.

Authorised By

Ursula Long	Analytical Services Manager
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

eurofins | Environment Testing

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **JBS & G Australia (NSW) P/L**

Contact name: Jessica Staehli
Project name: WOOLOOWARE
Project ID: 51163
COC number: Not provided
Turn around time: 1 Day
Date/Time received: Nov 11, 2019 1:04 PM
Eurofins reference: **687337**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Split sample sent to requested external lab.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Ursula Long on Phone : or by e.mail: UrsulaLong@eurofins.com

Results will be delivered electronically via e.mail to Jessica Staehli - JStaehli@jbsg.com.au.

Note: A copy of these results will also be delivered to the general JBS & G Australia (NSW) P/L email address.

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NATA # 1261
Site # 23736

Company Name: JBS & G Australia (NSW) P/L
Address: Level 1, 50 Margaret St
Sydney
NSW 2000

Project Name: WOOLOOWARE
Project ID: 51163

Order No.:
Report #: 687337
Phone: 02 8245 0300
Fax:

Received: Nov 11, 2019 1:04 PM
Due: Nov 12, 2019
Priority: 1 Day
Contact Name: Jessica Staehli

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	OSA2_PW_02	Oct 15, 2019		Water	M19-No13897	X
2	OSA2_PW_03	Oct 15, 2019		Water	M19-No13898	X
3	OSA2_PW_05	Oct 15, 2019		Water	M19-No13899	X
4	OSA2_PW_06	Oct 15, 2019		Water	M19-No13900	X
5	OSA2_PW_08	Oct 15, 2019		Water	M19-No13901	X
6	OSA2_PW_10	Oct 15, 2019		Water	M19-No13902	X
7	OSA2_PW_11	Oct 15, 2019		Water	M19-No13903	X
8	OSA2_PW_12	Oct 15, 2019		Water	M19-No13904	X
9	OSA2_PW_15	Oct 15, 2019		Water	M19-No13905	X

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NATA # 1261 Site # 20794

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NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 11, 2019 1:04 PM
Address:	Level 1, 50 Margaret St	**Report #:**	687337	**Due:**	Nov 12, 2019
	Sydney	**Phone:**	02 8245 0300	**Priority:**	1 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
10	OSA2_PW_16	Oct 15, 2019		Water	M19-No13906	X
11	OSA2_PW_17	Oct 15, 2019		Water	M19-No13907	X
12	OSA2_PW_19	Oct 15, 2019		Water	M19-No13908	X
13	OSA2_PW_01	Oct 15, 2019		Water	M19-No13909	X
Test Counts						13

Certificate of Analysis

eurofins

Environment Testing

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

JBS & G Australia (NSW) P/L
Level 1, 50 Margaret St
Sydney
NSW 2000

Attention: **Jessica Staehli**

Report	**687337-W**
Project name	WOOLOOWARE
Project ID	51163
Received Date	Nov 11, 2019

Client Sample ID			**OSA2_PW_02**	**OSA2_PW_03**	**OSA2_PW_05**	**OSA2_PW_06**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M19-No13897**	**M19-No13898**	**M19-No13899**	**M19-No13900**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	0.00002	0.00001	0.00002
Acenaphthylene	0.00001	mg/L	0.00001	0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	0.00001	0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00008	0.00006	0.00004	0.00004
Benzo(a)pyrene	0.00001	mg/L	0.00006	0.00004	0.00003	0.00003
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00007	0.00005	0.00003	0.00004
Benzo(g.h.i)perylene	0.00001	mg/L	0.00004	0.00003	0.00002	0.00003
Benzo(k)fluoranthene	0.00001	mg/L	0.00009	0.00006	0.00004	0.00003
Chrysene	0.00001	mg/L	0.00010	0.00006	0.00005	0.00006
Dibenz(a.h)anthracene	0.00001	mg/L	0.00001	0.00001	< 0.00001	0.00001
Fluoranthene	0.00001	mg/L	0.00010	0.00012	0.00007	0.00006
Fluorene	0.00001	mg/L	< 0.00001	0.00001	< 0.00001	0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00006	0.00005	0.00003	0.00004
Naphthalene	0.00001	mg/L	0.00001	0.00002	0.00003	0.00002
Phenanthrene	0.00001	mg/L	0.00003	0.00004	0.00002	0.00002
Pyrene	0.00001	mg/L	0.00016	0.00016	0.00008	0.00008
Total PAH*	0.00001	mg/L	0.00083	0.00075	0.00045	0.00049
2-Fluorobiphenyl (surr.)	1	%	75	96	77	59
p-Terphenyl-d14 (surr.)	1	%	57	68	53	77

Client Sample ID			**OSA2_PW_08**	**OSA2_PW_10**	**OSA2_PW_11**	**OSA2_PW_12**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**M19-No13901**	**M19-No13902**	**M19-No13903**	**M19-No13904**
Date Sampled			**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**	**Oct 15, 2019**
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	0.00001	< 0.00001	0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	0.00004	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00009	0.00015	0.00007	0.00005
Benzo(a)pyrene	0.00001	mg/L	0.00007	0.00011	0.00006	0.00004
Benzo(b&j)fluoranthene	0.00001	mg/L	0.00006	0.00013	0.00006	0.00005
Benzo(g.h.i)perylene	0.00001	mg/L	0.00003	0.00007	0.00004	0.00003
Benzo(k)fluoranthene	0.00001	mg/L	0.00009	0.00017	0.00007	0.00005

Environment Testing

Client Sample ID			OSA2_PW_08	OSA2_PW_10	OSA2_PW_11	OSA2_PW_12
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-No13901	M19-No13902	M19-No13903	M19-No13904
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Chrysene	0.00001	mg/L	0.00011	0.00022	0.00010	0.00007
Dibenz(a.h)anthracene	0.00001	mg/L	0.00002	0.00004	0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	0.00010	0.00024	0.00013	0.00008
Fluorene	0.00001	mg/L	< 0.00001	0.00001	0.00001	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.00001	0.00015	0.00006	0.00004
Naphthalene	0.00001	mg/L	0.00002	0.00001	0.00003	0.00002
Phenanthrene	0.00001	mg/L	0.00003	0.00005	0.00003	0.00002
Pyrene	0.00001	mg/L	0.00013	0.00024	0.00015	0.00009
Total PAH*	0.00001	mg/L	0.00077	0.00163	0.00084	0.00054
2-Fluorobiphenyl (surr.)	1	%	85	55	51	91
p-Terphenyl-d14 (surr.)	1	%	56	73	74	62

Client Sample ID			OSA2_PW_15	OSA2_PW_16	OSA2_PW_17	OSA2_PW_19
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M19-No13905	M19-No13906	M19-No13907	M19-No13908
Date Sampled			Oct 15, 2019	Oct 15, 2019	Oct 15, 2019	Oct 15, 2019
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons (Trace level)						
Acenaphthene	0.00001	mg/L	0.00027	0.00001	0.00002	< 0.00001
Acenaphthylene	0.00001	mg/L	0.00031	0.00001	0.00004	< 0.00001
Anthracene	0.00001	mg/L	0.00066	< 0.00001	0.00004	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.0016	0.00010	0.00030	0.00002
Benzo(a)pyrene	0.00001	mg/L	0.0013	0.00012	0.00033	0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	0.0016	0.00015	0.00046	0.00002
Benzo(g.h.i)perylene	0.00001	mg/L	0.00065	0.00007	0.00017	0.00001
Benzo(k)fluoranthene	0.00001	mg/L	0.0015	0.00014	0.00039	0.00002
Chrysene	0.00001	mg/L	0.0021	0.00022	0.00048	0.00002
Dibenz(a.h)anthracene	0.00001	mg/L	0.00022	0.00006	0.00004	0.00003
Fluoranthene	0.00001	mg/L	0.0058	0.00023	0.00067	0.00002
Fluorene	0.00001	mg/L	0.00043	< 0.00001	0.00002	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.0012	0.00015	0.00037	0.00005
Naphthalene	0.00001	mg/L	0.00010	0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	0.0021	0.00005	0.00016	< 0.00001
Pyrene	0.00001	mg/L	0.0044	0.00025	0.00067	0.00002
Total PAH*	0.00001	mg/L	0.02424	0.00157	0.00416	0.00022
2-Fluorobiphenyl (surr.)	1	%	82	84	86	52
p-Terphenyl-d14 (surr.)	1	%	72	69	82	53

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Client Sample ID			OSA2_PW_01
Sample Matrix			Water
Eurofins Sample No.			M19-No13909
Date Sampled			Oct 15, 2019
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons (Trace level)			
Acenaphthene	0.00001	mg/L	0.00017
Acenaphthylene	0.00001	mg/L	0.00010
Anthracene	0.00001	mg/L	< 0.00001
Benz(a)anthracene	0.00001	mg/L	0.00057
Benzo(a)pyrene	0.00001	mg/L	0.0013
Benzo(b&j)fluoranthene	0.00001	mg/L	0.0015
Benzo(g.h.i)perylene	0.00001	mg/L	0.00060
Benzo(k)fluoranthene	0.00001	mg/L	0.0013
Chrysene	0.00001	mg/L	0.0022
Dibenz(a.h)anthracene	0.00001	mg/L	0.00018
Fluoranthene	0.00001	mg/L	0.0033
Fluorene	0.00001	mg/L	0.00015
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	0.0011
Naphthalene	0.00001	mg/L	0.00002
Phenanthrene	0.00001	mg/L	0.00092
Pyrene	0.00001	mg/L	0.0029
Total PAH*	0.00001	mg/L	0.01631
2-Fluorobiphenyl (surr.)	1	%	53
p-Terphenyl-d14 (surr.)	1	%	87

Environment Testing

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Nov 11, 2019	7 Days

- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 11, 2019 1:04 PM
Address:	Level 1, 50 Margaret St Sydney NSW 2000	**Report #:**	687337	**Due:**	Nov 12, 2019
		Phone:	02 8245 0300	**Priority:**	1 Day
		Fax:		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	OSA2_PW_02	Oct 15, 2019		Water	M19-No13897	X
2	OSA2_PW_03	Oct 15, 2019		Water	M19-No13898	X
3	OSA2_PW_05	Oct 15, 2019		Water	M19-No13899	X
4	OSA2_PW_06	Oct 15, 2019		Water	M19-No13900	X
5	OSA2_PW_08	Oct 15, 2019		Water	M19-No13901	X
6	OSA2_PW_10	Oct 15, 2019		Water	M19-No13902	X
7	OSA2_PW_11	Oct 15, 2019		Water	M19-No13903	X
8	OSA2_PW_12	Oct 15, 2019		Water	M19-No13904	X
9	OSA2_PW_15	Oct 15, 2019		Water	M19-No13905	X

ABN – 50 005 085 521
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	JBS & G Australia (NSW) P/L	**Order No.:**		**Received:**	Nov 11, 2019 1:04 PM
Address:	Level 1, 50 Margaret St	**Report #:**	687337	**Due:**	Nov 12, 2019
	Sydney	**Phone:**	02 8245 0300	**Priority:**	1 Day
	NSW 2000	**Fax:**		**Contact Name:**	Jessica Staehli
Project Name:	WOOLOOWARE				
Project ID:	51163				

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271						X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
10	OSA2_PW_16	Oct 15, 2019		Water	M19-No13906	X
11	OSA2_PW_17	Oct 15, 2019		Water	M19-No13907	X
12	OSA2_PW_19	Oct 15, 2019		Water	M19-No13908	X
13	OSA2_PW_01	Oct 15, 2019		Water	M19-No13909	X
Test Counts						13

Environment Testing

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ug/L:** micrograms per litre
ppm: Parts per million	**ppb:** Parts per billion	**%:** Percentage
org/100mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

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Environment Testing

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Total PAH*			mg/L	< 0			0.00001	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Acenaphthene	M19-No13907	CP	%	115			70-130	Pass	
Acenaphthylene	M19-No13907	CP	%	123			70-130	Pass	
Anthracene	M19-No13907	CP	%	113			70-130	Pass	
Benz(a)anthracene	M19-No13907	CP	%	97			70-130	Pass	
Benzo(a)pyrene	M19-No13907	CP	%	91			70-130	Pass	
Benzo(b&j)fluoranthene	M19-No13907	CP	%	90			70-130	Pass	
Benzo(g.h.i)perylene	M19-No13907	CP	%	89			70-130	Pass	
Benzo(k)fluoranthene	M19-No13907	CP	%	125			70-130	Pass	
Chrysene	M19-No13907	CP	%	113			70-130	Pass	
Dibenz(a.h)anthracene	M19-No13907	CP	%	77			70-130	Pass	
Fluoranthene	M19-No13907	CP	%	126			70-130	Pass	
Fluorene	M19-No13907	CP	%	127			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M19-No13907	CP	%	84			70-130	Pass	
Naphthalene	M19-No13907	CP	%	119			70-130	Pass	
Phenanthrene	M19-No13907	CP	%	120			70-130	Pass	
Pyrene	M19-No13907	CP	%	124			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	M19-No13906	CP	mg/L	0.00001	0.00002	27	30%	Pass	
Acenaphthylene	M19-No13906	CP	mg/L	0.00001	0.00003	82	30%	Fail	Q15
Anthracene	M19-No13906	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	M19-No13906	CP	mg/L	0.00010	0.00020	70	30%	Fail	Q15
Benzo(a)pyrene	M19-No13906	CP	mg/L	0.00012	0.00023	59	30%	Fail	Q15
Benzo(b&j)fluoranthene	M19-No13906	CP	mg/L	0.00015	0.00032	75	30%	Fail	Q15
Benzo(g.h.i)perylene	M19-No13906	CP	mg/L	0.00007	0.00016	84	30%	Fail	Q15
Benzo(k)fluoranthene	M19-No13906	CP	mg/L	0.00014	0.00029	70	30%	Fail	Q15
Chrysene	M19-No13906	CP	mg/L	0.00022	0.00037	52	30%	Fail	Q15
Dibenz(a.h)anthracene	M19-No13906	CP	mg/L	0.00006	0.00005	20	30%	Pass	
Fluoranthene	M19-No13906	CP	mg/L	0.00023	0.00041	55	30%	Fail	Q15
Fluorene	M19-No13906	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M19-No13906	CP	mg/L	0.00015	0.00027	57	30%	Fail	Q15
Naphthalene	M19-No13906	CP	mg/L	0.00001	0.00001	35	30%	Fail	Q15
Phenanthrene	M19-No13906	CP	mg/L	0.00005	0.00008	50	30%	Fail	Q15
Pyrene	M19-No13906	CP	mg/L	0.00025	0.00044	56	30%	Fail	Q15

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Ursula Long	Analytical Services Manager
Joseph Edouard	Senior Analyst-Organic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Appendix D Quality Assurance/Quality Control Summary

Data generated during this project must be appropriate to allow decisions to be made with confidence. Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC 2013, DEC 2007 and appropriate indicators of data quality (DQIs used to assess QA/QC) and standard JBS&G's procedures for field sampling and handling. Sample analysis was conducted by NATA Australia accredited laboratories with limits of reporting (LOR) for each analyte being below the adopted validation criteria.

To assess the usability of the data prior to making decisions, the data has been assessed against pre-determined DQIs for completeness, comparability, representativeness, precision and accuracy. The acceptable limit on decision error is 95% compliance with DQIs.

The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), and are shown in **Table 1**.

- Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples;
- Accuracy - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards;
- Representativeness - expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy;
- Comparability - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods; and
- Completeness - is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.

If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

Table 1: Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<50% RPD[1]
Split duplicates (inter laboratory)	1 / 20 samples	<50% RPD[1]
Laboratory Duplicates	1 / 20 samples	<50% RPD[1]
Accuracy		

Data Quality Objective	Frequency	Data Quality Indicator
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes		-
Laboratory blanks	1 per lab batch	<LOR
Samples extracted and analysed within holding times.	-	14 days for organics, metals 6 months
Trip spike (for volatiles)	1/sampling event	70-130% recovery
Trip blank (for volatiles) Rinsate blank	1/sampling event 1/sampling event	<LOR <LOR
Comparability		
Standard operating procedures for sample collection & handling	All samples	All samples
Standard analytical methods used for all analyses	All samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Limits of reporting appropriate and consistent	All samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All samples	All samples
Appropriate documentation	All samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid

(1) If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgement will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

(2) Lower recoveries may be recorded for some semi-volatile organic analyses particularly including phenols, Results within the laboratory nominated limits may also be acceptable.

Data quality indicators (DQIs) have been calculated as per the requirements of **Table 4.2** and are summarised in **Table 2** following. Laboratory reports are provided as **Appendix C**.

Table 2: Summary of Quality Assurance / Quality Control Assessment

Data Quality Indicator	Frequency	Results Reported	DQI met
Precision			
Blind duplicates – sediment	4/63	0-197 RPD	See discussion below
Blind duplicates – pore water	2/32	0-164 RPD	See discussion below
Blind duplicates – surface water (grab sample)	3/24	0-168 RPD	See discussion below
Blind duplicates – biota	2/15	0-65 RPD	See discussion below
Split duplicates – sediment	4/63	0-199 RPD	See discussion below
Split duplicates – pore water	2/32	0-71 RPD	See discussion below
Split duplicates – surface water (grab sample)	3/24	0-192 RPD	See discussion below
Split duplicates – biota	N/A	N/A	See discussion below
Laboratory duplicates – sediments	12/63	0-54 RPD	See discussion below
Laboratory duplicates – pore water	3/32	0-160 RPD	See discussion below
Laboratory duplicates – surface water (grab sample)	5/24	0 RPD	Yes
Laboratory duplicates – biota	3/17	0-17 RPD	Yes
Accuracy			
Surrogate spikes – sediment	All samples for organic constituent analysis	59-148 % recovery	See discussion below
Surrogate spikes – pore water	All samples for organic constituent analysis	51-137 % recovery	See discussion below
Surrogate spikes – surface water (grab sample)	All samples for organic constituent analysis	52-146 % recovery	See discussion below
Surrogate spikes – biota	All samples for organic constituent analysis	110-124 % recovery	Yes
Laboratory control samples – sediment	1	71-130 % recovery	Yes
Laboratory control samples – pore water	1	75-128 % recovery	Yes
Laboratory control samples – surface water (grab sample)	1	87-124 % recovery	Yes
Laboratory control samples – biota	1	86-112 % recovery	Yes
Matrix spikes – sediment	13/63	71-124 % recovery	Yes
Matrix spikes – pore water	9/32	70-126 % recovery	Yes
Matrix spikes – surface water (grab sample)	8/24	75-128 % recovery	Yes
Matrix spikes – biota	7/17	90-127 % recovery	Yes
Representativeness			
Sampling appropriate for media and analytes	All media	All sampling appropriate	Yes
Samples extracted and analysed within holding times.	14 days for organics, metals 6 months	All primary samples extracted and analysed within holding times	See discussion below
Laboratory blank – sediment	14/63	<LOR	Yes
Laboratory blank – pore water	11/32	<LOR	Yes

Data Quality Indicator	Frequency	Results Reported	DQI met
Laboratory blank – surface water (grab sample)	14/24	<LOR	Yes
Laboratory blank – biota	1/17	<LOR	Yes
Trip spike (for volatiles)	1/sampling event	85-120 % recovery	Yes
Trip blank (for volatiles) Rinsate blank	1/sampling event 1/sampling event	<LOR <LOR	Yes
Comparability			
Standard operating procedures for sample collection & handling	All samples	Standard procedures for all sampling	Yes
Standard analytical methods used for all analyses	All samples	Standard analytical methods	Yes
Consistent field conditions, sampling staff and laboratory analysis	All works	Consistent field staff and consistent field and laboratory conditions	Yes
Limits of reporting appropriate and consistent	All samples	LORs appropriate and generally consistent	Yes
Completeness			
Sample description and COCs completed and appropriate	All samples	Field documentation and COC provided and completed	Yes
Appropriate documentation	All works	Documentation provided and completed	Yes
Satisfactory frequency and result for QC samples	All samples	See discussion below	Yes
Data from critical samples is considered valid	-	Critical samples valid	Yes

D1.1 Discussion of QA/QC Results

The results of QA/QC samples outside the acceptance criteria are discussed below.

D1.1.1 Precision

Blind Duplicates

Tabulated results for duplicate analysis and calculated relative percentage differences (RPDs) are attached below. The number of blind duplicate samples submitted for analysis of the COPCs met the required DQI frequency as summarised in **Table 1**. It is noted that an additional biota blind duplicate sample was analysed to account for the absence of a split duplicate sample.

There were multiple RPD values that were outside the JBS&G preferred range of 0-50% RPD within primary and blind duplicate sediment samples. However, since the concentration of a number of constituents were less than 10 times the limit of reporting, the increased acceptance limit of 197 % RPD is not considered to be significant. Where the concentrations exceeded 10 times the limit of reporting, as observed in duplicate sample QC15102019-SED01, and as a conservative measure, the highest values were considered in the interpretation of data from this field program.

The RPDs in reported compound concentrations between the primary and blind duplicate samples within surface water grab samples were generally all within the preferred range of 0-50% RPD with the exception of RPDs between the primary sample OSA2-SW-04 and duplicate sample QC15102019-SW1 with RPDs ranging from 67-168. As the concentrations of the constituents were less than 10 times the limit of reporting, the increased acceptance limit of 168 % RPD is not considered to be significant.

The RPDs in reported compound concentrations between the primary and blind duplicate samples within pore water samples were generally within the preferred range of 0-50% RPD, with the exception of the following:

- OSA-PW-11 and QA19102018-1 – Benzo(a)pyrene (67% RPD), Benzo(b,j)fluoranthene (67% RPD), benzo(g,h,i)perylene (100% RPD), benzo(k)fluoranthene (67% RPD), fluoranthene (67% RPD) and Total PAHs (62% RPD); and
- OSA2-PW-01 and QC15102019-PW01 – TRH >C_{16}-C_{34} Fraction (100 % RPD) and all PAH compounds with an RPD range from 64-164 %.

These elevated RPDs within OSA-PW-11 and QA19102018-1 are attributed to the low concentration levels reported within the primary and blind duplicate samples, and as the concentration of all constituents were less than 10 times the limit of reporting, the increased acceptance limit of 100 % RPD is not considered to be significant. As a conservative measure, the highest values were considered in the interpretation of data.

The elevated RPDs within samples OSA2-PW-01 and QC15102019-PW01 are attributed to suspended sediment present within the pore water samples, causing interference within the sample analysis procedure and causing heterogeneity within the primary and duplicate samples. As a result, the duplicate sample was subsequently filtered and re-analysed for PAHs, with discussion on the representativeness of the sample dataset discussed in the below section.

The RPDs in reported compound concentrations between the primary and blind duplicate samples within biota samples were generally within the preferred range of 0-50% RPD, with the exception of Total PAHs within primary sample OSA-OYS-02 and blind duplicate QC16112018-2 (65% RPD). As the Total PAH concentrations were less than 10 times the limit of reporting, the increased acceptance limit of 65 % RPD is not considered to affect the precision of the data.

Split Duplicates

Tabulated results for duplicate analysis and calculated relative percentage differences (RPDs) are attached below. As per the blind duplicates, the number of split duplicate samples submitted for analysis of the COPCs met the required DQI frequency as summarised in **Table 1**, with the exception of the split duplicate frequency for biota samples. No split biota duplicate samples were collected due to the lack of available secondary laboratories able to analyse oyster tissue for PAHs.

There were multiple RPD values that were outside the JBS&G preferred range of 0-50% RPD within primary and split duplicate sediment samples. However, since the concentration of the majority of constituents were less than 10 times the limit of reporting, the increased acceptance limit of 110 % RPD is not considered to be significant. Where the concentrations exceeded 10 times the limit of reporting, and as a conservative measure, the highest values were considered in the interpretation of data from this field program.

The RPDs in reported compound concentrations between the primary and split duplicate samples within surface water grab samples and pore water samples were generally all within the preferred range of 0-50% RPD. Where RPD exceedances between the primary and split duplicates these constituents were all less than 10 times the limit of reporting, therefore the increased limits of acceptance (71 % RPD for pore water and 190 % RPD for surface water) are not considered to be significant.

Laboratory Duplicates

A sufficient number of laboratory duplicates were analysed for sediment and water samples. RPDs for laboratory duplicates were within the DQI targets or laboratory acceptable ranges, with the exception of one sediment duplicate sample (lab batch 623691) for TRH C15-C28 Fraction with 54 % RPD and PAH compounds within pore water duplicates in lab batches 683343 and 687337 with RPDs ranging from 0-160 % RPD. As the results were generally below 10 times the limit of reporting, these elevated RPDs are not considered to affect the precision of the dataset. Where the results were above 10 times the limit of reporting, the laboratory reported that the RPD passes the laboratory's internal acceptance criteria and is therefore not considered to influence the outcome of the investigation.

D1.1.2 Accuracy

Surrogate Spikes

The number of surrogate spikes undertaken for the COPCs met the DQI frequency for soil and water samples analysed at the primary laboratory as summarised in **Table 2** and generally all recoveries were reported within the JBS&G acceptable range (70-130%). A small number of surrogates (in water) were reported outside (above) the JBS&G acceptable range, but were with the laboratories acceptable limits (typically between 50 and 150 % recovery) under their NATA accreditation.

Elevated surrogate recoveries indicate the reported concentrations may potentially be greater than the actual concentrations, while low surrogate recoveries indicate the reported concentrations may potentially be less than the actual concentrations. Taking this into account it is considered that samples with elevated or lower surrogate recoveries do not affect the reliability of the data for this investigation.

Matrix Spikes

All matrix spike recoveries for soil and water samples were compliant with the DQI target range and within the NATA acceptable limits for the analytical methods.

Laboratory Control Samples

A sufficient number of laboratory control samples (LCS) were analysed. Laboratory control sample recoveries were all within the laboratories NATA acceptable limits for the analytical methods.

D1.1.3 Representativeness

Sampling appropriate for media and analytes

All sediment, water (including surface water and pore water) and biota sampling works completed during the investigation were conducted in accordance with JBS&G standard operating procedures. Sediment and pore water sampling during the investigations were conducted with the advancement of a manually-operated piston coring device and a manually-operated vibrocoring device and was considered appropriate for the potential site contaminants. Surface water was collected via the collection of grab samples during sampling events, and via the deployment of polydimethylsiloxane (PDMS) strips co-deployed with Passive Flow Monitors to determine the average PAH and TRH concentrations in water over an extended period of time, where this method was considered appropriate for the objective of the assessment with respect to PAHs only. It is noted that TRH was initially reported within each passive water sampler analysed as part of the investigation – however, upon review of the sampling medium utilised within the passive samplers (PDMS strips), it was identified that the medium contained organic polymer compounds that are reported within the TRH screen utilised by the laboratory. In addition, TRH was reported in the blank sample at similar concentrations to the primary samples. As such, all TRH results reported from the passive samplers have been excluded from the investigation.

Pore water samples extracted during the 2019 investigation works required a greater volume of surficial sediments to achieve the required water sample volume for analysis. In addition, the sediments collected consisted of fine-grained mangrove muds which were easily dispersible within surface water and pore water.

The centrifugation process attempted to eliminate the majority of the sediment particulates suspended in the pore water samples, however, transferral of the pore water samples to the sample bottles resulted in minor disturbances to the fine-grained muds during the 2019 investigation. Samples were not filtered in the field or at the laboratory prior to analysis.

With consideration to the low solubility of benzo(a)pyrene in water, with no identified co-eluting compounds (such as BTEX) reported, that may have contributed to an increased solubility, the elevated PAH concentrations reported during the 2019 investigation required further assessment to assess whether potential sediment particulates were present within the pore water samples.

The most elevated benzo(a)pyrene result (sample QC15102019-1) in the dataset was filtered and subsequently re-analysed at the laboratory, with PAH concentrations previously exceeding the adopted 95% protection level criteria appearing to be below the 99% species level protection criteria for all PAH compounds.

The remaining samples exhibiting elevated PAH concentrations were subsequently filtered and re-analysed for PAHs to assess whether sediment particulates were contributing to elevated PAH concentrations. The results of the filtered samples were considered to be more representative than unfiltered due to minimal interference from sediment particulates during analysis.

Biota sampling was conducted via the deployment of a sample set of oysters at each sampling location, remaining at each location for an extended period of time, this method is considered appropriate for determining PAH uptake within the oyster tissues. The sediment, surface water, pore water and biota samples were collected by a method consistent with obtaining broad screening data. The results are considered broadly characteristic of the lateral locations where samples were located. The sediment, water and biota data are considered to be of a sufficient quality, from the perspective of the sampling method adopted, to meet the objectives of this assessment.

<u>Trip Spike</u>

Trip spike recoveries were within the acceptable limit of 70-130%, indicating that the adopted assessment sample preservation methods were appropriate to result in a low risk of contaminant concentration loss during transport of the samples.

<u>Trip Blank</u>

A trip blank was submitted with the batch of sediment, pore water and surface water grab samples submitted to the laboratory. There were no reported concentrations of BTEX or VOC compounds above the laboratory LOR thus demonstrating the absence of significant contaminant cross contamination issues during the temporary storage and transportation of samples analysed during this investigation.

<u>Rinsate Blank</u>

No rinsate samples were collected for the surface water and biota sampling events as no reusable sampling equipment was used. For the pore water and sediment sampling events, samples were collected from the centre of the coring devices to eliminate the potential for cross contamination of samples from decontaminated sampling equipment during the 2018 sampling event. Due to increased organic inclusions (dense mangrove roots) during the 2019 event, sediment samples required manual extraction from the cores as a whole and were subsequently transferred to sample jars, with samples unable to be collected from the centre of the coring devices to avoid cross contamination. The cores were thoroughly decontaminated using detergent and deionised water between each location, with a rinsate blank collected following decontamination of the sampling equipment with report results below the laboratory detection limits.

<u>Laboratory Blanks</u>

Results for all laboratory blanks for sediment, water and biota samples were less than the limit of reporting indicating the analytical methods were not contributing to the analytical values reported.

Holding Times

All analytes were generally undertaken within the holding times. Copies of laboratory sample receipts are included in **Appendix C**.

Pore water samples that were re-extracted and analysed in lab batch 687337 were extracted and analysed out of holding times. Sample OSA2 PW 01 was re-analysed for PAHs without filtering to identify the potential for loss of contaminants during sample storage at the laboratory.

The unfiltered PAH analysis for OSA2 PW 01 was generally consistent with the PAH concentrations reported during the initial batch (lab report 683343) demonstrating minimal loss of PAH contaminants during storage at the lab. Therefore the pore water results in lab batch 687337 extracted outside of the recommended holding times are not considered to affect the accuracy of the dataset.

D1.1.4 Comparability

Eurofins (primary laboratory for sediment, pore water and surface water grab sample analysis), National Measurement Institute (primary laboratory for biota analysis) and Envirolab (secondary laboratory for sediment, pore water, surface water grab samples and surface water passive sampler analysis) were NATA accredited for all analytical methods used. The laboratories used similar analytical methods and the analytical data were comparable between laboratories as indicated by the results of the split duplicate analysis. It is noted that the surface passive water samplers could not be analysed at a NATA accredited laboratory, notwithstanding the analytical laboratory implemented a QA/QC program to assess the reliability of the data – in addition the methods adopted were consistent with those published in peer reviewed scientific journals. Field works have been undertaken by a team of experienced samplers in accordance with the same standard operating procedure. All field documentation was appropriately completed.

D1.1.5 Completeness

Documentation

All laboratory documentation is complete and correct. Chain of custody documentation is provided with laboratory reports in **Appendix C**.

Frequency for QC Samples

Frequency of analysis for the QC samples collected is at the required frequency for each analyte analysed, with the exception of the split duplicate frequency for biota sampling due to the lack of an available secondary laboratory.

D1.2 Assessment of QA/QC

The field sampling and handling procedures produced QA/QC results which indicate that the soil, sediment, water and biota data are of an acceptable quality and suitable for use in site characterisation.

The NATA certified laboratory results sheets indicate that the project laboratory was generally achieving levels of performance within its recommended control limits during the period when the samples from this program were analysed.

On the basis of the results of the field and laboratory QA/QC program, the sediment, water and biota data is of an acceptable quality in order to achieve the objectives of the assessment.

2018 Sediment Field Duplicates
Project Number: 54083
Project Name: Woolooware

Field Duplicates (SOIL)
Filter: SDG in('628128','623691')

			SDG	623691	623691		623691	ENVIROLAB 2018-10-19T00:00:00		628128	628128		628128	ENVIROLAB 2018-11-16T00:00:00	
			Field ID	OSA SED 11	QC18102018-1	**RPD**	OSA SED 11	QA18102018-1	**RPD**	OSA-SED13-0-0.1	QC16112018-SED01	**RPD**	OSA-SED13-0-0.1	QA16112018-SED01	**RPD**
			Sampled Date/Time	18/10/2018	18/10/2018		18/10/2018	18/10/2018		16/11/2018	16/11/2018		16/11/2018	16/11/2018	
Chem_Group	**ChemName**	**Units**	**EQL**												
TPHs (NEPC 1999)	C6-C9 Fraction	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
	C10-C14 Fraction	mg/kg	20 (Primary): 50 (Interlab)	<20.0	<20.0	0	<20.0	<50.0	0	<20.0	<20.0	0	<20.0	<50.0	0
	C15-C28 Fraction	mg/kg	50 (Primary): 100 (Interlab)	<50.0	<50.0	0	<50.0	<100.0	0	**98.0**	**140.0**	**35**	98.0	<100.0	0
	C29-C36 Fraction	mg/kg	50 (Primary): 100 (Interlab)	<50.0	<50.0	0	<50.0	<100.0	0	**<50.0**	**81.0**	**47**	<50.0	<100.0	0
	C10-C36 Fraction (Total)	mg/kg	50	<50.0	<50.0	0	<50.0			**98.0**	**221.0**	**77**	98.0		
TRHs (NEPC 2013)	>C10-C16 Fraction	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0
	>C16-C34 Fraction	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	**130.0**	**200.0**	**42**	130.0	<100.0	26
	>C34-C40 Fraction	mg/kg	100	<100.0	<100.0	0	<100.0	<100.0	0	<100.0	<100.0	0	<100.0	<100.0	0
	>C10-C40 Fraction (Total)	mg/kg	100 (Primary): 50 (Interlab)	<100.0	<100.0	0	<100.0	<50.0	0	**130.0**	**200.0**	**42**	**130.0**	**<50.0**	**89**
	>C10-C16 less Naphthalene (F2)	mg/kg	50	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0	<50.0	<50.0	0
	C6-C10 Fraction	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
	C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
BTEXN	Benzene	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.1	<0.2	0
	Ethylbenzene	mg/kg	0.1 (Primary): 1 (Interlab)	<0.1	<0.1	0	<0.1	<1.0	0	<0.1	<0.1	0	<0.1	<1.0	0
	Toluene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene (o)	mg/kg	0.1 (Primary): 1 (Interlab)	<0.1	<0.1	0	<0.1	<1.0	0	<0.1	<0.1	0	<0.1	<1.0	0
	Xylene (m & p)	mg/kg	0.2 (Primary): 2 (Interlab)	<0.2	<0.2	0	<0.2	<2.0	0	<0.2	<0.2	0	<0.2	<2.0	0
	Xylene (Total)	mg/kg	0.3 (Primary): 1 (Interlab)	<0.3	<0.3	0	<0.3	<1.0	0	<0.3	<0.3	0	<0.3	<1.0	0
	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab)	<0.5	<0.5	0	<0.5	<1.0 - 0.05	0	<0.5	<0.5	0	<0.5	<0.1	0
	Naphthalene	mg/kg	0.05 (Primary): 1 (Interlab)	<0.05	<0.05	0	<0.05	<1.0 - 0.05	0						
	Naphthalene	mg/kg	0.005 (Primary): 1 (Interlab)							0.049	0.061	22	0.049	<0.1	0
PAHs	Acenaphthene	mg/kg	0.05 (Primary): 0.01 (Interlab)	<0.05	<0.05	0	<0.05	0.05	0						
	Acenaphthene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**0.044**	**0.1**	**78**	0.044	<0.1	0
	Acenaphthylene	mg/kg	0.05 (Primary): 0.01 (Interlab)	<0.05	<0.05	0	<0.05	0.07	33						
	Acenaphthylene	mg/kg	0.005 (Primary): 0.1 (Interlab)							0.06	0.09	40	0.06	0.1	50
	Anthracene	mg/kg	0.05 (Primary): 0.01 (Interlab)	<0.05	<0.05	0	<0.05	0.07	33						
	Anthracene	mg/kg	0.005 (Primary): 0.1 (Interlab)							0.16	0.26	48	0.16	0.2	22
	Benz(a)anthracene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.11**	**0.38**	**110**	**0.11**	**0.68**	**144**						
	Benz(a)anthracene	mg/kg	0.005 (Primary): 0.1 (Interlab)							1.8	3.0	50	1.8	1.6	12
	Benzo(a)pyrene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.13**	**0.39**	**100**	**0.13**	**0.76**	**142**						
	Benzo(a)pyrene	mg/kg	0.005 (Primary): 0.05 (Interlab)							2.3	3.0	26	2.3	1.6	36
	Benzo(a)pyrene TEQ (lower bound)*	mg/kg	0.05	**0.18**	**0.6**	**108**	**0.18**	**1.1**	**144**						
	Benzo(a)pyrene TEQ (lower bound)*	mg/kg	0.005 (Primary): 0.5 (Interlab)							3.5	5.1	37	3.5	2.7	26
	Benzo(a)pyrene TEQ (medium bound)*	mg/kg	0.05	**0.2**	**0.6**	**100**	**0.2**	**1.1**	**138**						
	Benzo(a)pyrene TEQ (medium bound)*	mg/kg	0.005 (Primary): 0.5 (Interlab)							3.5	5.1	37	3.5	2.7	26
	Benzo(a)pyrene TEQ (upper bound)*	mg/kg	0.05	**0.23**	**0.6**	**89**	**0.23**	**1.1**	**131**						
	Benzo(a)pyrene TEQ (upper bound)*	mg/kg	0.005 (Primary): 0.5 (Interlab)							3.5	5.1	37	3.5	2.7	26
	Benzo(b,j)fluoranthene	mg/kg	0.05	**0.12**	**0.32**	**91**	0.12								
	Benzo(b,j)fluoranthene	mg/kg	0.005							**1.9**	**3.2**	**51**	1.9		
	Benzo(g,h,i)perylene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.11**	**0.21**	**63**	**0.11**	**0.45**	**121**						
	Benzo(g,h,i)perylene	mg/kg	0.005 (Primary): 0.1 (Interlab)							0.91	1.5	49	0.91	1.1	19
	Benzo(k)fluoranthene	mg/kg	0.05	**0.11**	**0.29**	**90**	0.11								
	Benzo(k)fluoranthene	mg/kg	0.005							**1.5**	**2.8**	**60**	1.5		
	Chrysene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.13**	**0.38**	**98**	**0.13**	**0.76**	**142**						
	Chrysene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**1.8**	**3.1**	**53**	1.8	1.9	5
	Dibenz(a,h)anthracene	mg/kg	0.05 (Primary): 0.01 (Interlab)	<0.05	0.07	33	**<0.05**	**0.1**	**67**						
	Dibenz(a,h)anthracene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**0.5**	**0.88**	**55**	**0.5**	**0.2**	**86**
	Fluoranthene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.23**	**0.71**	**102**	**0.23**	**1.4**	**144**						
	Fluoranthene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**3.3**	**6.8**	**69**	3.3	3.2	3
	Fluorene	mg/kg	0.05 (Primary): 0.01 (Interlab)	<0.05	<0.05	0	<0.05	0.05	0						
	Fluorene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**0.072**	**0.15**	**70**	0.072	<0.1	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.11**	**0.31**	**95**	**0.11**	**0.38**	**110**						
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**1.2**	**2.3**	**63**	1.2	0.8	40
	Phenanthrene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**<0.05**	**0.15**	**100**	**<0.05**	**0.32**	**146**						
	Phenanthrene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**0.74**	**1.3**	**55**	0.74	0.7	6
	PAHs (Total)	mg/kg	0.05	**1.3**	**3.96**	**101**	1.3								
	PAHs (Total)	mg/kg	0.005							**20.0**	**35.0**	**55**	20.0		
	Pyrene	mg/kg	0.05 (Primary): 0.01 (Interlab)	**0.25**	**0.75**	**100**	**0.25**	**1.4**	**139**						
	Pyrene	mg/kg	0.005 (Primary): 0.1 (Interlab)							**3.4**	**6.4**	**61**	3.4	3.2	6
Other	% Moisture 103oC	%	1	64.0	65.0	2	64.0			49.0	47.0	4	49.0		
	Total Organic Carbon	%	0.1	7.9	7.3	8	7.9			2.1	3.2	42	2.1		

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

2019 Sediment Field Duplicates
Project Number: 51163
Project Name: Woolooware

Field Duplicates (SOIL)			**SDG**	683343	683343		683343	ENVIROLAB 2019-10-17T00:00:00		683343	683343		683343	ENVIROLAB 2019-10-17T00:00:00	
Filter: SDG in('683945','683343','684897','687337','			**Field ID**	OSA2_SED04_0-0.1	QC15102019_SED01	**RPD**	OSA2_SED04_0-0.1	QA15102019-SED1	**RPD**	OSA2_SED07_0-0.1	QC16102019_SED01	**RPD**	OSA2_SED07_0-0.1	QA16102019-SED1	**RPD**
			Sampled Date/Time	15/10/2019	15/10/2019		15/10/2019	15/10/2019		16/10/2019	16/10/2019		16/10/2019	16/10/2019	
Chem_Grou	**ChemName**	**Units**	**EQL**												
TPHs (NEPC	C6-C9 Fraction	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
	C10-C14 Fraction	mg/kg	20 (Primary): 50 (Interlab)	<20.0	<20.0	0	<20.0	<50.0	0	<20.0	<20.0	0	<20.0	<50.0	0
	C15-C28 Fraction	mg/kg	50 (Primary): 100 (Interlab)	**53.0**	**450.0**	**158**	**53.0**	**1100.0**	**182**	69.0	<50.0	32	69.0	<100.0	0
	C29-C36 Fraction	mg/kg	50 (Primary): 100 (Interlab)	54.0	<50.0	8	**54.0**	**900.0**	**177**	<50.0	<50.0	0	**<50.0**	**150.0**	**100**
	C10-C36 Fraction (Total)	mg/kg	50	**107.0**	**450.0**	**123**	107.0			69.0	<50.0	32	69.0		
TRHs (2013	>C10-C16 Fraction	mg/kg	50	<50.0	<50.0	0	**<50.0**	**180.0**	**113**	<50.0	<50.0	0	<50.0	<50.0	0
	>C16-C34 Fraction	mg/kg	100	**<100.0**	**500.0**	**133**	**<100.0**	**1700.0**	**178**	<100.0	<100.0	0	**<100.0**	**220.0**	**75**
	>C34-C40 Fraction	mg/kg	100	<100.0	<100.0	0	**<100.0**	**310.0**	**102**	<100.0	<100.0	0	<100.0	<100.0	0
	>C10-C40 Fraction (Total)	mg/kg	100 (Primary): 50 (Interlab)	**<100.0**	**500.0**	**133**	**<100.0**	**2200.0**	**183**	<100.0	<100.0	0	**<100.0**	**220.0**	**75**
	>C10-C16 less Naphthalene (F2)	mg/kg	50	<50.0	<50.0	0	**<50.0**	**180.0**	**113**	<50.0	<50.0	0	<50.0	<50.0	0
	C6-C10 Fraction	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
	C6-C10 less BTEX (F1)	mg/kg	20 (Primary): 25 (Interlab)	<20.0	<20.0	0	<20.0	<25.0	0	<20.0	<20.0	0	<20.0	<25.0	0
BTEXN	Benzene	mg/kg	0.1 (Primary): 0.2 (Interlab)	<0.1	<0.1	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.1	<0.2	0
	Ethylbenzene	mg/kg	0.1 (Primary): 1 (Interlab)	<0.1	<0.1	0	<0.1	<1.0	0	<0.1	<0.1	0	<0.1	<1.0	0
	Toluene	mg/kg	0.1 (Primary): 0.5 (Interlab)	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
	Xylene (o)	mg/kg	0.1 (Primary): 1 (Interlab)	<0.1	<0.1	0	<0.1	<1.0	0	<0.1	<0.1	0	<0.1	<1.0	0
	Xylene (m & p)	mg/kg	0.2 (Primary): 2 (Interlab)	<0.2	<0.2	0	<0.2	<2.0	0	<0.2	<0.2	0	<0.2	<2.0	0
	Xylene (Total)	mg/kg	0.3 (Primary): 3 (Interlab)	<0.3	<0.3	0	<0.3	<3.0	0	<0.3	<0.3	0	<0.3	<3.0	0
	Naphthalene	mg/kg	0.5 (Primary): 1 (Interlab)	<0.5			**<0.5**	**<1.0 - 6.2**	**170**	<0.5			<0.5	<1.0 - 0.03	0
	Naphthalene	mg/kg	0.005 (Primary): 1 (Interlab)	0.04			**0.04**	**<1.0 - 6.2**	**197**	0.02			0.02	<1.0 - 0.03	40
PAHs	Acenaphthene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.01**	**0.3**	**187**	**0.01**	**3.1**	**199**	0.2	0.17	16	**0.2**	**0.37**	**60**
	Acenaphthylene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.06**	**0.86**	**174**	**0.06**	**19.0**	**199**	0.13	0.18	32	**0.13**	**0.4**	**102**
	Anthracene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.04**	**1.1**	**186**	**0.04**	**11.0**	**199**	0.31	0.21	38	**0.31**	**0.7**	**77**
	Benz(a)anthracene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.19**	**5.5**	**187**	**0.19**	**43.0**	**198**	1.9	1.7	11	**1.9**	**3.2**	**51**
	Benzo(a)pyrene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.18**	**4.9**	**186**	**0.18**	**47.0**	**198**	1.9	1.6	17	**1.9**	**3.4**	**57**
	Benzo(b,j)fluoranthene	mg/kg	0.005	**0.07**	**2.8**	**190**	0.07			1.7	1.4	19	1.7		
	Benzo(g,h,i)perylene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.11**	**3.0**	**186**	**0.11**	**30.0**	**199**	1.4	1.0	33	**1.4**	**2.5**	**56**
	Benzo(k)fluoranthene	mg/kg	0.005	**0.22**	**3.2**	**174**	0.22			1.8	1.2	40	1.8		
	Chrysene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.21**	**5.3**	**185**	**0.21**	**48.0**	**198**	2.2	1.9	15	2.2	3.1	34
	Dibenz(a,h)anthracene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.01**	**1.3**	**197**	**0.01**	**5.3**	**199**	0.37	0.47	24	0.37	0.4	8
	Fluoranthene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.32**	**10.0**	**188**	**0.32**	**91.0**	**199**	5.4	4.1	27	5.4	7.6	34
	Fluorene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.02**	**0.57**	**186**	**0.02**	**5.3**	**198**	0.28	0.24	15	**0.28**	**0.53**	**62**
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.09**	**4.1**	**191**	**0.09**	**20.0**	**198**	1.7	1.3	27	1.7	1.6	6
	Phenanthrene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.17**	**3.8**	**183**	**0.17**	**55.0**	**199**	2.0	1.7	16	2.0	3.2	46
	PAHs (Total)	mg/kg	0.005	**2.31**	**58.98**	**185**	2.31			25.91	20.821	22	25.91		
	Pyrene	mg/kg	0.005 (Primary): 0.01 (Interlab)	**0.57**	**12.0**	**182**	**0.57**	**150.0**	**198**	4.6	3.6	24	4.6	6.4	33
Other	% Moisture 103oC	%	1	75.0	74.0	1	75.0			69.0	71.0	3	69.0		
	Total Organic Carbon	%	0.1	17.0	14.0	19	17.0			8.9	8.4	6	8.9		

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

2018 Pore Water Field Duplicates
Project Number: 54083
Project Name: Woolooware
Field Duplicates (WATER)
Filter: SDG in('623693')

			SDG	623693	623693		623693	ENVIROLAB 2018-10-19T00:00:00	
			Field ID	OSA PW 11	QC 19102018-1	**RPD**	OSA PW 11	QA19102018-1	**RPD**
			Sampled Date/Time	18/10/2018	18/10/2018		18/10/2018	18/10/2018	
Chem_Group	**ChemName**	**Units**	**EQL**						
TPHs (NEPC 1999)	C6-C9 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	C10-C14 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	C15-C28 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	C29-C36 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	C10-C36 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1		
TRHs (NEPC 2013)	>C10-C16 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	>C16-C34 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	>C34-C40 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	>C10-C40 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1		
	>C10-C16 less Naphthalene (F2)	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	C6-C10 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	C6-C10 less BTEX (F1)	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
BTEXN	Benzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Ethylbenzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Toluene	mg/l	0.001	0.003	0.003	0	**0.003**	**0.002**	**40**
	Xylene (o)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Xylene (m & p)	mg/l	0.002	<0.002	<0.002	0	<0.002	<0.002	0
	Xylene (Total)	mg/l	0.003	<0.003	<0.003	0	<0.003		
	Naphthalene	mg/l	0.01 (Primary): 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.0002	0
	Naphthalene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0002	0
PAHs	Acenaphthene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Acenaphthylene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Anthracene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Benz(a)anthracene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Benzo(a)pyrene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	**0.00002**	**0.00001**	**67**	0.0	<0.0001	0
	Benzo(b,j)fluoranthene	mg/l	0.00001	**0.00002**	**0.00001**	**67**	0.0		
	Benzo(g,h,i)perylene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	**0.00003**	**0.00001**	**100**	0.0	<0.0001	0
	Benzo(k)fluoranthene	mg/l	0.00001	**0.00002**	**0.00001**	**67**	0.0		
	Chrysene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Dibenz(a,h)anthracene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Fluoranthene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	**0.00002**	**0.00001**	**67**	0.0	<0.0001	0
	Fluorene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	Indeno(1,2,3-c,d)pyrene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	**0.0**	**0.0**	**67**	0.0	<0.0001	0
	Phenanthrene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	<0.0	<0.0	0	<0.0	<0.0001	0
	PAHs (Total)	mg/l	0.00001	**0.0002**	**0.0001**	**62**	0.0002		
	Pyrene	mg/l	0.00001 (Primary): 0.0001 (Interlab)	0.0	0.0	29	0.0	<0.0001	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

2019 Pore Water Field Duplicates
Project Number: 54083
Project Name: Woolooware

SOIL
WATER

Field Duplicates (WATER)
Filter: SDG in('683945','683343','684897','687337','686881')

				SDG	683343	683343		683343	ENVIROLAB 2019-10-17T00:00:00	
				Field ID	OSA2_PW_01	QC15102019_PW1	**RPD**	OSA2_PW_01	QA15102019-PW1	**RPD**
				Sampled Date/Time	15/10/2019	15/10/2019		15/10/2019	15/10/2019	
Filter	**Chem_Group**	**ChemName**	**Units**	**EQL**						
TPHs (NEPC 1999)	TPHs (NEPC 1999)	C6-C9 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TPHs (NEPC 1999)		C10-C14 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TPHs (NEPC 1999)		C15-C28 Fraction	mg/l	0.1	**<0.1**	**0.2**	**67**	<0.1	0.12	18
TPHs (NEPC 1999)		C29-C36 Fraction	mg/l	0.1	<0.1	0.1	0	**<0.1**	0.14	33
TPHs (NEPC 1999)		C10-C36 Fraction (Total)	mg/l	0.1	**<0.1**	**0.3**	**100**	<0.1		
TPHs (NEPC 1999)										
TRHs (NEPC 2013)	TRHs (NEPC 2013)	>C10-C16 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TRHs (NEPC 2013)		>C16-C34 Fraction	mg/l	0.1	**<0.1**	**0.3**	**100**	**<0.1**	**0.21**	**71**
TRHs (NEPC 2013)		>C34-C40 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
TRHs (NEPC 2013)		>C10-C40 Fraction (Total)	mg/l	0.1	**<0.1**	**0.3**	**100**	<0.1		
TRHs (NEPC 2013)		>C10-C16 less Naphthalene (F2)	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TRHs (NEPC 2013)		C6-C10 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TRHs (NEPC 2013)		C6-C10 less BTEX (F1)	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TRHs (NEPC 2013)										
BTEXN	BTEXN	Benzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Ethylbenzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Toluene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Xylene (o)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Xylene (m & p)	mg/l	0.002	<0.002	<0.002	0	<0.002	<0.002	0
BTEXN		Xylene (Total)	mg/l	0.003	<0.003	<0.003	0	<0.003		
BTEXN										
Polycyclic Aromatic Hydrocarbons	Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/l	0.00001	**0.0001**	**0.0007**	**155**	0.0001	0.0001	29
Polycyclic Aromatic Hydrocarbons		Acenaphthylene	mg/l	0.00001	**0.0002**	**0.0003**	**64**	0.0002	0.0002	0
Polycyclic Aromatic Hydrocarbons		Anthracene	mg/l	0.00001	**0.0002**	**0.001**	**144**	0.0002	0.0002	12
Polycyclic Aromatic Hydrocarbons		Benz(a)anthracene	mg/l	0.00001	**0.002**	**0.0088**	**126**	0.002	0.0031	43
Polycyclic Aromatic Hydrocarbons		Benzo(a)pyrene	mg/l	0.00001	**0.0022**	**0.011**	**133**	0.0022	0.0026	17
Polycyclic Aromatic Hydrocarbons		Benzo(b,j)fluoranthene	mg/l	0.00001	**0.0025**	**0.0095**	**117**	0.0025		
Polycyclic Aromatic Hydrocarbons		Benzo(g,h,i)perylene	mg/l	0.00001	**0.0019**	**0.0047**	**85**	0.0019	0.002	5
Polycyclic Aromatic Hydrocarbons		Benzo(k)fluoranthene	mg/l	0.00001	**0.0023**	**0.012**	**136**	0.0023		
Polycyclic Aromatic Hydrocarbons		Chrysene	mg/l	0.00001	**0.003**	**0.01**	**108**	0.003	0.0024	22
Polycyclic Aromatic Hydrocarbons		Dibenz(a,h)anthracene	mg/l	0.00001	**0.0002**	**0.0023**	**162**	0.0002	0.0003	34
Polycyclic Aromatic Hydrocarbons		Fluoranthene	mg/l	0.00001	**0.0031**	**0.022**	**151**	0.0031	0.0049	45
Polycyclic Aromatic Hydrocarbons		Fluorene	mg/l	0.00001	**0.0001**	**0.0008**	**158**	0.0001	0.0001	29
Polycyclic Aromatic Hydrocarbons		Indeno(1,2,3-c,d)pyrene	mg/l	0.00001	**0.002**	**0.0067**	**108**	0.002	0.0014	35
Polycyclic Aromatic Hydrocarbons		Phenanthrene	mg/l	0.00001	**0.0006**	**0.006**	**164**	0.0006	0.0009	44
Polycyclic Aromatic Hydrocarbons		PAHs (Total)	mg/l	0.00001	**0.0233**	**0.1158**	**133**	0.0233		
Polycyclic Aromatic Hydrocarbons		Pyrene	mg/l	0.00001	**0.0029**	**0.02**	**149**	0.0029	0.0044	41

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

2018 Surface Water Grab Sample Field Duplicates
Project Number: 54083
Project Name: Woolooware

Field Duplicates (WATER)
Filter: SDG in('628153','625694')

			SDG	625694	625694		625694	ENVIROLAB 2018-11-01T00:00:00		628153	628153		628153	ENVIROLAB 2018-11-16T00:00:00	
			Field ID	OSA-SW-03A	QC01112018-SW1	**RPD**	OSA-SW-03A	QA01112018-SW01	**RPD**	OSA-SW-13B	QC-16112018-SW01	**RPD**	OSA-SW-13B	QA16112018-SW01	**RPD**
			Sampled Date/Time	1/11/2018	1/11/2018		1/11/2018	1/11/2018		16/11/2018	16/11/2018		16/11/2018	16/11/2018	
Chem_Group	**ChemName**	**Units**	**EQL**												
TPHs (NEPC 1999)	C6-C9 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0						
	C10-C14 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0
	C15-C28 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	C29-C36 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	C10-C36 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1			<0.1	<0.1	0	<0.1		
TRHs (NEPC 2013)	>C10-C16 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0
	>C16-C34 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	>C34-C40 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0	<0.1	<0.1	0
	>C10-C40 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1			<0.1	<0.1	0	<0.1		
	>C10-C16 less Naphthalene (F2)	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0						
	C6-C10 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0						
	C6-C10 less BTEX (F1)	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0						
BTEXN	Benzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0						
	Ethylbenzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0						
	Toluene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0						
	Xylene (o)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0						
	Xylene (m & p)	mg/l	0.002	<0.002	<0.002	0	<0.002	<0.002	0						
	Xylene (Total)	mg/l	0.003	<0.003	<0.003	0	<0.003								
	Naphthalene	mg/l	0.01 (Primary): 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0						
	Naphthalene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0002	0
PAHs	Acenaphthene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Acenaphthylene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Anthracene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Benz(a)anthracene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Benzo(a)pyrene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Benzo(b,j)fluoranthene	mg/l	0.00001	<0.0	<0.0	0	<0.0			<0.0	<0.0	0	<0.0		
	Benzo(g,h,i)perylene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Benzo(k)fluoranthene	mg/l	0.00001	<0.0	<0.0	0	<0.0			<0.0	<0.0	0	<0.0		
	Chrysene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Dibenz(a,h)anthracene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Fluoranthene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Fluorene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Indeno(1,2,3-c,d)pyrene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	Phenanthrene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0
	PAHs (Total)	mg/l	0.00001	<0.0	<0.0	0	<0.0			<0.0	<0.0	0	<0.0		
	Pyrene	mg/l	0.00001 (Primary): 0.001 (Interlab)	<0.0	<0.0	0	<0.0	<0.001	0	<0.0	<0.0	0	<0.0	<0.0001	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

2019 Surface Water Grab Sample Field Duplicates
Project Number: 54083
Project Name: Woolooware

SOIL
WATER

Field Duplicates (WATER)
Filter: SDG in('683945','683343','684897','687337','686881')

				SDG	683343	683343		683343	ENVIROLAB 2019-10-17T00:00:00	
				Field ID	OSA2_SW_04	QC15102019_SW1	**RPD**	OSA2_SW_04	QA15102019-SW1	**RPD**
				Sampled Date/Time	15/10/2019	15/10/2019		15/10/2019	15/10/2019	
Filter	**Chem_Group**	**ChemName**	**Units**	**EQL**						
TPHs (NEPC 1999)	TPHs (NEPC 1999)	C6-C9 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TPHs (NEPC 1999)		C10-C14 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TPHs (NEPC 1999)		C15-C28 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
TPHs (NEPC 1999)		C29-C36 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
TPHs (NEPC 1999)		C10-C36 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1		
TPHs (NEPC 1999)										
TRHs (NEPC 2013)	TRHs (NEPC 2013)	>C10-C16 Fraction	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TRHs (NEPC 2013)		>C16-C34 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
TRHs (NEPC 2013)		>C34-C40 Fraction	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
TRHs (NEPC 2013)		>C10-C40 Fraction (Total)	mg/l	0.1	<0.1	<0.1	0	<0.1		
TRHs (NEPC 2013)		>C10-C16 less Naphthalene (F2)	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
TRHs (NEPC 2013)		C6-C10 Fraction	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TRHs (NEPC 2013)		C6-C10 less BTEX (F1)	mg/l	0.02 (Primary): 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
TRHs (NEPC 2013)										
BTEXN	BTEXN	Benzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Ethylbenzene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Toluene	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Xylene (o)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
BTEXN		Xylene (m & p)	mg/l	0.002	<0.002	<0.002	0	<0.002	<0.002	0
BTEXN		Xylene (Total)	mg/l	0.003	<0.003	<0.003	0	<0.003		
BTEXN										
Polycyclic Aromatic Hydrocarbons	Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/l	0.00001	**<0.0001**	**0.0004**	**120**	<0.0001	0.0001	**0**
Polycyclic Aromatic Hydrocarbons		Acenaphthylene	mg/l	0.00001	<0.0001	0.0001	0	**<0.0001**	**0.0002**	**67**
Polycyclic Aromatic Hydrocarbons		Anthracene	mg/l	0.00001	<0.0001	<0.0001	0	**<0.0001**	**0.0002**	**67**
Polycyclic Aromatic Hydrocarbons		Benz(a)anthracene	mg/l	0.00001	**<0.0001**	**0.0002**	**67**	**<0.0001**	**0.0003**	**100**
Polycyclic Aromatic Hydrocarbons		Benzo(a)pyrene	mg/l	0.00001	**<0.0001**	**0.0002**	**67**	**<0.0001**	**0.0002**	**67**
Polycyclic Aromatic Hydrocarbons		Benzo(b,j)fluoranthene	mg/l	0.00001	**<0.0001**	**0.0002**	**67**			
Polycyclic Aromatic Hydrocarbons		Benzo(g,h,i)perylene	mg/l	0.00001	<0.0001	<0.0	0	<0.0001	0.0001	0
Polycyclic Aromatic Hydrocarbons		Benzo(k)fluoranthene	mg/l	0.00001	**<0.0001**	**0.0003**	**100**			
Polycyclic Aromatic Hydrocarbons		Chrysene	mg/l	0.00001	**<0.0001**	**0.0004**	**120**	<0.0001	0.0001	**0**
Polycyclic Aromatic Hydrocarbons		Dibenz(a,h)anthracene	mg/l	0.00001	<0.0001	<0.0001	0	<0.0001	**0.0002**	**67**
Polycyclic Aromatic Hydrocarbons		Fluoranthene	mg/l	0.00001	<0.0001	0.0001	**0**	<0.0001	**0.0005**	**192**
Polycyclic Aromatic Hydrocarbons		Fluorene	mg/l	0.00001	<0.0001	0.0	0	<0.0001	**0.0002**	**67**
Polycyclic Aromatic Hydrocarbons		Indeno(1,2,3-c,d)pyrene	mg/l	0.00001	<0.0001	<0.0001	0	<0.0001	0.0001	0
Polycyclic Aromatic Hydrocarbons		Phenanthrene	mg/l	0.00001	**<0.0001**	**0.0003**	**100**	<0.0001	0.0001	0
Polycyclic Aromatic Hydrocarbons		PAHs (Total)	mg/l	0.00001	0.0003	0.0003	0			
Polycyclic Aromatic Hydrocarbons		Pyrene	mg/l	0.00001	<0.0001	0.0001	**0**	<0.0001	**0.0004**	**120**

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: JBS&G (NSW & WA) PTY LTD

NMI QA Report No: JBSG01/181116 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
Organics Section								
PAH				**N18/032351**				**N18/032351**
Naphthalene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	100	113
Acenaphthylene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Acenaphthene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Fluorene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	95	106
Phenanthrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	109	120
Anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Fluoranthene	NGCMS_1111	0.01	<0.01	0.011	0.013	17	-	-
Pyrene	NGCMS_1111	0.01	<0.01	0.016	0.018	12	-	-
Benz[a]anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Chrysene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	112	127
Benzo[b]&[k]fluoranthene	NGCMS_1111	0.02	<0.02	<0.02	<0.02	-	-	-
Benzo[a]pyrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	100	103
Indeno[1_2_3-cd]pyrene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Dibenz[ah]anthracene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	104	114
Benzo[ghi]perylene	NGCMS_1111	0.01	<0.01	<0.01	<0.01	-	-	-
Surrogate: TER-D14	NGCMS_1111	-	-	110	124	11	86	90

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150% (PAH).
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **6/12/2018**

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Appendix I

Destructive Hazardous Materials (HAZMAT) Assessment

Destructive Hazardous Materials (HAZMAT) Assessment

Lot 3, Captain Cook Drive, Woolooware Bay, NSW, 2230

Prepared for: Transport for NSW c/o APP

EP2240.001_v2 | 20 October 2021

APPROVED COMPANY ISO 9001 Quality Management Systems — QMS Certification Services

APPROVED COMPANY AS/NZS 4801 Occupational Health & Safety Management Systems — QMS Certification Services

APPROVED COMPANY ISO 14001 Environmental Management Systems — QMS Certification Services

CONSULTANCY ahca 20/21 BUSINESS MEMBER

EP RISK

20 October 2021
Ref: EP2240.001_v2

Transport for NSW
Level 7, 116 Miller Street
North Sydney, NSW

Attention: David Doyle

Destructive Hazardous Materials (HAZMAT) Assessment
Lot 3 Captain Cook Drive, Woolooware Bay, NSW, 2230

INTRODUCTION

Transport for NSW (TfNSW) engaged EP Risk Management Pty Ltd (EP Risk) to undertake a Destructive Hazardous Materials (HAZMAT) Assessment (the Assessment) of the commercial oyster farming facility, Lot 3 Captain Cook Drive, Woolooware Bay, NSW, 2230 (the Site).

The Site is legally described as part Lot 3 in Deposited Plan (DP) 1165618 is approximately 1.0 hectare (ha) in area. A diagram of the Site can be viewed within **Attachment 1 – Figure 1.**

It is understood that the Site is in the process of redevelopment, with certain buildings proposed for demolition, which require an updated Destructive HAZMAT Assessment in accordance with Australian Standard (AS) AS2601-2001 *Demolition of Structures*. Prior to demolition, employers are required to identify materials in a structure that may be hazardous to the health of employees or the public. The presence (including laboratory analysis), location, extent, accessibility, type and condition of the HAZMAT are detailed within this report, refer to **Attachment 3 – HAZMAT Survey Summary Tables (Register).**

OBJECTIVE

The objective of the Assessment was to identify HAZMAT within accessible building structures on Site and to satisfy the requirements of the SafeWork NSW, Code of Practice: *How to Manage and Control Asbestos in the Workplace* 2019.

SCOPE OF WORK

The scope of work undertaken comprised the following:

1. Site inspection on **27 August 2021**, which included a visual inspection, photographic record and sample collection of suspected hazardous building materials. The following HAZMAT types were visually inspected for:
    a. Asbestos-containing Materials (ACM);
    b. Synthetic Mineral Fibre (SMF) materials;
    c. Polychlorinated biphenyls (PCB) containing capacitors within electrical fittings;
    d. Lead-containing Paint (LCP); and
    e. Ozone Depleting Substances (ODS).
2. Analytical testing of three (3) bulk material samples for asbestos identification by a National Association of Testing Authorities (NATA) accredited laboratory.
3. Representative sampling (if required) of paint surfaces suspected to contain lead.
    a. Collection of suspected (if any) lead paint chip samples suspected to contain lead; and
    b. Submission of suspected (if any) paint chip samples to a NATA accredited laboratory able to conduct lead content testing within paint chips.
4. Provision of this report in accordance with SafeWork NSW requirements.

REGULATORY FRAMEWORK

Work Health and Safety Act 2011

There are requirements under the Work Health and Safety Act ('the Act') as follows:

- The person conducting a business or undertaking is responsible to ensure health, safety and welfare of employees.
- Persons in control of workplaces are required to ensure the health and safety of non-employees.
- Employers must consult with employees on health and safety matters and establish health and safety committees.

Work Health and Safety Regulation 2017

Supports the Work Health and Safety Act by adopting a performance-based approach. The Regulation requires employers to adopt a risk management approach including hazard identification and risk assessment as well as the adoption of mandatory risk controls and consultation.

SafeWork NSW Code of Practice: How to Manage and Control Asbestos in the Workplace 2019

This Code provides information on how to identify the presence of asbestos at the workplace and how to implement measures to eliminate or minimise the risk of exposure to airborne asbestos fibres.

SafeWork NSW Code of Practice: How to Safely Remove Asbestos 2019

This Code provides practical guidance for persons conducting a business or undertaking who have duties under the WHS Act and WHS Regulations to safely remove asbestos from all workplaces including structures, plant and equipment.

METHODOLOGY

The purpose of the assessment was to identify, as far as reasonably practicable, ACM, SMF, PCB, LCP and ODS present in building structures at the Site prior to demolition of those structures for future development.

Asbestos-containing Materials (ACM)

The asbestos assessment component was conducted in accordance with the NSW WHS Regulation 2017 and the SafeWork NSW Code of Practice: *How to Manage and Control Asbestos in the Workplace,* 2019. Building materials that were suspected of containing asbestos were sampled at the discretion of the Occupational Hygienist / Licensed Asbestos Assessor ('LAA'). Samples of suspected ACM were analysed by Eurofins | Mgt ('Eurofins'), which is NATA accredited for the analysis of asbestos bulk samples.

The risk assessment process considers the following:

1. Material Type (ACM/SMF/PCB/LCP/ODS).
2. Location (accessibility to sensitive receptors).
3. Extent (quantity of the material).
4. Condition (surface treatment, encased, intact or damaged).
5. Potential for disturbance (based on the factors listed above).

A description of the terminology used in the Risk Assessment is presented in **Table 1** below.

Table 1 – Terminology of Risk Assessment

Category	Terminology	Description
Condition	**Good**	Minor or no damage.
	Average	Some areas of damage or deterioration.
	Poor	Extensive damage or deterioration.
Sealed	**Yes**	Material coated, sealed or encapsulated.
	No	Partially coated, sealed or encapsulated.
Friability	**Friable**	Material easily crumbled or reduced by hand pressure.
	Bonded	Fibres bound within a matrix and not friable.
Potential for Disturbance	**Low**	Little activity due to location, height or enclosure (e.g. monthly access).
	Moderate	Moderate activity due to location, height or enclosure (e.g. weekly access).
	High	Daily activity due to location, height or enclosure (e.g. daily access).
Risk of Exposure	**Low**	Low or negligible risk to occupants due to low material status or access.
	Moderate	Moderate risk to occupants due to deterioration of materials and moderate access.
	High	High risk due to friable or uncontained materials and high activity.

Synthetic Mineral Fibres (SMF)

This component of the assessment was carried out in accordance with the guidelines documented in *The National Code of Practice for the Safe Use of Synthetic Mineral Fibres* [NOHSC:2006 (1990)]. SMF materials were determined in this assessment based upon visual identification.

Polychlorinated Biphenyls (PCB)

Where safely accessible, specifications of capacitors incorporated in light fittings and ceiling fans were recorded and cross-referenced with the Australian and New Zealand Environment and Conservation Council (ANZECC) Identification of PCB-containing Capacitors information booklet 1997. Due to the danger of accessing electrical components and in some cases height restrictions, some electrical fittings may not have been accessed. In these instances, comment is provided in the assessment report on the likelihood of PCB-containing materials being present. This determination is based upon the age and appearance of the electrical fittings.

Lead-Containing Paint (LCP)

Representative painted surfaces suspected of containing lead were sampled and analysed to determine the lead concentration in paint at a NATA accredited laboratory for this analysis. It should be noted the qualitative *LeadCheck*™ paint swab method was only considered a valid screening assessment tool where positive readings were recorded. This is because the method is only capable of detecting lead in paint at concentrations of 0.5 % and above. It is noted the Australia/New Zealand Standards AS/NZS 4361.2 – 2017 *Guide to Hazardous Paint Management – Part 2: Residential and commercial buildings* defines 'lead paint' as paint with a lead content greater than 0.1 % by dry weight. Therefore, a positive *LeadCheck*™ paint swab test can be assumed to contain greater than 0.5 % lead content and is considered lead paint.

However, a negative reading cannot confirm the absence of lead paint. Where the *LeadCheck* paint swab returned a negative result, it was therefore necessary to conduct laboratory analysis of samples suspected of containing lead to quantitatively determine the content of lead within the paint. Lead paint chip samples were collected and submitted for analysis to Eurofins | mgt ('Eurofins') which is a NATA accredited laboratory in accordance with Australian/New Zealand Standard AS/NZS 4361.2 – 2017 Guide to Hazardous Paint Management – Part 2: *Lead Paint in Residential, Public and Commercial Buildings* and AS ISO/IEC 17025 – 2018, *General requirements for the competence of testing and calibration laboratories*.

Particular attention was paid to areas where LCP was more likely to have been used (e.g. exterior gloss paints, window and door architraves and skirting boards).

The objective of LCP identification in this assessment is to highlight the presence of LCP within the Site building(s), not to specifically identify every location of LCP.

Ozone Depleting Substances (ODS)

This component of the assessment comprised a visual inspection of air conditioning units and any chillers at the Site and included a review of the air conditioners' refrigerant types, generally by locating product specification tags attached to the units.

RESULTS

Review of Existing Documentation

It is understood that prior to this inspection there was an existing HAZMAT report[1] issued by EP Risk in June 2017 (EP Risk, 2017) available for this Site. The following items are noted:

- Several suspected asbestos-containing electrical backing boards;
- One example of lead-containing paint to the exterior of Building 5;
- SMF in the form of roof and ceiling space insulation; and
- Numerous air conditioning units containing suspected ODS.

HAZMAT Inspection

EP Risk attended the Site on **27 August 2021** to undertake a visual assessment, collecting representative samples from structures suspected to contain hazardous materials. Photographs of the inspection are provided in **Attachment 2**, the following structures were inspected at the Site and assessed during the Assessment:

- **Building 4:**
  - Exterior;
  - Cool room;
  - Storage area; and
  - Sales rooms.
- **Building 4 Amenities:**
  - Exterior;
  - Water Closet; and
  - Shower room.
- **Building 5:**
  - Exterior;
  - Docking wharf;
  - Workshop;
  - Main room; and
  - Kitchen.
- **Building 6:**
  - Exterior;
  - Verandah; and
  - Interior (currently storage).
- **Building 7:**
  - Exterior.
  - Interior (currently storage).

[1] EP Risk (2017) EP0548.001 *Hazardous Materials (HAZMAT) Assessment Lot 2, Captain Cook Drive, Woolooware, NSW , June 2017.*

- **Building 8:**
  - Exterior;
  - Wash room ceiling space;
  - Wash room;
  - Pump room;
  - Tank room;
  - Kitchen/Office; and
  - Main room.
- **Property boundary:**
  - Driveway;
  - Timber boardwalk paths; and
  - Storage areas surrounding buildings.

The following Buildings are believed to have been demolished prior to 2021 re-inspection.

- Building 1
- Building 2
- Building 3
- Building 9
- Building 10
- Building 11

Particular attention was paid to the following structures/areas:

- Within sink cabinetry and behind/within false walls;
- Wall cavities (where existing);
- Beneath carpet and floor structure, including flooring material.
- Within ceiling and roof spaces – where accessible.
- Roof and concrete joins; and
- Electrical backing boards.

Three (3) representative bulk material samples were collected of suspected ACM to identify the presence of asbestos by NATA accredited laboratory analysis in accordance with Australian Standard (AS) 4964-2004, *Method for the qualitative identification of asbestos in bulk samples, 2004*.

Asbestos was detected within one (1) sample at or above the laboratory limit of reporting (LOR). This was an electrical backing board. It should be noted that there are two (2) other electrical boards that were not sampled but appear visually identical to this board and are therefore presumed to contain asbestos.

Suspected Synthetic Mineral Fibre Materials (SMF) were observed on-site including throughout ceiling space insulation, sarking insulation on the underside of the roof and internal insulation material within hot water units.

PCB-containing capacitors were suspected within various fluorescent light fittings located throughout the Site and a pedestal fan within Building 8, attributable to the age and appearance of those electrical fittings.

Two (2) samples of LCP were collected and analysed for the previous report (EP Risk, 2017), based upon the analytical laboratory results, lead concentrations were reported above the threshold for lead paint > 0.1 % (w/w) for both samples analysed.

- Building 5, exterior, green paint system - lead (Pb) concentration >0.1% w/w (0.55 %);
- Building 5, interior, yellow paint system - lead (Pb) concentration >0.1% w/w (1.6 %);

Chrorohydrofluorocarbon (CHFC) ozone depleting substances (ODS) refrigerant gases in the form of R22 refrigerant gas were suspected within numerous air conditioning units and chillers at the Site.

The findings of the HAZMAT survey are presented within the HAZMAT register as **Attachment 3**. Copies of the ALS Global and Envirolab NATA accredited laboratory reports are provided as **Attachment 4**.

CONCLUSION

TfNSW engaged EP Risk to undertake a HAZMAT inspection Assessment of the Site to identify existing HAZMAT within accessible building structures on Site and to provide advice with respect to removal and ongoing maintenance of HAZMAT at the Site.

Asbestos was detected within one (1) bulk material sample collected and analysed, an electrical backing board within Building 8. Two (2) additional backing boards identical in appearance are also presumed to contain asbestos and are located within Building 8 and Building 4 at the Site.

A total of two (2) representative bulk paint samples were collected previously (EP Risk, 2017) from suspected lead containing painted surfaces. Both samples were collected from Building 5. One from the exterior and one form the interior. Lead (Pb) concentrations were >0.1% w/w (0.55% and 1.6%, respectively) therefore confirming them as lead-containing paint in accordance with AS/NZS 4361.2 – 2017 *Guide to Hazardous Paint Management – Part 2: Residential and commercial buildings*.

Presumed SMF containing insulation materials were identified in Building 4, Building 5 and Building 8 within AC units, ceiling insulation, cooler room walls and ceiling and hot water tanks.

Suspected ozone depleting substance - R22 refrigerant was identified in Building 4 and Building 8 within AC units.

RECOMMENDATIONS

Based on the findings of the Assessment, it is recommended the following control measures be adopted as part of the management of the hazardous building materials at the Site.

Asbestos-containing Materials

- The suspected asbestos containing backing boards identified within the HAZMAT Register (**Attachment 3**) which have not been labelled as such, must be labelled as per Section 2.5 of the SafeWork NSW Code of Practice: *How to Manage and Control Asbestos in the Workplace*, 2019. ACM electrical backing boards identified on-site can be removed without a Class B asbestos removal licence in accordance with the SafeWork NSW Code of Practice *How to Safely Remove Asbestos* 2019, based on the quantity being <10 m^2 of bonded asbestos.
- If the presumed ACM is to remain on-site for the foreseeable future ensure that exposed sections are encapsulated, labelled as containing asbestos and maintain in a good condition.
- During demolition/refurbishment works for any materials encountered and suspected of containing asbestos, but not referenced in this report, works must cease, and an occupational hygienist should be notified to assess whether the material contains asbestos.

Synthetic Mineral Fibres

- In accordance with The National Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC:2006 (1990)], removal of bonded SMF materials should be conducted such that there is minimal physical abrasion, including from cutting. If there is a risk of physical abrasion occurring, such as in circumstances where heat or other causes have made the bonded SMF attach itself to the substrate then removal should be performed as for unbonded SMF. Unbonded SMF should be thoroughly wetted prior to removal. Dry removal may be necessary when there are electrical and heat considerations, in which case increased respiratory protection may be necessary when working in enclosed or poorly ventilated spaces or where the SMF insulation has undergone physical damage.

Lead-Containing Paint

- Any works that are likely to disturb lead containing paint surfaces should be conducted in accordance with the requirements of AS/NZS 4361.2 – 2017 Guide to Hazardous Paint Management – Part 2: Residential and commercial buildings.

Polychlorinated Biphenyls

- Should electrical fittings not inspected as part of this assessment be encountered and suspected of containing PCB oil containing capacitors, they should be treated as containing PCB oils until such time as evidence suggests otherwise e.g. further assessed/sampled/tested.

- Electrical fittings that contain or are suspected to contain PCB oil-containing capacitors should be removed as hazardous/regulated waste under controlled working conditions prior to the demolition or refurbishment works.

Ozone Depleting Substances

- If the ozone depleting substances identified on-site require removal, they should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Amendment Regulation 2012.
- It is important to note that, if a system which utilises ODS-refrigerants is in good working order, there is no need to transition to an alternative refrigerant/system (until 2029).

CLOSURE

The report(s) and/or information produced by EP Risk should not be reproduced and/or presented/reviewed except in full.

Please feel free to contact the undersigned on 0423 079 707 should you have any queries.

Yours sincerely,

James Thompson
Senior Associate Occupational Hygienist
NSW Licensed Asbestos Assessor (LAA000192)
EP Risk Management Pty Ltd
ABN 81 147 147 591

ATTACHMENTS

Attachment 1 – Figure 1
Attachment 2 – Photolog
Attachment 3 – HAZMAT Survey Summary Tables
Attachment 4 – NATA Accredited Laboratory Certificate of Analysis
Attachment 5 – Areas Not Accessed

QUALITY CONTROL

Version	Author	Date	Reviewer	Date	Quality Review	Date
v.1	J. Thompson	16.09.2021	K. Thomas	16.09.2021	K. Thomas	16.09.2021
v.2	J. Thompson	20.10.2021	K. Thomas	20.10.2021	O. Godfrey	20.10.2021

DOCUMENT CONTROL

Version	Date	Reference	Submitted to
v.1	*16.09.2021*	*EP2240.001_TfNSW c- APP_Woolooware Bay_HAZMAT_v1*	*Transport for NSW*
v.2	*20.10.2021*	*EP2240.001_TfNSW_Woolooware Bay_HAZMAT_v2*	*Transport for NSW*

LIMITATIONS

This Destructive Hazardous Materials (HAZMAT) Assessment was conducted on the behalf of TfNSW for the purpose/s stated in the **Objective**.

EP Risk has prepared this document in good faith but is unable to provide certification outside of areas over which EP Risk had some control or were reasonably able to check. The report also relies upon information provided by third parties. EP Risk has undertaken all practical steps to confirm the reliability of the information provided by third parties and do not accept any liability for false or misleading information provided by these parties.

It is not possible in a Destructive Hazardous Materials (HAZMAT) Assessment to present all data, which could be of interest to all readers of this report. Readers are referred to any referenced investigation reports for further data.

Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

All work conducted, and reports produced by EP Risk are based on a specific scope and have been prepared for TfNSW and therefore cannot be relied upon by any other third parties unless agreed in writing by EP Risk.

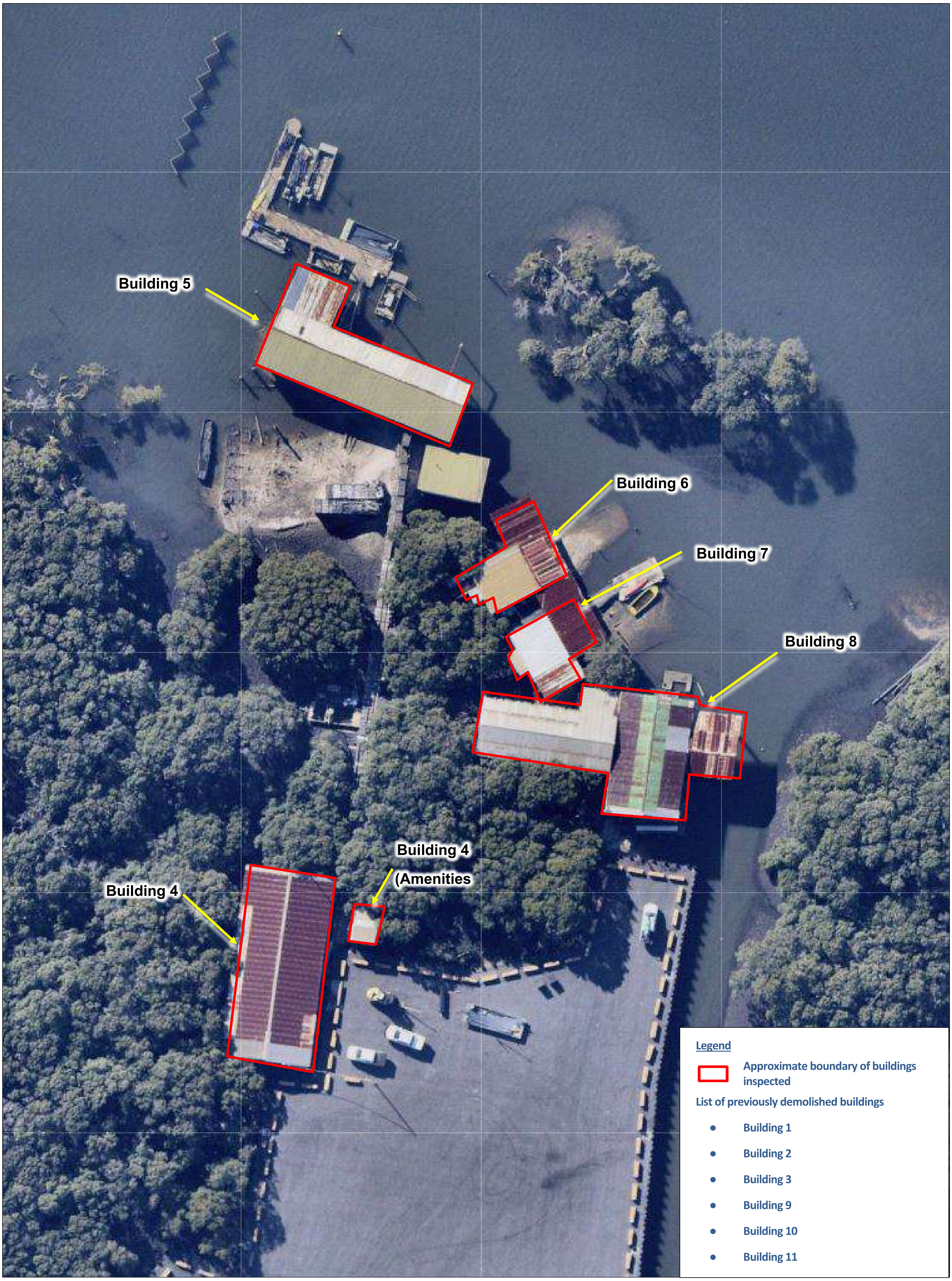
The report(s) and/or information produced by EP Risk should not be reproduced and/or presented/reviewed except in full.

Given that a representative sampling program has been adopted, not all materials suspected of containing asbestos and that at the time of the investigation were sampled and assessed. It is noted that some asbestos materials may have been suspected to contain asbestos based on their similar appearance to previously sampled materials.

Therefore, it is possible that asbestos materials, which may be concealed within inaccessible areas/voids, may not have been located during the investigation. Such areas include, but are not limited to:

- Materials concealed behind structural members and within inaccessible building voids;
- Areas inaccessible without the aid of scaffolding or lifting devices;
- Areas below ground;
- Inaccessible ceiling or wall cavities;
- Areas which require substantial demolition to access;
- Areas beneath floor covering where ACM were not expected to exist;
- Materials contained within plant and not accessible without dismantling the plant; and
- Areas where access is restricted due to locked doors, safety risks, or being occupied at the time of the investigation.

Attachment 1 – Figure 1



EP RISK

www.episk.com.au

EP2240.001 - TfNSW Woolooware Bay HAZMAT
Lot 2, Captain Cook Drive, Woolooware, NSW, 2229

Figure 1 – Site Layout

Job No: EP2240.001
Date: 20/10/2021
Drawing Ref: Fig 1
Version No: v1

N

0 4 8 16
Approximate Scale Only (m)

Co-ordinate system: MGA 56
Drawn by: JT Checked by: KT
Scale of regional map not shown
Source: Near Maps

20 October 2021
Ref: EP2240.001_v2

Attachment 2 – Photolog

Oscar Godfrey
EP Risk Management Pty Ltd

EP2240.001
WOOLOOWARE BAY HAZMAT REINSPECTION

PHOTOLOG

Friday, 27 August 2021

21 Items / Observations

ITEM 01. BUILDING 5 WHARF

Lead-containing external green paint system

ITEM 02. BUILDING 5 INNER WALL PANELS

Fibre Cement Sheeting (Sample ID: EP0548.001_MS01)

NATA Accredited Laboratory Sample ID: 168515-1

No Asbestos Detected

ITEM 03. BUILDING 5 COMPRESSOR

ITEM 04. BUILDING 5 KITCHEN INNER WALL PANEL BLUE

Fibre Cement Sheeting - confirmed not to contain asbestos (Sample ID: EP2240.001_ASB01)

NATA Accredited Laboratory Sample ID: ES2131490-018

Asbestos Not Detected

ITEM 05. BUILDING 5 KITCHEN ROOF

Suspected SMF insulation

ITEM 06. BUILDING 5 FLUORESCENT LIGHT FITTING

Suspected PCB containing capacitors

ITEM 07. BUILDING 6 CEILING INSULATION

Suspected SMF sarking

ITEM 08. BUILDING 5 EXTERIOR GREEN WALL PAINT

Lead-containing paint (Sample ID: EP0548.001_PS02)

NATA Accredited Laboratory Sample ID: 168515-4

Lead Concentration = 0.55% (% w/w) [>0.1% w/w]

ITEM 09. BUILDING 5 INTERIOR WORKSHOP YELLOW WALL PAINT

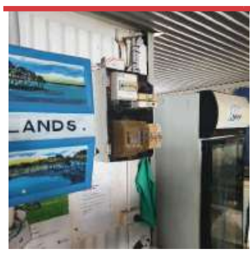
Lead-containing paint (Sample ID: EP0548.001_PS01)

NATA Accredited Laboratory Sample ID: 168515-3

Lead Concentration = 1.6% (% w/w) [>0.1% w/w]

ITEM 10. BUILDING 4 HOT WATER HEATER (X 2)

Suspected SMF internal insulation



ITEM 11. BUILDING 8 ELECTRICAL BACKING BOARD

Confirmed to contain asbestos (Sample ID: EP2240.001_ASB02)

NATA Accredited Laboratory Sample ID: ES2131490-017

Chrysotile Asbestos Present

ITEM 12. BUILDING 8 CHILLER X 2

Unknown refrigerant gas

Suspected to contain R22 refrigerant which is an Ozone Depleting Substance (ODS).

ITEM 13. BUILDING 8 ELECTRICAL BACKING BOARD

Presumed to contain asbestos.

Similar in appearance to sample EP2240.001_ASB02 (ACM)

ITEM 14. BUILDING 8 COOL ROOM PEDESTAL FAN

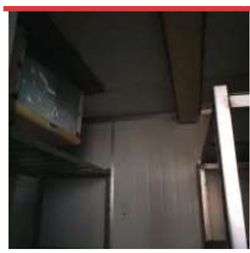
Suspected PCB containing capacitors

ITEM 15. BUILDING 8 COOL ROOM FLUORESCENT LIGHT FITTING

Suspected PCB containing capacitors

ITEM 16. BUILDING 4 ELECTRCIAL BACKING BOARD

Presumed to contain asbestos.
Similar in appearance to sample EP2240.001_ASB02 (ACM)



ITEM 17. BUILDING 4 COOL ROOM

Suspected R22 Refrigerant within chiller
ODS

ITEM 18. BUILDING 4 CEILING AC UNIT

Suspected R22 Refrigerant within AC Unit
ODS

ITEM 19. **BUILDING 4 REAR BUILDING HOT WATER UNIT**

Suspected SMF internal insulation

ITEM 20. **BUILDING 4 UNUSED AC UNIT**

R410a refrigerant

Non-ODS

ITEM 21. **BUILDING 4 PACKERS BEHIND ELECTRICAL BOARD**

Fibre cement sheeting - confirmed not to contain asbestos (EP2240.001_ASB03)

NATA Accredited Laboratory Sample ID: ES2131490-019

Asbestos Not Detected

Attachment 3 – HAZMAT Survey Summary Tables

Client: Transport for NSW (TfNSW)
Address: LOT 2, Captain Cook Drive, Woolooware, NSW, 2230

Surveyor: James Thompson

SafeWork NSW Licensed Asbestos Assessor: LAA000192

Survey Date: 27/08/2021
Resurvey Due: 27/08/2026

Hazardous Materials (HAZMAT) Register

EP2240.001_TfNSW_Wooloware Bay_HAZMAT Register_v1

	Material Location and Description							Material Status and Risk Assessment										Required Actions	
Line Item	Interior / Exterior / Level	Room / Area / Section	Location	Item Description	Material Description	Hazard Type	Sample No.	Sample Status	Approx. Extent	Unit	Friability (ACM Only)	Surface Treatment	Condition	Disturb. Potential	Risk Status	Control Priority	Labelled (Yes/No)	Comments & Recommendations	Photo Reference
Asbestos-containing Materials ('ACM')																			
1	Building 4 Interior	Southern wall	Central	Electrical distribution board	Bituminous material	Asbestos	Not sampled Similar in appearance to EP2240.001_ASB02	Assumed to contain asbestos	1	m^2	Bonded / Non-friable	Nil	Good	Low	Low	Low	No	Similar in appearance to Sample: EP2240.001_ASB02. Label as asbestos-containing and maintain in current condition if to remain in situ. A Class B (non-friable) licensed asbestos removal contractor should be engaged to remove >1m^2 of non-friable asbestos-containing material under controlled non-friable asbestos removal conditions prior to refurbishment or demolition works.	Item 16
2	Building 4 Interior	Southern wall	Central	Packers behind electrical distribution board	Fibre cement sheeting	Asbestos	EP2240.001_ASB03 (NATA Lab ID: ES2131490-019)	Asbestos Not Detected	-	-	-	-	-	-	-	-	-	-	Item 21
3	Building 8 Interior	Pump room	Northern wall	Electrical distribution board	Bituminous material	Asbestos	EP2240.001_ASB02 (NATA Lab ID: ES2131490-017)	Chrysotile Asbestos Detected	1	m^2	Bonded / Non-friable	Nil	Good	Low	Low	Low	No	Label as asbestos-containing and maintain in current condition if to remain in situ. A Class B (non-friable) licensed asbestos removal contractor should be engaged to remove >1m^2 of non-friable asbestos-containing material under controlled non-friable asbestos removal conditions prior to refurbishment or demolition works.	Item 11
4	Building 8 Interior	Attached to corrugated sheet metal	Walls	Electrical distribution board	Bituminous material	Asbestos	Not sampled Similar in appearance to EP2240.001_ASB02	Assumed to contain asbestos	1	m^2	Bonded / Non-friable	Nil	Good	Low	Low	Low	No	Similar in appearance to Sample: EP2240.001_ASB02. Label as asbestos-containing and maintain in current condition if to remain in situ. A Class B (non-friable) licensed asbestos removal contractor should be engaged to remove >1m^2 of non-friable asbestos-containing material under controlled non-friable asbestos removal conditions prior to refurbishment or demolition works.	Item 13
5	Building 8 Interior	Kitchen	Throughout	Walls	Fibre cement sheeting	Asbestos	EP0548.001_MS02 (NATA Lab ID: 168515-2)	Asbestos Not Detected	-	-	-	-	-	-	-	-	-	-	-
6	Building 5 Interior	West South East	Throughout	Walls	Fibre cement sheeting	Asbestos	EP0548.001_MS01 (NATA Lab ID: 168515-1)	Asbestos Not Detected	-	-	-	-	-	-	-	-	-	-	Item 02
	Building 5 Interior	Kitchen	Inner wall panelling	Walls	Fibre cement sheeting	Asbestos	EP2240.001_ASB01 (NATA Lab ID: ES2131490-018)	Asbestos Not Detected	-	-	-	-	-	-	-	-	-	-	Item 04
~~7~~	~~Building 3 Interior~~	~~South western elevation~~	~~Attached to pole~~	~~Electrical distribution board~~	~~Bituminous material~~	~~Asbestos~~	~~Not sampled (electrical hazard)~~	~~Presumed not to contain asbestos~~	-	-	-	-	-	-	-	-	-	~~This building was not present during August 2021 re-inspection. Building is presumed to have been demolished. No supporting documentation available at the time of writing.~~	-
Lead-containing Paint ('LCP')																			
8	Building 5 Exterior	Throughout	Walls	Light green coloured paint system	Lead-containing paint	Lead Paint - Chip	EP0548.001_PS02 (NATA Lab ID: 168515-4)	Positive	240	m^2	-	-	Poor	Med	Med	Med	No	NATA accredited analytical laboratory test result: 0.55 % lead content (%w/w) >0.1 % lead content, therfore classified as lead-containing paint as described in AS/NZS 4361.2:2017 Guide to hazardous paint management. Part 2: Lead paint in residential, public and commercial buildings.	Item 01 & Item 08
9	Building 5 Interior	Workshop	Walls	Yellow coloured paint system	Lead-containing paint	Lead Paint - Chip	EP0548.001_PS01 (NATA Lab ID: 168515-3)	Positive	100	m^2	-	-	Good	Low	Low	Low	No	NATA accredited analytical laboratory test result: 1.6 % lead content (%w/w) >0.1 % lead content, therfore classified as lead-containing paint as described in AS/NZS 4361.2:2017 Guide to hazardous paint management. Part 2: Lead paint in residential, public and commercial buildings.	Item 09
Synthetic Mineral Fibre Materials ('SMF')																			
10	Building 4 Interior	Rear room	Corner	Hot water heater	Insulation material - internal	SMF	Visually identified	Suspected Positive	1	Unit(s)	Bonded / Non-friable	-	Good	Low	Low	Low	No	Maintain in current condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	Item 19
11	Building 4 Amenities Interior	Water closet	Adjacent to sink	Hot water heater	Insulation material - internal	SMF	Visually identified	Suspected Positive	1	Unit(s)	Bonded / Non-friable	-	Good	Low	Low	Low	No	Maintain in current condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	-
12	Building 4 Amenities Interior	Shower	Redundant items	Hot water heater	Insulation material - internal	SMF	Visually identified	Suspected Positive	2	Unit(s)	Bonded / Non-friable	-	Good	Low	Low	Low	No	Maintain in current condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	Item 10
13	Building 5 Interior	Kitchen	Ceiling space	Insulation batts	Insulation material	SMF	Visually identified	Suspected Positive	20	m^2	Bonded / Non-friable	-	Good	Low	Low	Low	No	Maintain in current condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	Item 05
14	Building 6 Interior	Throughout	Ceiling space - underside of roof	Sarking insulation	Insulation material	SMF	Visually identified	Suspected Positive	100	m^2	Bonded / Non-friable	-	Good	Low	Low	Low	No	Maintain in current condition if to remain in-situ. Remove under controlled SMF conditions as per Code of Practice for the Safe Use of Synthetic Mineral Fibres [NOHSC: 2006 (1990)].	Item 07
Polychlorinated Biphenyls ('PCB')																			
15	Building 5 Interior	Throughout	Ceiling	Double tube light fittings	Capacitors	PCBs	Not sampled	Suspected Positive	10	Unit(s)	-	-	Good	Low	Low	Low	No	Due to the age and appearance of the redundant light fittings, PCB-containing capacitors are suspected to be present. The capacitors must be removed and disposed of in accordance with the Polychlorinated Biphenyls Management Plan, Revised Edition April 2003.	Item 06
16	Building 8 Interior	Cool Room	Stored item	Pedestal Fan	Capacitors	PCBs	Not sampled	Suspected Positive	1	Unit(s)	-	-	Good	Low	Low	Low	No	Due to the age and appearance of the redundant light fittings, PCB-containing capacitors are suspected to be present. The capacitors must be removed and disposed of in accordance with the Polychlorinated Biphenyls Management Plan, Revised Edition April 2003.	Item 14
17	Building 8 Interior	Cool Room	Ceiling	Fluorescent light fittings	Capacitors	PCBs	Not sampled	Suspected Positive	8	Unit(s)	-	-	Good	Low	Low	Low	No	Due to the age and appearance of the redundant light fittings, PCB-containing capacitors are suspected to be present. The capacitors must be removed and disposed of in accordance with the Polychlorinated Biphenyls Management Plan, Revised Edition April 2003.	Item 15
Ozone Depleting Substances ('ODS')																			
18	Building 8 Interior	Cool room	Rear of cool room	Chiller unit	Hydrochlorofluorocarbon (HCFC) refrigerant gas	Ozone Depleting Substances	R22 Refrigerant (suspected)	Suspected Positive	2	Unit(s)	-	-	Good	Low	Low	Low	No	Unknown refrigerant gas - suspect R22. Suspected ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Amendment Regulation 2012.	Item 12
19	Building 8 Interior	Wash room	Western wall	Air conditioning unit	Hydrochlorofluorocarbon (HCFC) refrigerant gas	Ozone Depleting Substances	R22 Refrigerant (suspected)	Suspected Positive	1	Unit(s)	-	-	Good	Low	Low	Low	No	Unknown refrigerant gas - suspect R22. Suspected ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Amendment Regulation 2012.	-
20	Building 4 Interior	Cool room	High level	Chiller unit	Hydrochlorofluorocarbon (HCFC) refrigerant gas	Ozone Depleting Substances	R22 Refrigerant (suspected)	Suspected Positive	1	Unit(s)	-	-	Good	Low	Low	Low	No	Unknown refrigerant gas - suspect R22. Suspected ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Amendment Regulation 2012.	Item 17
21	Building 4 Interior	Top of cool room	High level	Air conditioning unit	Hydrofluorocarbon (HFCs) refrigerant gas	Ozone Depleting Substances	R22 Refrigerant (suspected)	Suspected Positive	1	Unit(s)	-	-	Good	Low	Low	Low	No	Unknown refrigerant gas - suspect R22. Suspected ozone depleting substances identified in the assessment that require removal during refurbishment or demolition works should be appropriately decanted and disposed of by a licensed contractor in accordance with the Ozone Protection and Synthetic Greenhouse Gas Management Amendment Regulation 2012.	Item 18
22	Building 4 Interior	Central	Stored item	Air conditioning unit	Hydrofluorocarbon (HFCs) refrigerant gas	Ozone Depleting Substances	R410A Refrigerant	Assumed Negative	1	Unit(s)	-	-	-	-	-	-	-	Tag lists R410A as the refrigerant. Not regarded as an ozone depleting substance.	Item 20
Inaccessible Areas																			
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	There were no inaccessible areas during the August 2021 re-inspection.	-

Attachment 4 – NATA Accredited Laboratory Certificate of Analysis

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS **168515**

Client:
EP Risk Management Pty Ltd
PO Box 299
Maitland
NSW 2320

Attention: Mathew Burcher

Sample log in details:

Your Reference:	**EP0548**
No. of samples:	2 Materials, 2 Paints
Date samples received / completed instructions received	05/06/17 / 05/06/17

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	9/06/17 / 7/06/17
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing **Tests not covered by NATA are denoted with *.**

Results Approved By:

David Springer
General Manager

Asbestos ID - materials			
Our Reference:	UNITS	168515-1	168515-2
Your Reference	-------------	MS01	MS02
Date Sampled	------------	1/06/2017	1/06/2017
Type of sample		Material	Material
Date analysed	-	6/06/2017	6/06/2017
Mass / Dimension of Sample	-	100x70x5mm	10x6x1mm
Sample Description	-	Beige fibre cement material	Grey fibre cement material
Asbestos ID in materials	-	No asbestos detected Organic fibre detected	No asbestos detected Organic fibre detected

Lead in Paint			
Our Reference:	UNITS	168515-3	168515-4
Your Reference	------------- -	PS01	PS02
Date Sampled	------------	1/06/2017	1/06/2017
Type of sample		Paint	Paint
Date prepared	-	06/06/2017	06/06/2017
Date analysed	-	06/06/2017	06/06/2017
Lead in paint	%w/w	1.6	0.55

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Metals-004	Digestion of Paint chips/scrapings/liquids for Metals determination by ICP-AES/MS and or CV/AAS.

QUALITY CONTROL Lead in Paint	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			06/06/2017	[NT]	[NT]	LCS-2	06/06/2017
Date analysed	-			06/06/2017	[NT]	[NT]	LCS-2	06/06/2017
Lead in paint	%w/w	0.05	Metals-004	<0.05	[NT]	[NT]	LCS-2	100%

Report Comments:

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

CERTIFICATE OF ANALYSIS

Work Order	: **ES2131490**	Page	: 1 of 13
Client	: **EP Risk Management**	Laboratory	: Environmental Division Sydney
Contact	: ALEX THOMSON	Contact	: Tyler Anderson
Address	: 3/19 BOLTON STREET NEWCASTLE NSW 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 03 8540 7300	Telephone	: +61 2 8784 8555
Project	: EP2240	Date Samples Received	: 30-Aug-2021 18:20
Order number	: ----	Date Analysis Commenced	: 31-Aug-2021
C-O-C number	: ----	Issue Date	: 09-Sep-2021 16:52
Sampler	: JAMES THOMPSON, OSCAR GODFREY		
Site	: ----		
Quote number	: SY/497/20 Primary analysis only		
No. of samples received	: 19		
No. of samples analysed	: 18		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Brendan Schrader	Laboratory Technician	Newcastle - Asbestos, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG005T: Poor precision was obtained for Chromium on sample ES2131490 # 013. Confirmed by redigestion and reanalysis.
- EG035: Positive Hg result ES2131490 #16 has been confirmed by reanalysis.
- EP075(SIM): LOR raised due to the high amount of moisture present.
- **EA200 Legend**
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EP075(SIM): Poor duplicate precision due to sample heterogeneity. Insufficient sample for the confirmation of the results.
- EP075(SIM): Particular sample required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly.
- EP090 - Organotins: The LORs for particular analytes for particular samples have been raised due to matrix interference.
- EP090 - Organotins: Poor matrix spike recovery due to matrix interference.
- EA200: N/A - Not Applicable

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS02	MS03	MS04	MS05	MS06
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-002	ES2131490-003	ES2131490-004	ES2131490-005	ES2131490-006
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**18.2**	----	**15.0**	**46.2**	**67.8**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	----	<2	<2	**22**
Copper	7440-50-8	5	mg/kg	<5	----	<5	**9**	**902**
Lead	7439-92-1	5	mg/kg	<5	----	**6**	**19**	**60**
Nickel	7440-02-0	2	mg/kg	<2	----	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**14**	----	**65**	**46**	**1080**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	<0.1	<0.1	<0.1
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	**0.8**	<0.5	<0.5	<0.5	<0.8
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<2
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	**29.9**	<0.5	<0.5	<0.8
Acenaphthylene	208-96-8	0.5	mg/kg	**1.1**	<0.5	<0.5	<0.5	<0.8
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	**0.9**	<0.5	<0.5	<0.8
Fluorene	86-73-7	0.5	mg/kg	<0.5	**2.8**	<0.5	<0.5	<0.8
Phenanthrene	85-01-8	0.5	mg/kg	**1.2**	**16.9**	<0.5	<0.5	<0.8
Anthracene	120-12-7	0.5	mg/kg	<0.5	**0.6**	<0.5	<0.5	<0.8
Fluoranthene	206-44-0	0.5	mg/kg	**1.3**	**4.8**	<0.5	<0.5	**2.4**
Pyrene	129-00-0	0.5	mg/kg	**2.5**	**4.3**	<0.5	<0.5	**1.9**
Benz(a)anthracene	56-55-3	0.5	mg/kg	**0.9**	**1.0**	<0.5	<0.5	**0.9**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS02	MS03	MS04	MS05	MS06
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-002	ES2131490-003	ES2131490-004	ES2131490-005	ES2131490-006
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	**1.2**	**1.3**	<0.5	<0.5	**1.4**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	**1.2**	**1.0**	<0.5	<0.5	**2.0**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Benzo(a)pyrene	50-32-8	0.5	mg/kg	**1.1**	**0.5**	<0.5	<0.5	**1.1**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	**0.8**	<0.5	<0.5	<0.5	**1.0**
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	**11.3**	**64.0**	<0.5	<0.5	**10.7**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	**1.3**	**0.7**	<0.5	<0.5	**1.4**
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**1.6**	**1.0**	**0.6**	**0.6**	**1.9**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.9**	**1.3**	**1.2**	**1.2**	**2.4**
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	**50**	**100**	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**760**	**270**	**330**	**390**	**1000**
C29 - C36 Fraction	----	100	mg/kg	**1960**	**630**	**460**	**470**	**1910**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**2770**	**1000**	**790**	**860**	**2910**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	**70**	**110**	<50	<50	**120**
>C16 - C34 Fraction	----	100	mg/kg	**1180**	**390**	**550**	**620**	**1680**
>C34 - C40 Fraction	----	100	mg/kg	**2280**	**810**	**530**	**600**	**2010**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**3530**	**1310**	**1080**	**1220**	**3810**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**70**	**100**	<50	<50	**120**
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<2	----	<1	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	<2	----	<2	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	----	<1.0	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**92.6**	**91.1**	**88.8**	**88.7**	**94.2**
2-Chlorophenol-D4	93951-73-6	0.5	%	**93.4**	**92.9**	**91.9**	**91.7**	**95.3**
2.4.6-Tribromophenol	118-79-6	0.5	%	**109**	**108**	**109**	**107**	**108**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**101**	**98.4**	**95.9**	**97.7**	**101**
Anthracene-d10	1719-06-8	0.5	%	**104**	**98.7**	**100**	**101**	**104**

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	MS02	MS03	MS04	MS05	MS06
Sampling date / time				30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
				ES2131490-002	**ES2131490-003**	**ES2131490-004**	**ES2131490-005**	**ES2131490-006**
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	**100**	**97.8**	**97.4**	**98.0**	**102**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**75.0**	**----**	**76.0**	**----**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**42.8**	**46.9**	**41.3**	**44.6**	**40.3**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	<2	**7**	**3**	<2
Copper	7440-50-8	5	mg/kg	<5	<5	**13**	**9**	<5
Lead	7439-92-1	5	mg/kg	<5	<5	**26**	**5**	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	**6**	<2	<2
Zinc	7440-66-6	5	mg/kg	<5	**20**	**2830**	**78**	**15**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	**2.3**	<0.5	<0.5	**0.6**	**1.7**
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<1
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	**2.5**	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.0**
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.6**
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	**1.7**	<0.5	**18.0**
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**2.1**
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	**1.8**	<0.5	**32.4**
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	**1.8**	<0.5	**24.1**
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**12.2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	**1.0**	<0.5	**12.8**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	**0.9**	<0.5	**16.0**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**4.2**
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**8.1**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**4.6**
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.2**
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**5.1**
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	**12.1**	<0.5	**143**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	**0.8**	<0.5	**13.2**
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**1.1**	**0.6**	**13.2**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.4**	**1.2**	**13.2**
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	<50	<50	**70**	**90**	**90**
C15 - C28 Fraction	----	100	mg/kg	**510**	**440**	**360**	**1160**	**640**
C29 - C36 Fraction	----	100	mg/kg	**630**	**780**	**530**	**4210**	**670**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**1140**	**1220**	**960**	**5460**	**1400**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	**100**	<50	<50	**180**	**120**
>C16 - C34 Fraction	----	100	mg/kg	**720**	**840**	**580**	**1870**	**860**
>C34 - C40 Fraction	----	100	mg/kg	**630**	**840**	**540**	**5430**	**560**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**1450**	**1680**	**1120**	**7480**	**1540**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**100**	<50	<50	**180**	**120**
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	----	<5	<2	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	----	<9	<1	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	----	<2.5	<1.8	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**86.0**	**92.0**	**88.7**	**78.5**	**87.4**
2-Chlorophenol-D4	93951-73-6	0.5	%	**90.5**	**95.0**	**94.2**	**88.9**	**94.6**
2.4.6-Tribromophenol	118-79-6	0.5	%	**112**	**107**	**106**	**107**	**113**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**97.7**	**99.9**	**98.7**	**97.6**	**102**
Anthracene-d10	1719-06-8	0.5	%	**101**	**105**	**102**	**101**	**102**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	98.6	101	101	92.6	101
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	----	98.3	69.6	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**13.7**	**41.0**	**41.9**	**12.9**	**51.7**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	**8**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	<1
Chromium	7440-47-3	2	mg/kg	<2	**62**	<2	----	**11**
Copper	7440-50-8	5	mg/kg	<5	<5	<5	----	**25**
Lead	7439-92-1	5	mg/kg	<5	**32**	**23**	----	**60**
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	----	**5**
Zinc	7440-66-6	5	mg/kg	<5	**13**	**45**	----	**3700**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	**0.3**
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	**1.7**	**1.0**	<0.5	<80.0
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<160
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	**1.3**	<0.5	<0.5	<80.0
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<160
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**266**
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**116**
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**163**
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**170**
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**2010**
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**268**
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1250**
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1580**
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**487**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**602**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**510**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**138**
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**458**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**188**
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**242**
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**8450**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**599**
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**639**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**679**
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	<50	**130**	**70**	<50	**1930**
C15 - C28 Fraction	----	100	mg/kg	**370**	**700**	**410**	**340**	**66300**
C29 - C36 Fraction	----	100	mg/kg	**630**	**2680**	**360**	**400**	**27200**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**1000**	**3510**	**840**	**740**	**95400**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	**60**	**220**	**110**	**60**	**6770**
>C16 - C34 Fraction	----	100	mg/kg	**700**	**2960**	**540**	**590**	**83200**
>C34 - C40 Fraction	----	100	mg/kg	**680**	**1570**	**350**	**410**	**13600**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**1440**	**4750**	**1000**	**1060**	**104000**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**60**	**220**	**110**	**60**	**5930**
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	----	----	<2	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	----	----	<2	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<1.0	----	----	<0.5	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**94.9**	**82.8**	**79.9**	**84.9**	**66.3**
2-Chlorophenol-D4	93951-73-6	0.5	%	**97.4**	**90.4**	**89.6**	**90.8**	**71.2**
2.4.6-Tribromophenol	118-79-6	0.5	%	**110**	**113**	**116**	**105**	**72.5**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**102**	**100**	**98.8**	**98.2**	**80.8**
Anthracene-d10	1719-06-8	0.5	%	**106**	**105**	**103**	**101**	**82.6**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	102	103	100	99.1	107
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	84.0	----	----	66.8	----

Analytical Results

Sub-Matrix: **SOLID**
(Matrix: **SOLID**)

Compound	CAS Number	LOR	Unit	ASB02	ASB01	ASB03	----	----
Sampling date / time				30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	----	----
				ES2131490-017	ES2131490-018	ES2131490-019	--------	--------
				Result	Result	Result	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	**No**	**No**	----	----
Asbestos Type	1332-21-4	-	--	**Ch**	**-**	**-**	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	**N/A**	**No**	**No**	----	----
Sample weight (dry)	----	0.01	g	**2.35**	**2.34**	**5.30**	----	----
Synthetic Mineral Fibre	----	0.1	g/kg	**No**	**No**	**No**	----	----
Organic Fibre	----	0.1	g/kg	**No**	**Yes**	**Yes**	----	----
APPROVED IDENTIFIER:	----	-	--	**B.SCHRADER**	**B.SCHRADER**	**B.SCHRADER**	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOLID**

Method: Compound	Sample ID - Sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	ASB02 - 30-Aug-2021 00:00	One piece of asbestos cement sheeting approximately 20x15x5mm.
EA200: Description	ASB01 - 30-Aug-2021 00:00	Several pieces of cement sheeting.
EA200: Description	ASB03 - 30-Aug-2021 00:00	Two pieces of cement sheeting.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology). Only applies to samples ES2131490 (002, 004).

(SOIL) EG005(ED093)T: Total Metals by ICP-AES

(SOIL) EG035T: Total Recoverable Mercury by FIMS

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology). Only applies to samples ES2131490 (002, 004, 012, 015).

(SOIL) EA055: Moisture Content (Dried @ 105-110°C)

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOLID) EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples

Attachment 5 – Areas Not Accessible

Given the constraints of practicable access encountered during this Assessment, the following areas were not inspected. Assessments are restricted to those areas that are reasonably accessible at the time of our assessment with respect to the following:

- Without contravention of relevant statutory requirements or Codes of Practice.
- Without placing the consultant and/or others at undue risk.
- Excluding plant, structures and equipment that was 'in service' and operational.

The areas where there were access restrictions during the assessment included the following:

- In crawl spaces and hatches underneath the building at the site due to confined spaces.
- Underneath the concrete slab of all building structures at the site.
- Energised services, gas, electrical, pressurised vessel and chemical lines.
- Height restricted areas above 2.7m within building interiors.
- Within cavities that cannot be accessed by the means of a manhole or inspection hatch.
- Within voids or internal areas of plant, equipment, air-conditioning ducts etc.
- Within service shafts, ducts etc., concealed within the building structure.
- Within those areas accessible only by dismantling equipment still in use.
- Within totally inaccessible areas such as voids and cavities present but intimately concealed within the building structure.
- All areas outside the Scope of Work.

If proposed works entail possible disturbance of any suspect materials in the above locations, or any other location not mentioned within this report, further investigation may be required as part of a hazardous building materials management and abatement program prior to the commencement of such works.

Appendix J

Factual Results Summary Letter Timber Structures

Factual Results Summary Letter (LTR01)

Timber Structures

Lot 3 Captain Cook Drive, Woolooware Bay, NSW, 2230

Prepared for: Transport for New South Wales

EP2240.002_TfNSW_WoolowareBay_LTR01_v2

20 October 2021

APPROVED COMPANY ISO 9001 Quality Management Systems — QMS Certification Services

APPROVED COMPANY AS/NZS 4801 Occupational Health & Safety Management Systems — QMS Certification Services

APPROVED COMPANY ISO 14001 Environmental Management Systems — QMS Certification Services

EP RISK

20 October 2021
Ref: EP2240.002_v2

Transport for NSW
33 James Craig Rd
Rozelle NSW 2039

Attention: David Doyle

Factual Results Summary Letter – Timber Structures
Lot 3 Captain Cook Drive, Woolooware Bay, NSW

INTRODUCTION

Transport for NSW (TfNSW) engaged EP Risk Management Pty Ltd (EP Risk) to collect representative samples from timber piers and wharf structures to determine if they are suitable to be reused on-site at Lot 3 Captain Cook Drive, Woolooware Bay, NSW, 2230 (the Site). The Site is legally described as part Lot 3 in Deposited Plan (DP) 1165618 and is approximately 1.0 hectare (ha) in area.

BACKGROUND

It is understood TfNSW has undertaken intrusive works at the Site, including remediation of the southern portion of the Site (excluded from this assessment) and redevelopment of the Oyster Farm. The proposed redevelopment of the Oyster Farm includes 'rebuilding' of existing structure. Based on discussions with APP Corporation Pty Ltd (APP), timber from current structures, including wharfs and pier structures is proposed to be reused on site, where possible and timber surplus to the requirements of the Site is proposed to be sold or reused at another Site. Wharf and marine structures historically included construction using timber treated in a range of Contaminants of Potential Concern (CoPC). Products typically used on structures includes anti-foulants, anti-rot chemicals, coal tar creosotes and/or Chromated Copper Arsenate (CCA).

OBJECTIVE

The objective of this letter of environmental advice was to assess whether the timber structures were suitable to remain on-site as part of building features under the proposed commercial/industrial land use or to be potentially recycled to another site under a public open space land-use, in general accordance with National Environmental Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM) 1999, as amended April 2013 (NEPM 2013) and NSW Office of Environment and Heritage (OEH). *Protocols for recycling redundant utility poles and bridge timbers in New South Wales*, (OEH 2011).

SCOPE OF WORKS

In order to satisfy the objective, EP Risk performed the following scope of works:

- Site attendance and visual inspection of representative timber structures;

- Collection of a total of fifteen (15) wood samples from fifteen (15) representative timber structures using a battery-powered hand drill and chisel;
- Laboratory analysis of fifteen (15) selected wood samples at a National Association of Testing Authorities ('NATA') Accredited laboratory for a general suite of CoPC typical of historical treated timber; and
- Preparation of this factual results summary letter.

ASSESSMENT CRITERIA

To assess whether the timber structures are suitable to remain on-site under the current land use and to assess the potential risk to human health and the environment, analytical results are compared to published investigation level criteria. The NSW and Australian framework against which soil analytical results are compared to is detailed herein. With the absence of appropriate criteria for wood, EP Risk has adopted criteria from the NEPM 2013.

For the purposes of assessing the results of analytical testing of the materials, the following guidelines were considered:

- NEPM 2013;
- CRC CARE (2011), *Health screening levels for petroleum hydrocarbons in soil and groundwater. Summary,* CRC CARE Technical Report no. 10, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Concentrations of CoPC were compared against the following investigation levels:

- **Health-based criteria for the current and proposed land use**:. NEPM 2013 Health Investigation levels ('HILs') for 'Commercial/Industrial D' land use (HIL D)
- **Health-based criteria for other potential future proposed land use:** NEPM 2013 Health Investigation levels ('HILs') for 'Recreational C' land use (HIL C)

EP Risk has adopted the NEPM 2013 Tier 1 soil assessment criteria for direct contact, as it is the most recent published guidance that has been approved by NSW EPA under Section 105 of the *Contaminated Land Management Act 1997* ('CLM Act 1997'). The adopted assessment criteria are provided in **Table T1** in **Attachment 2**.

METHODOLOGY

A qualified and experienced Environmental Scientist from EP Risk attended Site on **27 August 2021** to observe on-site conditions and collect samples of the timber structures. A representative sampling approach was adopted, and samples were collected from the various timber structures likely to be reused on site including timber piers, joists, supports and boardwalks. A summary of the sample locations is provided as **Table 1**. A total of fourteen (14) samples (MS02 – MS14) were collected using a battery powered hand operated drill with wood shavings placed into a laboratory supplied jar for analysis. One sample (UF01) was collected from black surficial residue using a chisel. Samples were submitted to a NATA accredited laboratory for analysis for:

- Polycyclic Aromatic Hydrocarbons ('PAHs');
- Total Recoverable Hydrocarbons ('TRH');
- BTEX;

- Metals[1]
- Phenols; and
- Organotins.

Photographs taken during the inspections are provided as **Attachment 1**.

Quality Assurance

The samples were collected using a dedicated pair of disposable nitrile gloves, placed into a laboratory provided Teflon lined sample jar and transported in an iced cooled box to the nominated laboratory under chain of custody documentation. The samples were submitted to Eurofins MGT ('Eurofins'), a NATA accredited environmental laboratory for the analysis undertaken. The project laboratory's internal QA/QC procedures included the analysis of laboratory prepared blanks, spikes surrogate samples, control samples and duplicate samples.

FIELD OBSERVATIONS

Table 1 – Sample Summary

Timber Structure Type	Sample Location	Sample ID	Visual Observations	Analytical Schedule
Timber Pier	Building 4 Amenities	MS03	No staining observed	TRH, BTEX, PAH, Metals, Phenols
	Building 8	MS04	No staining observed	
	Building 8	MS06	Green staining[2] at the surface	
	Building 6	MS08	Green staining at the surface	
	Northern Boardwalk	MS12	No staining observed	
	Building 5	MS15	No staining observed	
Timber Joist	Building 5	MS14	No staining observed	

[1] Metals include Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc
[2] At the time of inspection it was difficult to distinguish if green staining at the surface could be attributable to CCA treatment or algae growth due to the marine environment.

Table 1 – Sample Summary

Timber Structure Type	Sample Location	Sample ID	Visual Observations	Analytical Schedule
	Northern Boardwalk	MS13	No staining observed	
	Building 6	MS07	Green staining at the surface	
Timber Support	Building 4	MS02	Minor black staining	
	Building 8	MS05	No staining observed	
	Building 6	MS11	Some black staining at the surface	
	Building 6	MS09	No staining observed	
	Building 4	UF01	Black residue observed at the surface. Strong hydrocarbon odour.	
Boardwalk Plank	Northern Boardwalk	MS10	Blue paint coating	

RESULTS

A summary table with comparison of results against the adopted criteria is provided as **Table T1** in **Attachment 2**. The NATA accredited laboratory certificate of analysis is provided in **Attachment 3**.

The samples collected reported concentrations below the adopted criteria with the exception of:

- Sample MS11 which reported a concentration of benzo(a)pyrene (BaP) TEQ (13.2 mg/kg) above the adopted HIL C of 3.0 mg/kg.
- Sample UF01 which reported concentrations of benzo(a)pyrene (BaP) TEQ (639 mg/kg) and PAHs (8,450 mg/kg) above the adopted HIL D of 40.0 mg/kg and 4,000 mg/kg, respectively.

DISCUSSION

Copper Chromate Arsenate (CCA)

Detectable levels of some metals including copper and chromium were observed in some samples collected and a greenish tinge was observed on the wood. However, Arsenic was not detected in the samples, with the exception of sample UF01, therefore these observations do not indicate the presence of CCA in timber structures present on Site.

CONCLUSION

Current and Proposed Land Use (HIL D)

Based on the visual inspection, review of laboratory analytical results and subject to the limitations attached, EP Risk considers the timber structures, with the exception of PAH impacted timber supports at sample location UF01, do not pose a risk to human health and the environment under the current and proposed commercial/industrial land use. Based on analytical results, no evidence of historical use of copper chrome arsenate (CCA) has been found.

For PAH impacted timber support at sample location UF01, approximately 1 m^3, based on the visual inspection, review of laboratory analytical results and subject to the limitations attached EP Risk concludes there is a potential risk of exposure to human health and the environment from black residue present on the timber support sampled. Therefore, in the current state without further assessment, the timber support at this location is not considered suitable for reuse. A waste classification report should be prepared to enable off-site disposal of the timber support.

Furthermore, during demolition of timber structures at the Site, if any black residue is observed (see **Attachment 1 – Photolog**, Image 14), these sections should be isolated from the remaining structures and considered unsuitable for reuse at the Site.

Other Potential Future Land Use (HIL C)

Additionally. based on the visual inspection, review of laboratory analytical results and subject to the limitations attached, EP Risk considers the B(a)P impacted timber structure at sample location MS11, approximately 1 m^3, poses a risk to human health and the environment under a potential Public open space land use. Therefore, in its current state without further assessment, the timber support at this location is not considered suitable for reuse under a public open space land use setting.

Furthermore, if any black staining is observed (see **Attachment 1 – Photolog**, Image 8), these sections should be isolated from the remaining structures and considered unsuitable for reuse under a public open space land use unless additional assessment such as a leachate assessment is conducted.

With the exception of B(a)P and PAH impacted timber identified, there is no evidence to suggest the treatment of other observed timber structures with preservatives or problematic substances. Timber proposed to be recycled should be conducted in accordance with the guidelines as outlined in OEH 2011.

CLOSURE

Please feel free to contact EP Risk on (02) 9922 5021 or the undersigned on 0433 432 720 should you have any queries.

Yours sincerely,

Oscar Godfrey
Environmental Engineer
EP Risk Management Pty Ltd
ABN: 81 147 147 591

QUALITY CONTROL

Version	Author	Date	Reviewer	Date	Quality Review	Date
v.1	O. Godfrey	15.09.2021	L. Munnichs	15.09.2021	L. Munnichs	15.09.2021
v. 2	O. Godfrey	20.10.2021	L. Munnichs	20.10.2021	L. Munnichs	20.10.2021

DOCUMENT CONTROL

Version	Date	Reference	Submitted to
v.1	*15.09.2021*	*EP2240.002_TfNSW_WooloowareBay_LTR01_v1*	*Transport for NSW*
v.2	*20.10.2021*	*EP2240.002_TfNSW_WooloowareBay_LTR01_v2*	*Transport for NSW*

LIMITATIONS

This report was produced on behalf of Transport for NSW for the purpose/s stated in the Introduction Section.

EP Risk has prepared this report in good faith but is unable to provide certification outside of areas over which EP Risk had some control or were reasonably able to check. This report relies upon information provided by third parties. EP Risk has undertaken all practical steps to confirm the reliability of the information provided by third parties and do not accept any liability for false or misleading information provided by these parties.

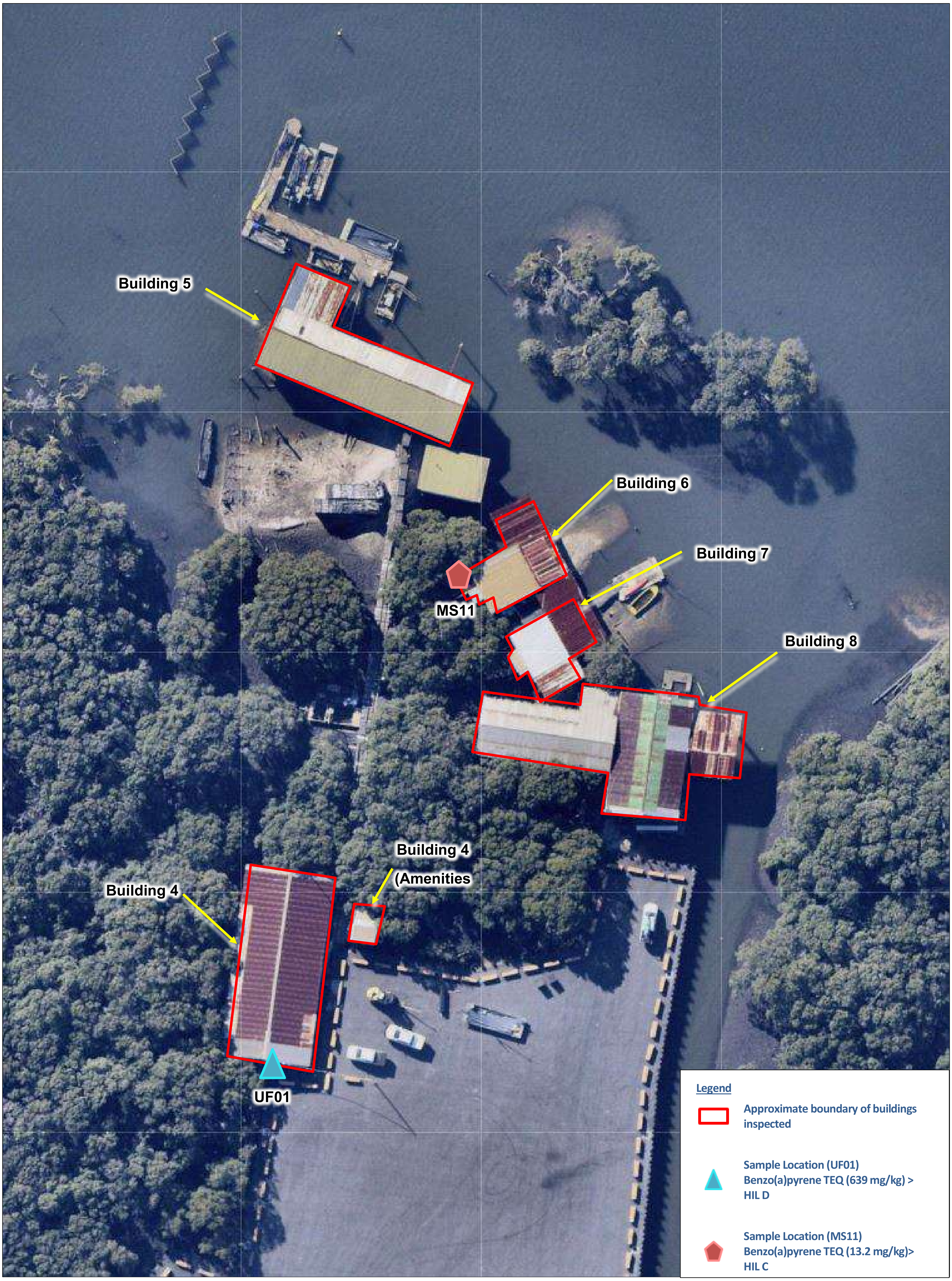
It is not possible in an Factual Results Summary Letter to present all data that could be of interest to all readers. Readers are referred to the referenced investigation report for further data.

Users of this report should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

All work conducted, and reports produced by EP Risk are based on a specific scope and have been prepared for this report and therefore cannot be relied upon by any other third parties unless agreed in writing by EP Risk.

The information contained within this report produced by EP Risk should not be reproduced and/or presented/reviewed except in full.

Figure



EP RISK

www.episk.com.au

EP2240.002 - TfNSW c/o APP Woolooware Bay HAZMAT
Lot 3, Captain Cook Drive, Woolooware, NSW, 2229

Figure 1 – Site Layout

Job No: EP2240.002
Date: 20/10/2021
Drawing Ref: Fig 1
Version No: v1

N

0 4 8 16
Approximate Scale Only (m)

Co-ordinate system: MGA 56
Drawn by: OG Checked by: LM
Scale of regional map not shown
Source: Near Maps

Attachment 1 – Photo Log

Oscar Godfrey
EP Risk Management Pty Ltd

EP2240 HAZMAT INSPECTION

Friday, 27 August 2021

14 Issues Observations

BUILDING 4 TIMBER CORNER PIECE

Sample location MS01

BUILDING 4 TIMBER SUPPORT UNDERNEATH BUILDING

Sample location MS02

BUILDING 4 AMENITIES UPRIGHT PIER

Sample location MS03

BOARDWALK TO BUILDING 5

BUILDING 8 UPRIGHT PIER

Sample location MS04

BUILDING 8 TIMBER SUPPORT

Sample location MS05

BOARDWALK PIER TIMBER PIER

Sample Location MS12

BUILDING 6 TIMBER SUPPORT

Sample Location MS11

Black staining present at the surface

BOARDWALK TIMBER SUPPPORT

Sample Location MS10

BUILDING 6 TIMBER SUPPORT

Sample location MS09

BUILDING 6 SQUARE PIER UPRIGHT

Sample Location MS08

BUILDING 6 TIMBER JOINER

Sample Location MS07

BUILDING 8 UPRIGHT PIER

Sample location MS06

BUILDING 4 BLACK RESIDUE ON TIMBER

Sample Location (UF01)

Attachment 2 – Analytical Summary Table

		Phenols												TRH					Metals							
		3&4-Methylphenol (m&p-cresol)	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,6-Dichlorophenol	2-Chlorophenol	2-Methylphenol	2-Nitrophenol	4-chloro-3-methylphenol	Pentachlorophenol	Phenol	C10-C16 (F2 minus Naphthalene)	C10-C16	C34-C40	C10-C40 (Sum of total)	C16-C34	Arsenic	Cadmium	Chromium (VI)	Copper	Lead	Mercury	Nickel	Zinc
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	50	50	100	50	100	5	1	2	5	5	0.1	2	5
NEPM 2013 Table 1A(1) HILs Rec C Soil												120	40,000						300	90	240	17,000	600	80	1,200	30,000
NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil												660	240,000						3000	900	3000	240,000	1500	730	6,000	400,000
Field ID	**Date**																									
MS02	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	0.8	70	70	2,280	3,530	1,180	<5	<1	<2	<5	<5	<0.1	<2	14
MS03	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	100	110	810	1,310	390								
MS04	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<50	<50	530	1,080	550	<5	<1	<2	<5	6	<0.1	<2	65
MS05	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<50	<50	600	1,220	620	<5	<1	<2	9	19	<0.1	<2	46
MS06	**30/08/2021**	<2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<2	<0.8	120	120	2,010	3,810	1,680	<5	<1	22	902	60	<0.1	<2	1,080
MS07	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	2.3	100	100	630	1,450	720	<5	<1	<2	<5	<5	<0.1	<2	<5
MS08	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<50	<50	840	1,680	840	<5	<1	<2	<5	<5	<0.1	<2	20
MS09	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<50	<50	540	1,120	580	<5	<1	7	13	26	<0.1	6	2,830
MS10	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	0.6	180	180	5,430	7,480	1,870	<5	<1	3	9	5	<0.1	<2	78
MS11	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	1.7	120	120	560	1,540	860	<5	<1	<2	<5	<5	<0.1	<2	15
MS12	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	60	60	680	1,440	700	<5	<1	<2	<5	<5	<0.1	<2	<5
MS13	**30/08/2021**	<1	<0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	1.7	220	220	1,570	4,750	2,960	<5	<1	62	<5	32	<0.1	<2	13
MS14	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	1.0	110	110	350	1,000	540	<5	<1	<2	<5	23	<0.1	<2	45
MS15	**30/08/2021**	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<0.5	60	60	410	1,060	590								
UF01	**30/08/2021**	<160	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<160	<80.0	5,930	6,770	13,600	104,000	83,200	8	<1	11	25	60	0.3	5	3,700

Environmental Standards

2013, NEPM 2013 Table 1A(1) HILs Rec C Soil

2013, NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil

		PAH																				Organotins	
		Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)	Dibutyltin (as Sn)	Monobutyletin (as Sn)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg
EQL		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1
NEPM 2013 Table 1A(1) HILs Rec C Soil																		3	3	3	300		
NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil																		40	40	40	4,000		
Field ID	**Date**																						
MS02	**30/08/2021**	<0.5	1.1	<0.5	0.9	1.1	1.2	0.8	<0.5	1.2	<0.5	1.3	<0.5	<0.5	<0.5	1.2	2.5	1.6	1.9	1.3	11.3	<2	<2
MS03	**30/08/2021**	0.9	<0.5	0.6	1.0	0.5	1.0	<0.5	<0.5	1.3	<0.5	4.8	2.8	<0.5	29.9	16.9	4.3	1.0	1.3	0.7	64.0		
MS04	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<2	<1
MS05	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5		
MS06	**30/08/2021**	<0.8	<0.8	<0.8	0.9	1.1	2.0	1.0	<0.8	1.4	<0.8	2.4	<0.8	<0.8	<0.8	<0.8	1.9	1.9	2.4	1.4	10.7		
MS07	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5		
MS08	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<9	<5
MS09	**30/08/2021**	<0.5	0.6	<0.5	0.6	0.6	0.9	0.6	<0.5	1.0	<0.5	1.8	<0.5	<0.5	2.5	1.7	1.8	1.1	1.4	0.8	12.1	<1	<2
MS10	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5		
MS11	**30/08/2021**	1.0	<0.5	2.1	12.2	8.1	16.0	5.1	4.2	12.8	1.2	32.4	1.6	4.6	<0.5	18.0	24.1	13.2	13.2	13.2	143		
MS12	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<1	<1
MS13	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5		
MS14	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5		
MS15	**30/08/2021**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5	<2	<2
UF01	**30/08/2021**	163	116	268	487	458	510	242	138	602	<80.0	1,250	170	188	266	2,010	1,580	639	679	599	8,450		

Environmental Standards

2013, NEPM 2013 Table 1A(1) HILs Rec C Soil

2013, NEPM 2013 Table 1A(1) HILs Comm/Ind D Soil

Attachment 3 – NATA Laboratory Report

CERTIFICATE OF ANALYSIS

Work Order	: **ES2131490**	Page	: 1 of 13
Client	: **EP Risk Management**	Laboratory	: Environmental Division Sydney
Contact	: ALEX THOMSON	Contact	: Tyler Anderson
Address	: 3/19 BOLTON STREET NEWCASTLE NSW 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 03 8540 7300	Telephone	: +61 2 8784 8555
Project	: EP2240	Date Samples Received	: 30-Aug-2021 18:20
Order number	: ----	Date Analysis Commenced	: 31-Aug-2021
C-O-C number	: ----	Issue Date	: 09-Sep-2021 16:52
Sampler	: JAMES THOMPSON, OSCAR GODFREY		
Site	: ----		
Quote number	: SY/497/20 Primary analysis only		
No. of samples received	: 19		
No. of samples analysed	: 18		

NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Brendan Schrader	Laboratory Technician	Newcastle - Asbestos, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Assistant Laboratory Manager	Brisbane Organics, Stafford, QLD
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG005T: Poor precision was obtained for Chromium on sample ES2131490 # 013. Confirmed by redigestion and reanalysis.
- EG035: Positive Hg result ES2131490 #16 has been confirmed by reanalysis.
- EP075(SIM): LOR raised due to the high amount of moisture present.
- **EA200 Legend**
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EP075(SIM): Poor duplicate precision due to sample heterogeneity. Insufficient sample for the confirmation of the results.
- EP075(SIM): Particular sample required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly.
- EP090 - Organotins: The LORs for particular analytes for particular samples have been raised due to matrix interference.
- EP090 - Organotins: Poor matrix spike recovery due to matrix interference.
- EA200: N/A - Not Applicable

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	MS02	MS03	MS04	MS05	MS06
Sampling date / time				30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
				ES2131490-002	ES2131490-003	ES2131490-004	ES2131490-005	ES2131490-006
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**18.2**	----	**15.0**	**46.2**	**67.8**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	----	<2	<2	**22**
Copper	7440-50-8	5	mg/kg	<5	----	<5	**9**	**902**
Lead	7439-92-1	5	mg/kg	<5	----	**6**	**19**	**60**
Nickel	7440-02-0	2	mg/kg	<2	----	<2	<2	<2
Zinc	7440-66-6	5	mg/kg	**14**	----	**65**	**46**	**1080**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	<0.1	<0.1	<0.1
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	**0.8**	<0.5	<0.5	<0.5	<0.8
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<2
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	**29.9**	<0.5	<0.5	<0.8
Acenaphthylene	208-96-8	0.5	mg/kg	**1.1**	<0.5	<0.5	<0.5	<0.8
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	**0.9**	<0.5	<0.5	<0.8
Fluorene	86-73-7	0.5	mg/kg	<0.5	**2.8**	<0.5	<0.5	<0.8
Phenanthrene	85-01-8	0.5	mg/kg	**1.2**	**16.9**	<0.5	<0.5	<0.8
Anthracene	120-12-7	0.5	mg/kg	<0.5	**0.6**	<0.5	<0.5	<0.8
Fluoranthene	206-44-0	0.5	mg/kg	**1.3**	**4.8**	<0.5	<0.5	**2.4**
Pyrene	129-00-0	0.5	mg/kg	**2.5**	**4.3**	<0.5	<0.5	**1.9**
Benz(a)anthracene	56-55-3	0.5	mg/kg	**0.9**	**1.0**	<0.5	<0.5	**0.9**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS02	MS03	MS04	MS05	MS06
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-002	ES2131490-003	ES2131490-004	ES2131490-005	ES2131490-006
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	**1.2**	**1.3**	<0.5	<0.5	**1.4**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	**1.2**	**1.0**	<0.5	<0.5	**2.0**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Benzo(a)pyrene	50-32-8	0.5	mg/kg	**1.1**	**0.5**	<0.5	<0.5	**1.1**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.8
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	**0.8**	<0.5	<0.5	<0.5	**1.0**
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	**11.3**	**64.0**	<0.5	<0.5	**10.7**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	**1.3**	**0.7**	<0.5	<0.5	**1.4**
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**1.6**	**1.0**	**0.6**	**0.6**	**1.9**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.9**	**1.3**	**1.2**	**1.2**	**2.4**
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	**50**	**100**	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**760**	**270**	**330**	**390**	**1000**
C29 - C36 Fraction	----	100	mg/kg	**1960**	**630**	**460**	**470**	**1910**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**2770**	**1000**	**790**	**860**	**2910**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	**70**	**110**	<50	<50	**120**
>C16 - C34 Fraction	----	100	mg/kg	**1180**	**390**	**550**	**620**	**1680**
>C34 - C40 Fraction	----	100	mg/kg	**2280**	**810**	**530**	**600**	**2010**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**3530**	**1310**	**1080**	**1220**	**3810**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**70**	**100**	<50	<50	**120**
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<2	----	<1	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	<2	----	<2	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<0.5	----	<1.0	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**92.6**	**91.1**	**88.8**	**88.7**	**94.2**
2-Chlorophenol-D4	93951-73-6	0.5	%	**93.4**	**92.9**	**91.9**	**91.7**	**95.3**
2.4.6-Tribromophenol	118-79-6	0.5	%	**109**	**108**	**109**	**107**	**108**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**101**	**98.4**	**95.9**	**97.7**	**101**
Anthracene-d10	1719-06-8	0.5	%	**104**	**98.7**	**100**	**101**	**104**

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	MS02	MS03	MS04	MS05	MS06
Sampling date / time				30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
				ES2131490-002	ES2131490-003	ES2131490-004	ES2131490-005	ES2131490-006
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	**100**	**97.8**	**97.4**	**98.0**	**102**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**75.0**	**----**	**76.0**	**----**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**42.8**	**46.9**	**41.3**	**44.6**	**40.3**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	<2	**7**	**3**	<2
Copper	7440-50-8	5	mg/kg	<5	<5	**13**	**9**	<5
Lead	7439-92-1	5	mg/kg	<5	<5	**26**	**5**	<5
Nickel	7440-02-0	2	mg/kg	<2	<2	**6**	<2	<2
Zinc	7440-66-6	5	mg/kg	<5	**20**	**2830**	**78**	**15**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	**2.3**	<0.5	<0.5	**0.6**	**1.7**
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<1
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	**2.5**	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.0**
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.6**
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	**1.7**	<0.5	**18.0**
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**2.1**
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	**1.8**	<0.5	**32.4**
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	**1.8**	<0.5	**24.1**
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**12.2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	**1.0**	<0.5	**12.8**
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	**0.9**	<0.5	**16.0**
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**4.2**
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**8.1**
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**4.6**
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	**1.2**
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	**0.6**	<0.5	**5.1**
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	**12.1**	<0.5	**143**
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	**0.8**	<0.5	**13.2**
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**1.1**	**0.6**	**13.2**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.4**	**1.2**	**13.2**
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	<50	<50	**70**	**90**	**90**
C15 - C28 Fraction	----	100	mg/kg	**510**	**440**	**360**	**1160**	**640**
C29 - C36 Fraction	----	100	mg/kg	**630**	**780**	**530**	**4210**	**670**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**1140**	**1220**	**960**	**5460**	**1400**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	**100**	<50	<50	**180**	**120**
>C16 - C34 Fraction	----	100	mg/kg	**720**	**840**	**580**	**1870**	**860**
>C34 - C40 Fraction	----	100	mg/kg	**630**	**840**	**540**	**5430**	**560**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**1450**	**1680**	**1120**	**7480**	**1540**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	**100**	<50	<50	**180**	**120**
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	----	<5	<2	----	----
Dibutyltin	1002-53-5	1	µgSn/kg	----	<9	<1	----	----
Tributyltin	56573-85-4	0.5	µgSn/kg	----	<2.5	<1.8	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**86.0**	**92.0**	**88.7**	**78.5**	**87.4**
2-Chlorophenol-D4	93951-73-6	0.5	%	**90.5**	**95.0**	**94.2**	**88.9**	**94.6**
2.4.6-Tribromophenol	118-79-6	0.5	%	**112**	**107**	**106**	**107**	**113**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**97.7**	**99.9**	**98.7**	**97.6**	**102**
Anthracene-d10	1719-06-8	0.5	%	**101**	**105**	**102**	**101**	**102**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS07	MS08	MS09	MS10	MS11
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-007	ES2131490-008	ES2131490-009	ES2131490-010	ES2131490-011
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	**98.6**	**101**	**101**	**92.6**	**101**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**----**	**98.3**	**69.6**	**----**	**----**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	13.7	41.0	41.9	12.9	51.7
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	8
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	<1
Chromium	7440-47-3	2	mg/kg	<2	62	<2	----	11
Copper	7440-50-8	5	mg/kg	<5	<5	<5	----	25
Lead	7439-92-1	5	mg/kg	<5	32	23	----	60
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	----	5
Zinc	7440-66-6	5	mg/kg	<5	13	45	----	3700
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	0.3
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	0.5	mg/kg	<0.5	1.7	1.0	<0.5	<80.0
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	<1	<1	<1	<160
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	1.3	<0.5	<0.5	<80.0
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
Pentachlorophenol	87-86-5	2	mg/kg	<2	<2	<2	<2	<160
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	266
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	116
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	163
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	170
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	2010
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	268
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	1250
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	1580
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	487

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	602
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	510
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	138
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	458
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	188
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<80.0
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	242
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	8450
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	599
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	0.6	0.6	639
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	1.2	1.2	679
EP080/071: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	50	mg/kg	<50	130	70	<50	1930
C15 - C28 Fraction	----	100	mg/kg	370	700	410	340	66300
C29 - C36 Fraction	----	100	mg/kg	630	2680	360	400	27200
^ C10 - C36 Fraction (sum)	----	50	mg/kg	1000	3510	840	740	95400
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	----	50	mg/kg	60	220	110	60	6770
>C16 - C34 Fraction	----	100	mg/kg	700	2960	540	590	83200
>C34 - C40 Fraction	----	100	mg/kg	680	1570	350	410	13600
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	1440	4750	1000	1060	104000
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	60	220	110	60	5930
EP090: Organotin Compounds								
Monobutyltin	78763-54-9	1	µgSn/kg	<1	----	----	<2	----
Dibutyltin	1002-53-5	1	µgSn/kg	<1	----	----	<2	----
Tributyltin	56573-85-4	0.5	µgSn/kg	<1.0	----	----	<0.5	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	94.9	82.8	79.9	84.9	66.3
2-Chlorophenol-D4	93951-73-6	0.5	%	97.4	90.4	89.6	90.8	71.2
2.4.6-Tribromophenol	118-79-6	0.5	%	110	113	116	105	72.5
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	102	100	98.8	98.2	80.8
Anthracene-d10	1719-06-8	0.5	%	106	105	103	101	82.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MS12	MS13	MS14	MS15	UF01
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00
Compound	*CAS Number*	*LOR*	*Unit*	ES2131490-012	ES2131490-013	ES2131490-014	ES2131490-015	ES2131490-016
				Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.5	%	**102**	**103**	**100**	**99.1**	**107**
EP090S: Organotin Surrogate								
Tripropyltin	----	0.5	%	**84.0**	**----**	**----**	**66.8**	**----**

Analytical Results

Sub-Matrix: SOLID (Matrix: SOLID)			Sample ID	ASB02	ASB01	ASB03	----	----
			Sampling date / time	30-Aug-2021 00:00	30-Aug-2021 00:00	30-Aug-2021 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2131490-017	ES2131490-018	ES2131490-019	--------	--------
				Result	Result	Result	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	**No**	**No**	----	----
Asbestos Type	1332-21-4	-	--	**Ch**	**-**	**-**	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	**N/A**	**No**	**No**	----	----
Sample weight (dry)	----	0.01	g	**2.35**	**2.34**	**5.30**	----	----
Synthetic Mineral Fibre	----	0.1	g/kg	**No**	**No**	**No**	----	----
Organic Fibre	----	0.1	g/kg	**No**	**Yes**	**Yes**	----	----
APPROVED IDENTIFIER:	----	-	--	**B.SCHRADER**	**B.SCHRADER**	**B.SCHRADER**	----	----

Analytical Results
Descriptive Results

Sub-Matrix: **SOLID**

Method: Compound	Sample ID - Sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	ASB02 - 30-Aug-2021 00:00	One piece of asbestos cement sheeting approximately 20x15x5mm.
EA200: Description	ASB01 - 30-Aug-2021 00:00	Several pieces of cement sheeting.
EA200: Description	ASB03 - 30-Aug-2021 00:00	Two pieces of cement sheeting.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP090S: Organotin Surrogate			
Tripropyltin	----	35	130

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EP090: Organotin Compounds

(SOIL) EP090S: Organotin Surrogate

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology). Only applies to samples ES2131490 (002, 004).

(SOIL) EG005(ED093)T: Total Metals by ICP-AES

(SOIL) EG035T: Total Recoverable Mercury by FIMS

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology). Only applies to samples ES2131490 (002, 004, 012, 015).

(SOIL) EA055: Moisture Content (Dried @ 105-110°C)

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOLID) EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples

Appendix K

Coastal Processes Letter

Our Ref: NW30294/001:L003:PDT
Contact: Doug Treloar

28 March 2022

Transport for NSW
33 James Craig Road
Rozelle NSW 2039

Attention: David Doyle

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9, 203 Pacific Highway
St Leonards NSW 2065
PO Box 19 1590

Phone +612 9496 7823

Dear Sir,

OYSTER FARM OVERWATER STRUCTURES – WOOLOOWARE BAY – ASSESSMENT OF POTENTIAL DELETERIOUS EFFECTS ON SEDIMENT PROCESSES

Preamble

Cardno, now Stantec, have been engaged by Transport for NSW (TfNSW), to provide coastal engineering advice as part of the planning and environmental approvals for The Oyster Farm in southern Woolooware Bay, see **Figure 1**. This site is to be rehabilitated to provide oyster farming facilities. Some work has already been completed, including a Vinyl sheet-pile, vertical seawall with a crest level of about 1.8m AHD – pers. com Doyle (TfNSW) – Treloar. As part of the Review of Environmental Factors (REF), TfNSW have requested that the matter of potential changes to sediment transport processes at the site and arising from these works be addressed. TfNSW are being assisted in this matter by APP Corporation Pty Limited, with structural design by Tonkin.

Specifically, Cardno have been requested to develop an understanding of the sedimentation disruption, if any, that might be caused by the overwater structures and whether the new structures (three over-water buildings), will result in any changes to sediment transport around the site and adjacent shoreline.

A site description drawn from Alison Hunt and Associates report (2021) has been used to describe the project. The existing site comprises a set of dilapidated, raised wooden structures – walkways and sheds, that are supported on wooden piers that are required to keep them above tidal and wave action. The overwater structures are presently being used for aquaculture and oyster processing, and they are the ones proposed for demolition and replacement.

Annexure A provides site photographs that describe the existing buildings, a recently developed hardstand area and new sheet pile wall (line of black dots) and a patch of developed mangrove trees on a low-tide island that lies north of the buildings

Preliminary drawings of the three proposed overwater structures, including pile layouts, are presented in **Annexure B**, as well as information on underside deck levels. APP have advised that the currently proposed finished floor level is 2.25m AHD. The underside floor level is 2.207m AHD, level of joist undersides is 1.957m AHD and the underside level of the headstocks is 1.832m AHD, with the tops of joists and headstocks aligning.

Certified System Quality ISO 9001 SAI GLOBAL

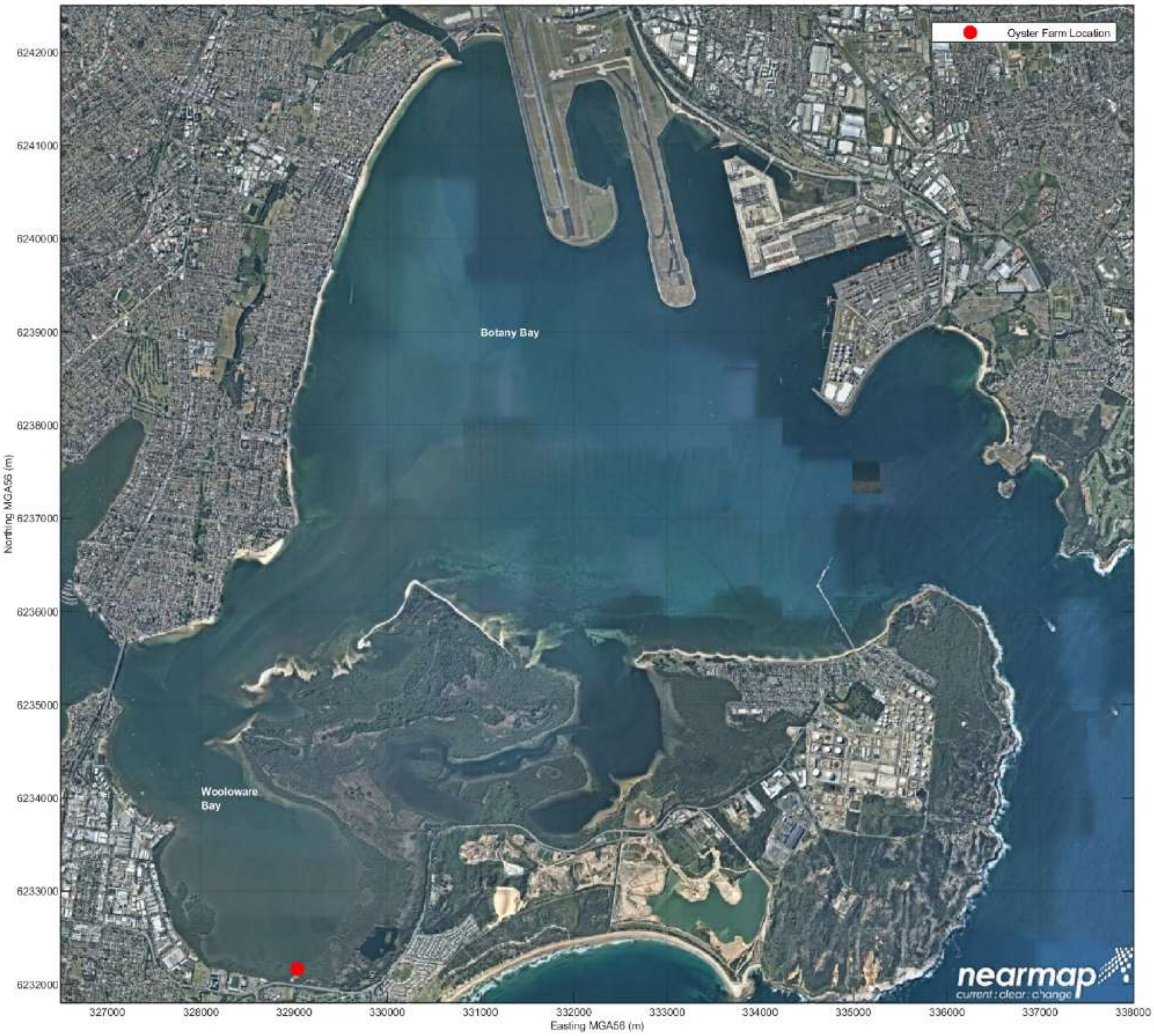


Figure 1: Map of Botany Bay and the Location of the Oyster Farm in Southern Wooloow are Bay

Methodology

Cardno has undertaken a high level, quantitative sediment transport assessment, notably in terms of the consequences of replacing the existing overwater buildings with new ones. The general methodology that was applied was:

1. ***Literature Review***. Cardno has reviewed our existing reports and studies within and near Woolooware Bay to obtain an overview of the coastal processes affecting the site;
2. ***Site Assessment.*** Cardno then developed a quantitative assessment of the impact of the proposed works on local sediment transport and whether any changes to the morphological features of the site are likely to occur as a consequence of building replacement. This assessment has been based on site specific wave and current data drawn from the investigations described in Cardno (2018).

Site Description

Apart from the oyster farm structures and recently re-built vertical seawall, there is a silty, low-tide beach that includes mangrove trees. These characteristics demonstrate that there is likely very little sediment transport within this low energy region. At high tide the water line will commonly meet the vertical walls and irregular back-beach line. The rebuilt seawall has a crest level of about 1.8m AHD and replaces a pre-existing seawall that was constructed from sandstone blocks and timber piles and planks that had suffered some damage. The central spine of the site is slightly higher at about 2.2m AHD. Sensitive items such as transformers and diesel pumps are set at levels of about 2.6m AHD.

Investigations

Cardno has undertaken previous wave, current and sediment movement type studies in southern Woolooware Bay, and additional data drawn from model systems used in those studies has been applied to this work. Those previous investigations were based on Cardno's calibrated wave and hydrodynamic model systems of Botany Bay. **Figures 2** and **3** describe the extents of those models, noting that the hydrodynamic model extends well up the Georges River in order to ensure a proper tidal prism description. More details are presented in Cardno (2018).

Figure 2 describes the SWAN wave model grid and bathymetry layouts applied to this investigation. The model set-up comprises two nested grids. The outer grid covers Botany Bay, extending from 80 m depth offshore, to Kangaroo Point in the west with a grid cell resolution of 50 m. Nested within this grid is a more refined grid of ~15 m resolution covering all of Woolooware and Kogarah Bays.

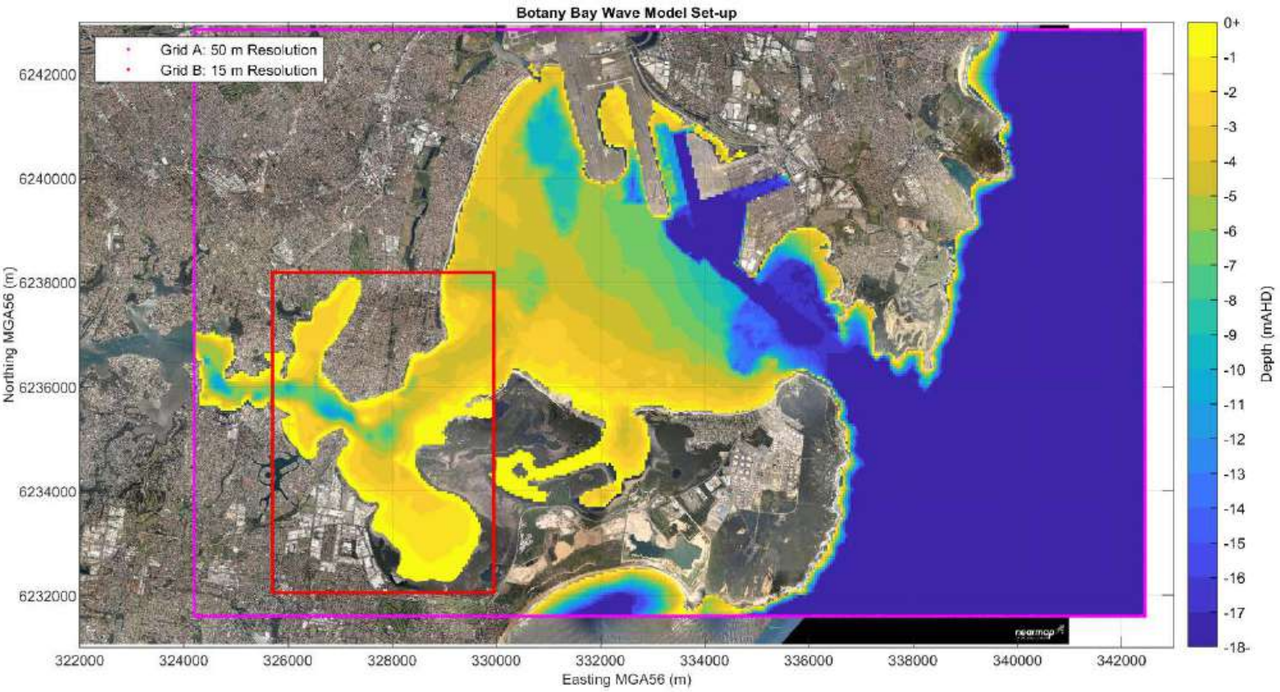


Figure 2 Botany and Wooloow are Bays Wave Model Set-up

Note that the major Botany Bay port and runway structures will only have a small effect on swell propagation to Woolooware Bay, other than the dredged shipping channels that refract wave energy that once propagated more towards Ramsgate to now propagate towards more southerly locations. These structures have negligible effect on local wind waves in Woolooware Bay. However, all structures were included in the wave modelling.

Details of the wave modelling are described in Cardno (2018). Those studies demonstrated the dominance of local sea wave energy in Woolooware Bay and at this site; whilst understanding that very long period, low height swell can disrupt oyster boat operations on rare occasions.

Figure 3 describes the hydrodynamic (water levels and currents), model grid and bathymetry applied to this study. The downstream model boundary has been set in the open sea in a depth of about 70m and defined as a water level (predicted tides) boundary. The model was previously calibrated for Port Botany Expansion investigations (Lawson and Treloar, 2003), as well as for Caltex Met-Ocean Investigations (Cardno, 2013).

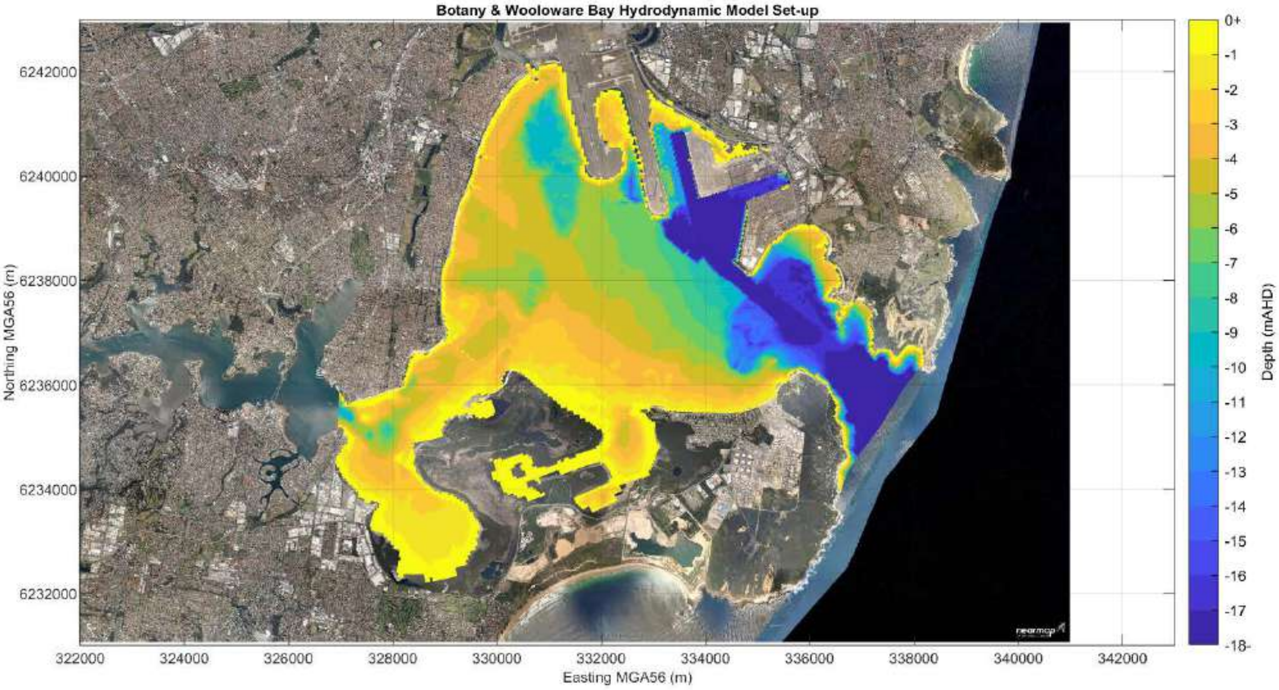


Figure 3 Botany and Wooloow are Bays Hydrodynamic Model Set-up

Two simulations were undertaken previously – each for a period of 15 days covering a full spring/neap tidal cycle. One simulation was undertaken with no wind applied to the model, only tidal fluctuations. The other simulation also simulated the same tides, but also included historical wind for the simulation period, as recorded at Sydney Airport.

The purpose of the simulations was to investigate the local wind and tidal currents, in terms of magnitude and direction. From here, an assessment could be made about whether these currents contribute to the local sediment transport regime.

Results of the simulations at the Oyster Farm site (in ≈2 m water depth at datum AHD) are presented in **Figure 4**. These results show that the depth averaged tidal currents in the region are particularly low. During the simulation period, which included a high range spring tide period, tidal currents were less than 0.12 m/s. Such low tidal currents are consistent with observations at the site, and are to be expected for a relatively wide embayment with a relatively small tidal prism.

The tidal currents generally follow the shoreline alignment for flood (incoming) and ebb (outgoing tide), with a brief period of slack water at the turning of each tide. Flood tides generally flow in a direction of 120-140°TN, and ebb tides around 310-320°TN – essentially coast parallel (noting that the convention is that current directions refer to the direction towards which the current flows).

The simulation that included winds demonstrates that periods of prolonged energetic wind activity affect the local nearshore current structure. The period from 27/7 to 02/8 experienced moderate southerly to westerly winds in the range of 5-10 m/s that persisted for several days. During this period current speeds reached a maximum of around 0.14 m/s, and peak current speeds generally exceeded those of the "no wind" simulation.

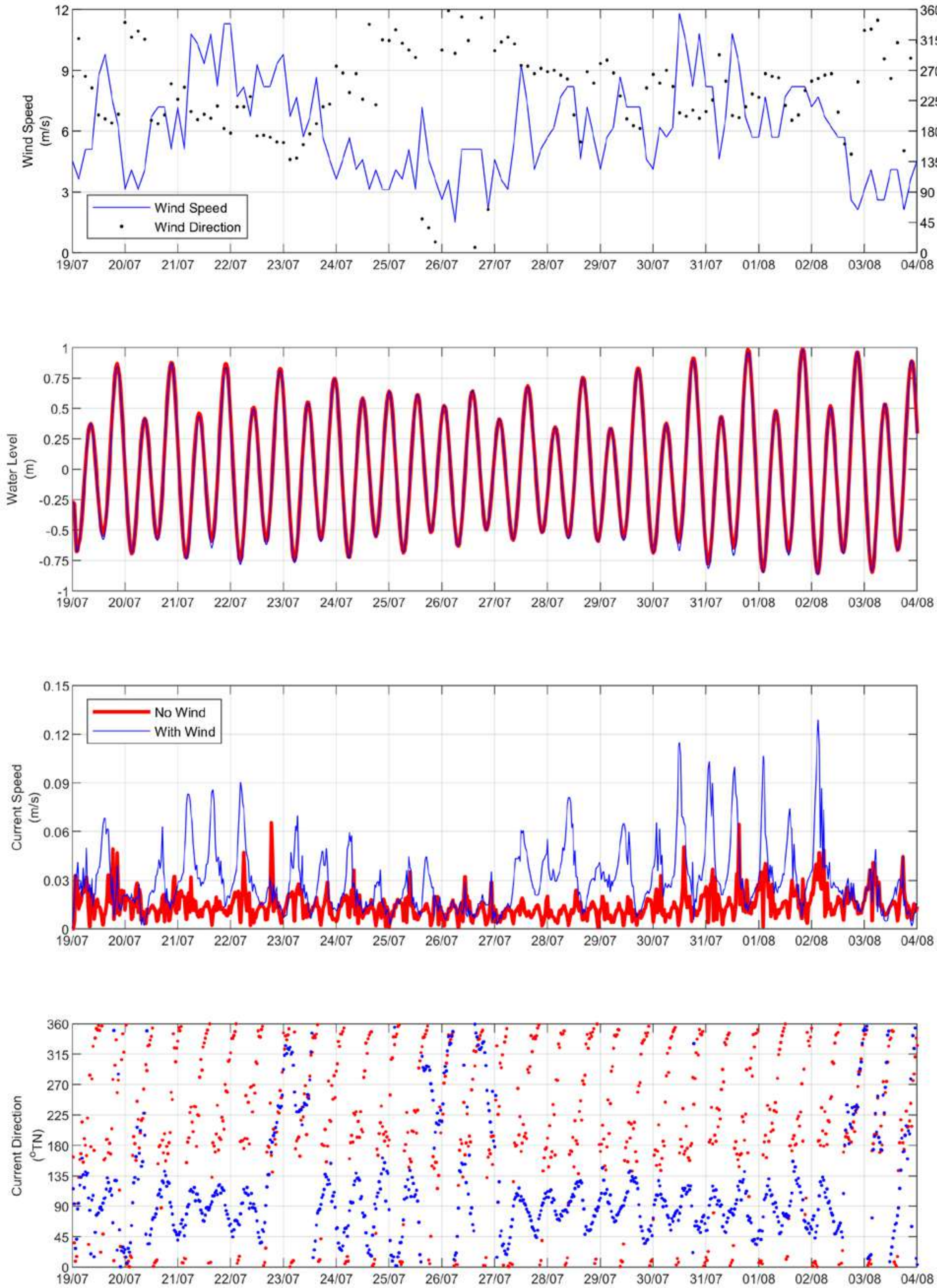


Figure 4: Results of Delft3D Hydrodynamic Simulations near the Oyster Farm

Local Morphological Processes

The purpose of this section is to interpret and analyse the results of the numerical modelling in order to define the local sediment transport mechanisms at the site, and subsequently assess the effect of the rehabilitated overwater buildings.

Wave Driven Sediment Transport

Given the shallow depths within Woolooware Bay (see **Figure 2**), very nearshore wave heights will be governed by depth limited wave breaking during periods of higher waves; also depending upon tidal level, which shifts the still water line significantly because of the flat seabed slopes. An assessment of the local wave energy at the site has been made through the development of a single wave height parameter (H_{se}) that encompasses the probabilities of occurrence of all wave height conditions; and can then be used to make a basic estimate of longshore/seabed sediment transport potential. This parameter is termed the effective wave height (H_e) and is based on the common case that the frequency of wave height occurrence can be described reasonably well by the log-normal distribution.

H_e is the significant wave-height which must incorporate the description of long-term wave occurrence near the shoreline. At a nearshore location the log-normal probability of exceedance distribution describing wave climate at the Oyster Farm was prepared for both local sea and swell waves. H_e was then calculated from:

$$H_{se}^2 = \int Hs^2 p(H)\, dH$$

where *p(H)* is the log normal distribution, with the result that

$$H_e = H_{50} e^{\delta^{sy}}$$

where H_{50} is the median wave-height defined by the log normal distribution = $(H_{10} \times H_{90})^{1/2}$
$y = ln(H)$
σ^{sy} = standard deviation of $y = 1/2.563\ ln\ (H_{10}/H_{90})$

Using this analysis method, the effective wave height at the Oyster Farm was assessed to be H_e = 0.12m, indicating that the site is a particularly low wave energy location. An approximation of the *potential* rate of longshore sediment transport at the site has been calculated using the LITPACK Coastal Processes modelling system developed by DHI. The rate is expressed in terms of cubic metres per metre per year along the seabed. LITPACK includes the Shield's sediment movement threshold and because the effective wave conditions are so low there is nominally zero wave caused sediment transport at the Oyster Farm – noting that even very small waves can cause sediment disturbance at the still water line.

This assessment indicated that the seabed sediment transport rate beneath the overwater buildings is ≈ 80 to 250 m^3 per year. However, this number should be approached with caution, as it assumes an infinite supply of sediment and an infinitely long beach with a sand profile that extends out past the closure depth. In reality the supply of sediment at the site appears to be much lower, as evidenced by the prevalence of mangroves near the study area foreshore. Hence, it is necessary to distinguish between the *potential* rate of sediment transport, (resulting from the above calculation) and the *actual* rate (the amount of sediment available to move along the shoreline).

The actual rate of sediment transport is likely to be lower, probably closer to zero, given the presence of mangrove trees.

Cardno have been advised (Doyle (TfNSW) – Cardno), that the proposed overwater buildings are to have a design life of 50 years, to about 2075. Hence sea level rise must be considered in building design. Typically, 100-years average recurrence interval (ARI) design conditions are to be considered.

A design underside floor level has been developed as follows:

- Severe ECL lying offshore and to the north, causing onshore ENE sector winds and waves; similar to June 2016 and May 1974
- 100-years ARI storm tide level at Fort Denison is 1.44m AHD (Watson and Lord, 2010)
- Increase in storm tide level in Woolooware Bay from Fort Denison is 0.2m – previous Cardno coastal engineering investigations for western Towra area
- SLR of 0.35m

- 100-years ARI wind wave at this site Hs=0.4m, crest height of Hmax=0.4m

This leads to a design structural water level of 2.4m AHD at 2075 for zero wave uplift.

The underside deck levels have been specified to be 2.2m AHD and the decks must be designed to accommodate a wave uplift of 3kPa. The effect on local sediment transport caused by this inter-action is very low. These uplift loads need to be transferred to the piles, but would cause no change to the current design, other than increased fixings from the flooring to the joists and the need to confirm pile capacity.

Note that these design parameters would not occur until 2075, and then only if the 100-years ARI storm tide and wave conditions occurred at that time. A concurrent horizontal wave load of 0.5kPa on east-west 'bearers or beams' should be included, as well as wind loading.

This design option will cause no identifiable change in the local sediment transport processes.

It is noted that the recently completed seawall works would be overtopped by the storm tide and wave action in the 2070-75 100-years storm tide and wave conditions.

Current Driven Sediment Transport

Van Rijn (1993) discusses the critical depth averaged velocity for initiation of sediment suspension under currents. Given the local sediment characteristics within Botany Bay and Woolooware Bay, which generally comprise medium grained marine sands of D_{50} 200 to 350µm, the Van Rijn formulae predict that the critical depth averaged velocity for sediment suspension is around 0.3 to 0.5m/s.

The current modelling results show that depth averaged tidal currents are generally of the order of ~0.1 m/s during spring tide periods. Consequently, it is unlikely that the day-to-day tidal currents affect the local sediment transport regime in any significant way. It is possible that under high wind conditions, wind driven currents may approach the critical depth averaged velocity for suspension. However, these events are likely to be infrequent, and would only have minimal impact compared to the day-to-day impact of local sea waves. However, in windy conditions, even low speed currents can transport sediment re-suspended by waves.

The proposed rebuilt overwater structures will not affect current flows any more than the existing supporting piles do.

Hence there will be no changes to tidal/wind driven current sediment processes.

Summary

Based on the investigations described above, the proposed overwater buildings will not cause any changes to the existing sediment transport environment, including where waves can reflect from the northern end of the new sheet piled wall because that structure replaces one of similar wave reflectivity.

Qualifications

Cardno has assessed potential long term changes to sediment processes as a result of the proposed works. No identifiable changes in coastal processes are expected.

Design wave uplift loads on the floors of the three new buildings and inter-connecting walkways have been estimated.

Gangway and pontoon wave loads have not been assessed.

We have not assessed construction phase effects such as potential generation of sediment plumes that might be caused by pile driving, for example. However, based on similar case investigations by Cardno – Botany Bay Kamay ferry terminals EIS input and Boat House Palm Beach DA based analyses, those effects will be very minor.

Yours faithfully,

D. H. Treloar

Doug Treloar
Senior Principal Coastal Engineering
for Cardno
Direct Line: +61 2 9496 7823
Email: Doug.Treloar@cardno.com.au

References

Alison Hunt & Associates (2021): Oyster Farm Overwater Structures.

Cardno (2018): Coastal Processes Investigations. Removal of Four Barges in West Woolooware Bay. Report R001 (59918195) prepared for Roads and Maritime Services.

Lawson and Treloar (2003): Proposed Expansion of Container Port Facilities in Botany Bay, NSW. Coastal Process and Water Resources Issues. Vol. 3: Waves, Currents and Coastal Process Investigations. Report prepared for Sydney Ports Corporation – Report J2076/R1999/Vol 3.

Rijn, L.C. van, Walstra, D.J.R. and Van Ormondt, M. (2004) Description of TRANSPOR2004 and Implementation in Delft3D. WL | Delft Hydraulics, report Z3748.00.

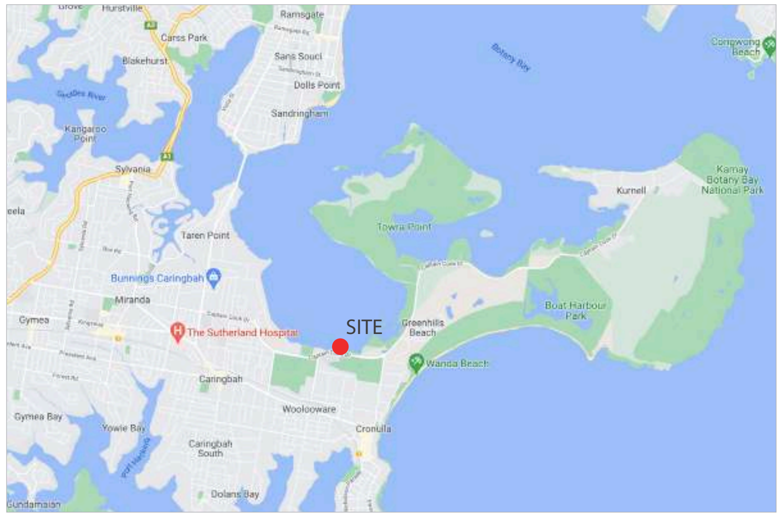
Watson, P and Lord, D (2010): Coastal Risk Management Guide (NSW).

Annexure A

Site Photographs

WOOLOOWARE BAY OYSTER FARM
LOT 2, CAPTAIN COOK DRIVE, WOOLOOWARE BAY NSW 2230
LANDSCAPE VISUALISATION STUDY

DRAWING LIST



LOCATION PLAN

EXISTING IMAGE - WOOLOOWARE BAY OYSTER FARM

DRAFT ONLY

Woolooware Bay Oyster Farm

COVER PAGE & LOCATION PLAN

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-1

REV -

CLIENT Transport NSW

ENGINEER Tonkin

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Image 1:
Existing birdseye view image of the existing Woolooware Bay Oyster Farm from the mangrove habitat area to the East. The image shows the close proximity of the site to the new Woolooware Bay development to the West.

The site contains the newly constructed hardstand area that will be used as the site for the onland structures and connection to the overwater structures. The site also contains the existing oyster farm buildings proposed for removal.

Image 2:
A visualisation of the proposed layout for the new Woolooware Bay Oyster Farm.

The visualisation contains the proposed onland structures and overwater structures that will allow for commercial oyster farming within Woolooware Bay on a day to day basis.

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-2

REV -

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DRAFT ONLY

Image 1:
Existing birdseye view image of the existing Woolooware Bay Oyster Farm from the southern boundary that runs parralell to Captain Cook Drive. The image captures the view looking north to the city from the proposed site.

The site contains the newly constructed hardstand area that will be used as the site for the onland structures and connection to the overwater structures. The site also contains the existing oyster farm buildings proposed for removal.

Image 2:
A visualisation of the proposed layout for the new Woolooware Bay Oyster Farm.

The visualisation contains the proposed onland structures and overwater structures that will allow for commercial oyster farming within Woolooware Bay on a day to day basis.

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021			DWG NO LA-3	REV -	CLIENT Transport NSW
Rev	Description	Date	Tel. 02 9452 4911	admin@	ENGINEER Tonkin
A	For Information	21.09.2021	mob. 0419 501 681	pdsdesign.com.	

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Image 1:
An existing image of the current overwater structures that form the Woolooware Bay Oyster Farm. The image represents the visual impact of the existing structures from water level in Woolooware Bay.

The image contains several run down structures partially hidden by a line of large mangrove trees.

Image 2:
A visualisation of the proposed overwater structures for the new Woolooware Bay Oyster Farm from Woolooware Bay.

The visualisation captures the visual impact the proposed structures will have from an eye level water view within Woolooware Bay.

DRAFT ONLY

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-4

REV -

CLIENT Transport NSW

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Image 1:
An existing image of the current overwater structures that form the Woolooware Bay Oyster Farm. The image represents the visual impact of the existing structures from water level in Woolooware Bay.

The image contains several run down structures partially hidden by a line of large mangrove trees.

Image 2:
A visualisation of the proposed overwater structures for the new Woolooware Bay Oyster Farm from Woolooware Bay.

The visualisation captures the visual impact the proposed structures will have from an eye level water view within Woolooware Bay.

DRAFT ONLY

Woolooware Bay Oyster Farm

3D Visualisation Study - Existing & Proposed Works

DATE 21.09.2021

Rev	Description	Date
A	For Information	21.09.2021

DWG NO LA-5

REV -

CLIENT Transport NSW

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Annexure B

Preliminary Drawings of Overwater Structures

LEVEL SCHEDULE (AHD)				
ELEMENT	TOP OF FLOOR LEVEL	UNDERSIDE OF FLOOR LEVEL	UNDERSIDE OF JOIST LEVEL	UNDERSIDE OF HEADSTOCK LEVEL
BUILDING 1	2.25	2.207	1.957	1.832
BUILDING 2	2.25	2.207	1.957	1.832
BUILDING 3	2.25	2.207	1.957	1.832
WALKWAY 1	2.245	2.207	1.957	1.957
WALKWAY 2	2.245	2.207	1.957	1.832
WALKWAY 3	2.245	2.207	1.957	1.832

THIS DRAWING IS TO BE VIEWED IN COLOUR AS SOME FEATURES / SYMBOLS ARE DIFFERENTIATED BY COLOUR. DRAWING NOT TO BE RELIED ON IF PRINTED IN GREYSCALE.

SCALE 1 : 200

OVERWATER STRUCTURE SITE PLAN

REFER TO DWG. No.'s S0010, S0011 & S0012 FOR CONSTRUCTION NOTES.
REFER TO DWG. No. S1010 FOR MEMBER SCHEDULE.

SHEET SIZE A1

100mm ON ORIGINAL DRAWING - DO NOT SCALE DRAWING

REV	AMENDMENT / REASON FOR ISSUE	DATE	DES.	DWN.
1	TOP AND UNDERSIDE OF FLOOR LEVELS ADDED	24.03.22	MB	LH
0	TENDER ISSUE	13.12.21	MB	LH
B	70% ISSUE	11.11.21	MB	LH
A	PRELIMINARY ISSUE	01.11.21	MB	LH

COORDS : MGA94 ZONE MGA-56 (GDA94)
DATUM : All Levels to AHD

SCALE : 1 : 200

SURVEYED: C.M.S. SURVEYORS
SURVEY DATE: 05.08.21

APPROVED / PROJECT LEADER
M. Baker

NOT FOR CONSTRUCTION

tonkin
tonkin.com.au

TRANSPORT FOR NSW

WOOLOOWARE BAY OYSTER LEASE
OVERWATER STRUCTURES

OVERWATER STRUCTURE SITE PLAN

PROJECT NUMBER	SHEET NUMBER	REVISION
202079	S1000	1

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BIM 360://202079_Woolooware Bay/202079 Woolooware Bay R21.rvt 24/03/2022 1:14:41 PM

WOOLOOWARE BAY OYSTER LEASE

OVERWATER STRUCTURES - BUILDING DESIGN
CONSTRUCTION CERTIFICATE

Landscape Drawing List

Drawing No.	Title
LA-000	COVER SHEET AND REFERENCE PLAN
LA-100	OVERWATER STRUCTURES SITE PLAN
LA-101	OVERWATER BUILDING 1 FLOOR PLAN
LA-102	OVERWATER BUILDING 1 ELEVATIONS
LA-103	OVERWATER BUILDING 1 ROOF & LIGHTING PLAN
LA-104	OVERWATER BUILDING 2 FLOOR PLAN
LA-105	OVERWATER BUILDING 2 ELEVATIONS
LA-106	OVERWATER BUILDING 2 ROOF & LIGHTING PLAN
LA-107	OVERWATER BUILDING 3 FLOOR PLAN
LA-108	OVERWATER BUILDING 3 ELEVATIONS
LA-109	OVERWATER BUILDING 3 ROOF PLAN
LA-110	OVERWATER BUILDING 3 LIGHTING PLAN
LA-111	OVERWATER BUILDING AMENITIES DETAILS
LA-112	OVERWATER BUILDING AMENITIES DETAILS
LA-113	OVERWATER BUILDING KITCHENETTE DETAILS

Site location Plan

NOTE: Landscape Plans must be read in conjunction with Tonkin's drawing package

NOTE: Plans are designed to be read and printed in colour

REFERENCE PLAN
Not To Scale

Paterson Design Studio
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Use figured dimensions only. All dimensions to be verified on site before commencing work. All dimensions are in mm unless otherwise stated. The drawings are to be read in conjunction with the specification and any other written instructions issued.
Any discrepancies shall be referred to the Superintendent for a written decision prior to ordering/ supply/ installation/ construction.

ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

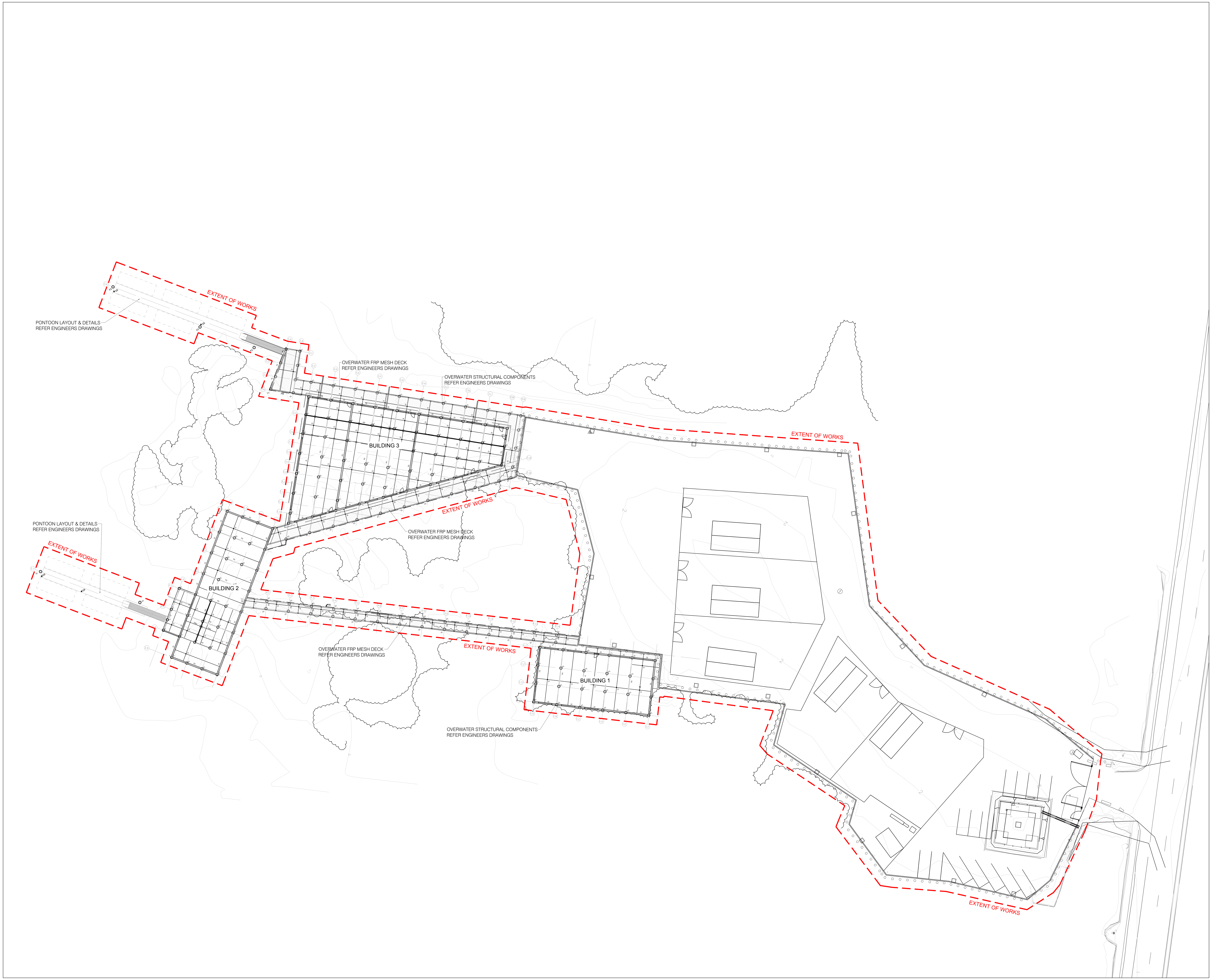
COVER SHEET AND
REFERENCE PLAN

DESIGNED:	DRAWN: DC	CHECK: DC

ISSUE	DATE:
CC ISSUE	06.12.21

SCALE

DRAWING NO.	REVISION
LA-000	-



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ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

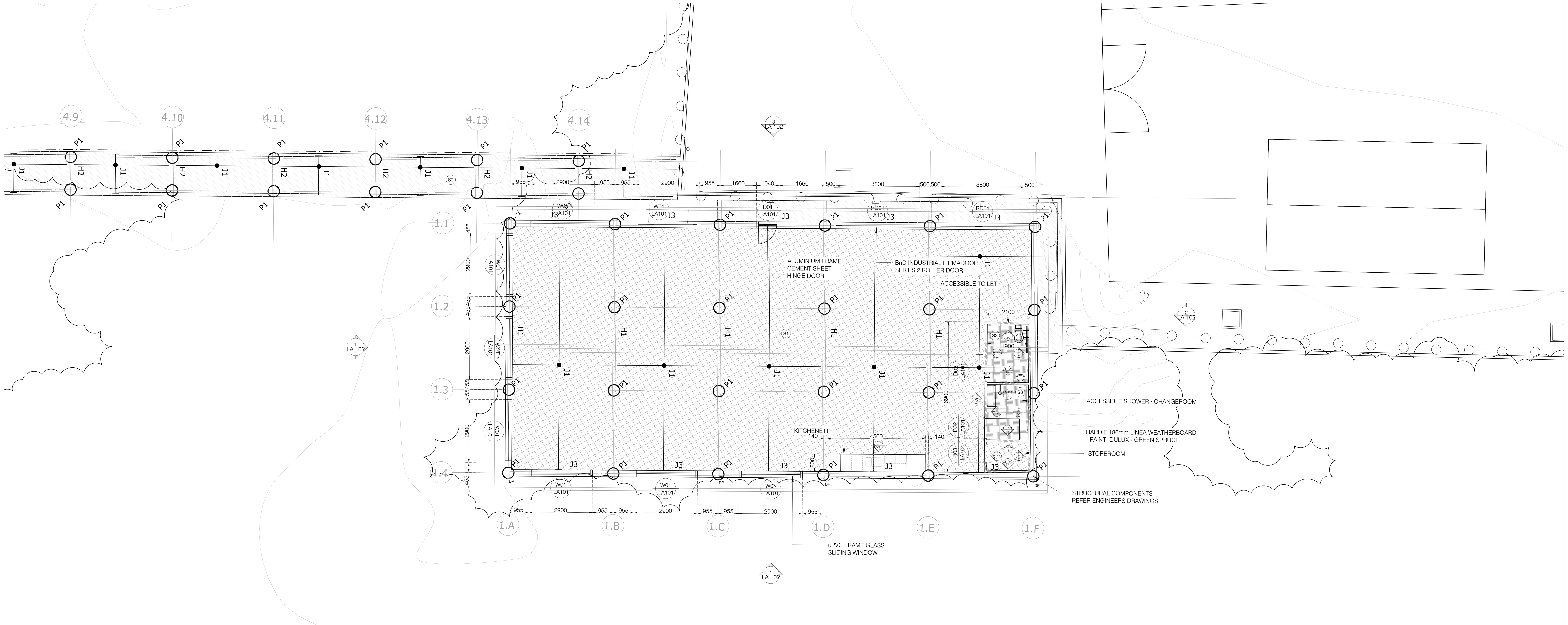
OYSTER LEASE SITE PLAN

DESIGNED:	DRAWN: DC	CHECK: DC

ISSUE	DATE:
CC ISSUE	06.12.21

SCALE

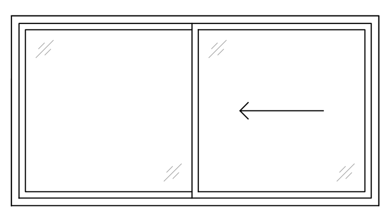
DRAWING NO.	REVISION
LA-100	-



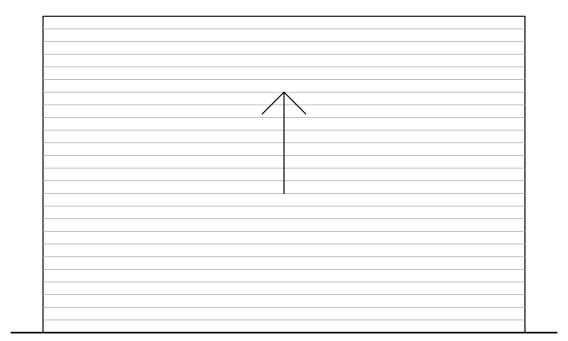
OVERWATER STRUCTURE - BUILDING 1 FLOOR PLAN

1:100

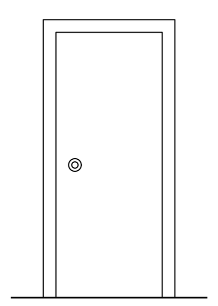
Overwater Structure - Building 1 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass sliding window	2900mm x 1500mm	900mm	2400mm	N/A	8
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3800mm	N/A	2600mm	N/A	2
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



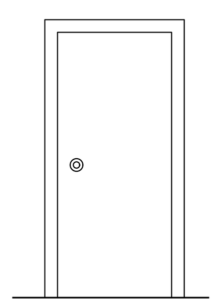
W01 Elevation
Scale: 1:20



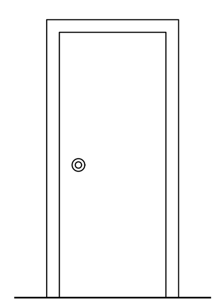
RD01 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
Scale: 1:20



D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 1 - DOOR & WINDOW SCHEDULE

1:100

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ENGINEER

tonkin

LEGEND

P1	STRUCTURAL PILONS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
H1	STRUCTURAL HEADSTOCKS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J1	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J2	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J3	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J4	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J5	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S1	38mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S3	FLOORING: POLYSAFE QUATTRO PUR FLOORING MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE INSTALL AS PER MANUFACTURER DETAILS
	STRUCTURAL WALL SYSTEM REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING ENGINEER: TONKIN ENGINEERS
	INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM REFER SPEC FOR INTERNAL CLADDING ENGINEER: TONKIN ENGINEERS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 1 FLOOR PLAN

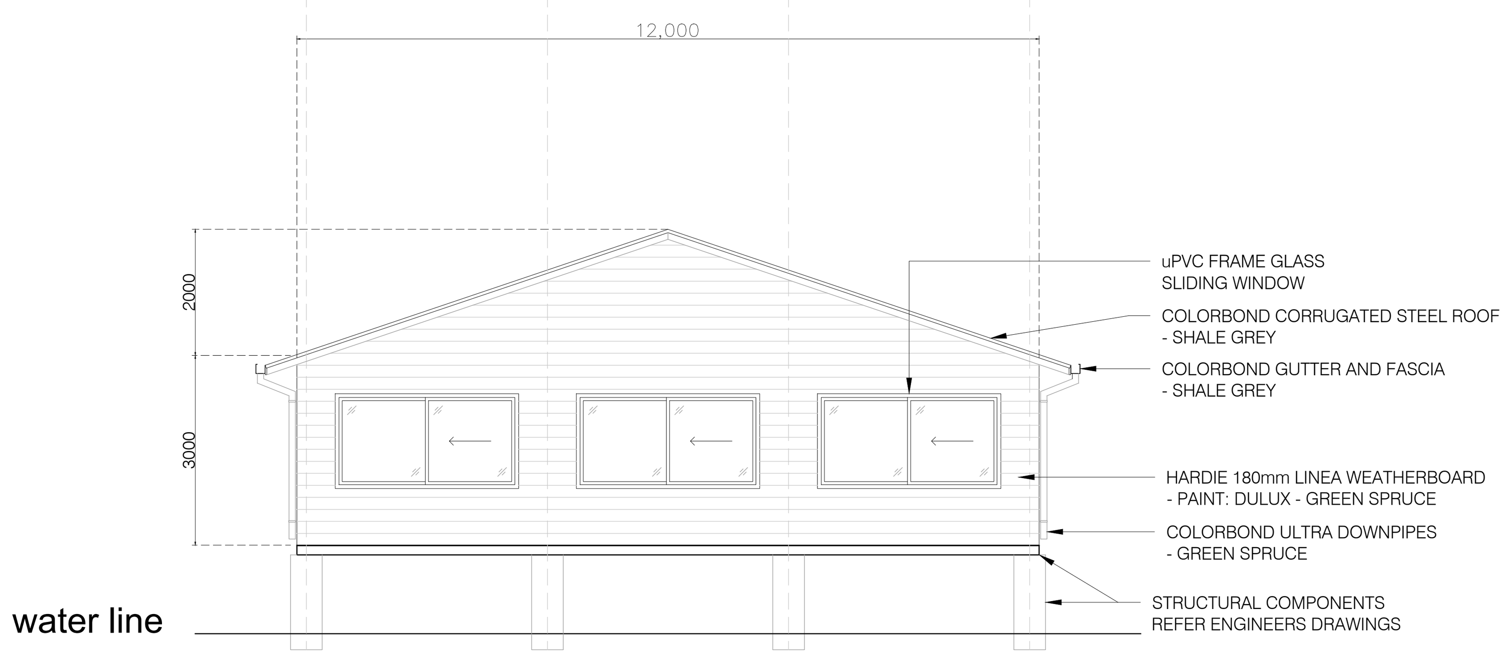
DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

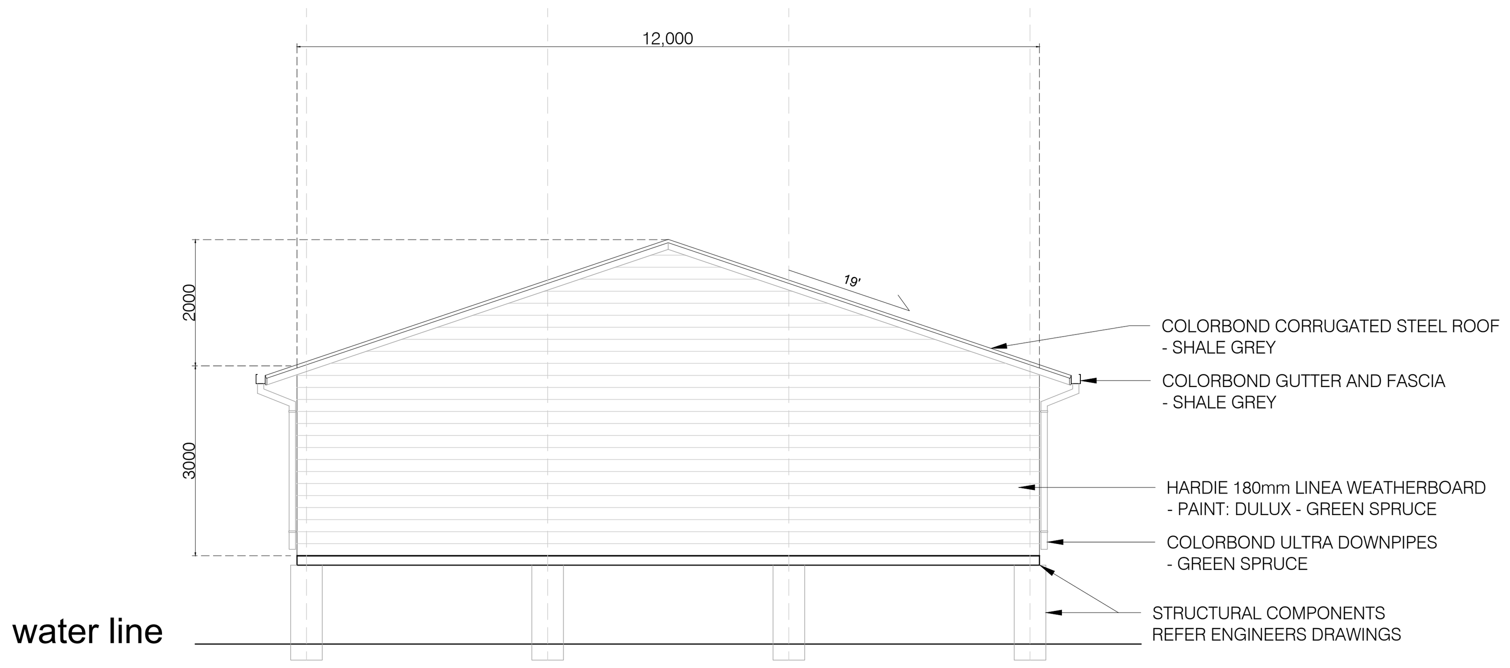
SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

N

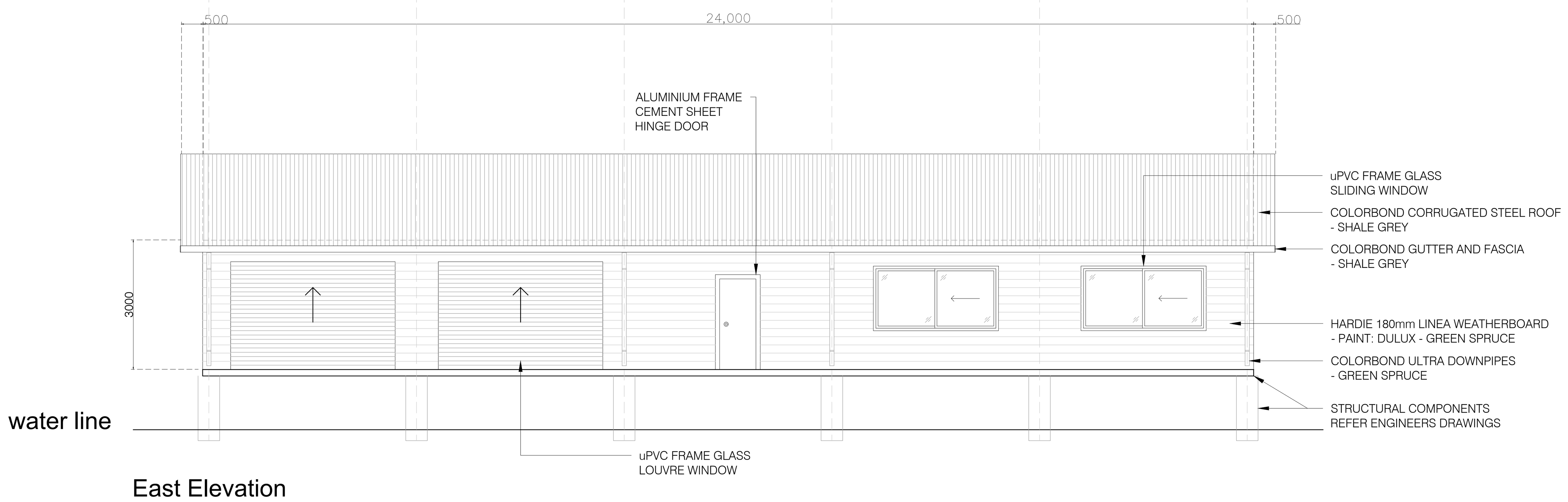
DRAWING NO. LA-101
REVISION -



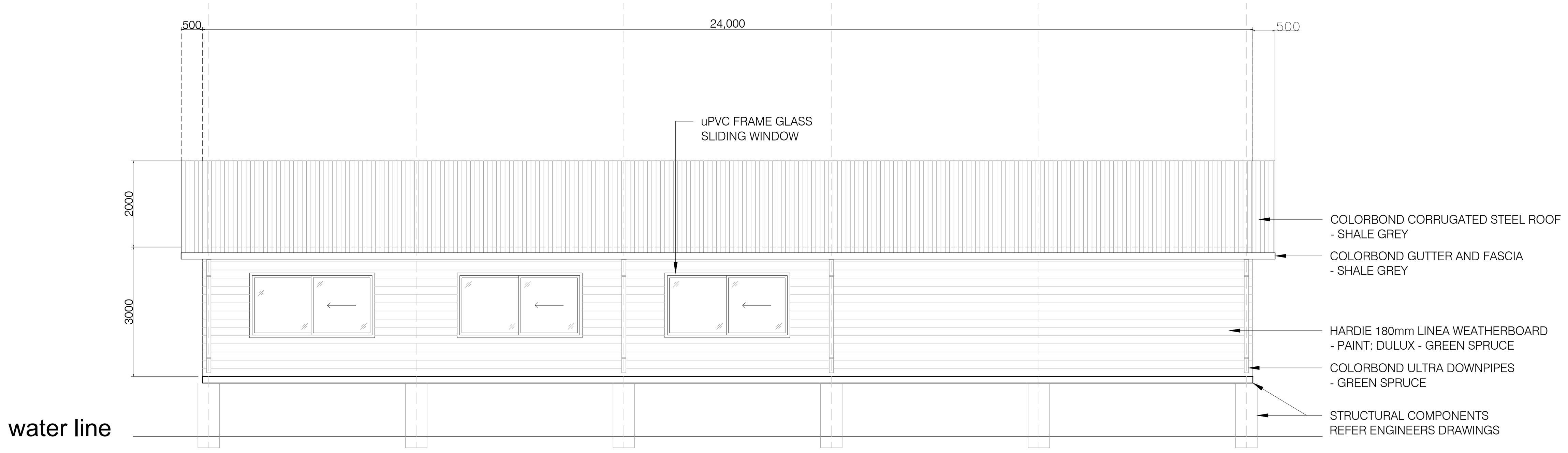
North Elevation



South Elevation



East Elevation



West Elevation

OVERWATER STRUCTURE - BUILDING 1 ELEVATIONS

1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated
Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 1 ELEVATIONS

DESIGNED: | DRAWN: DC | CHECK: DC

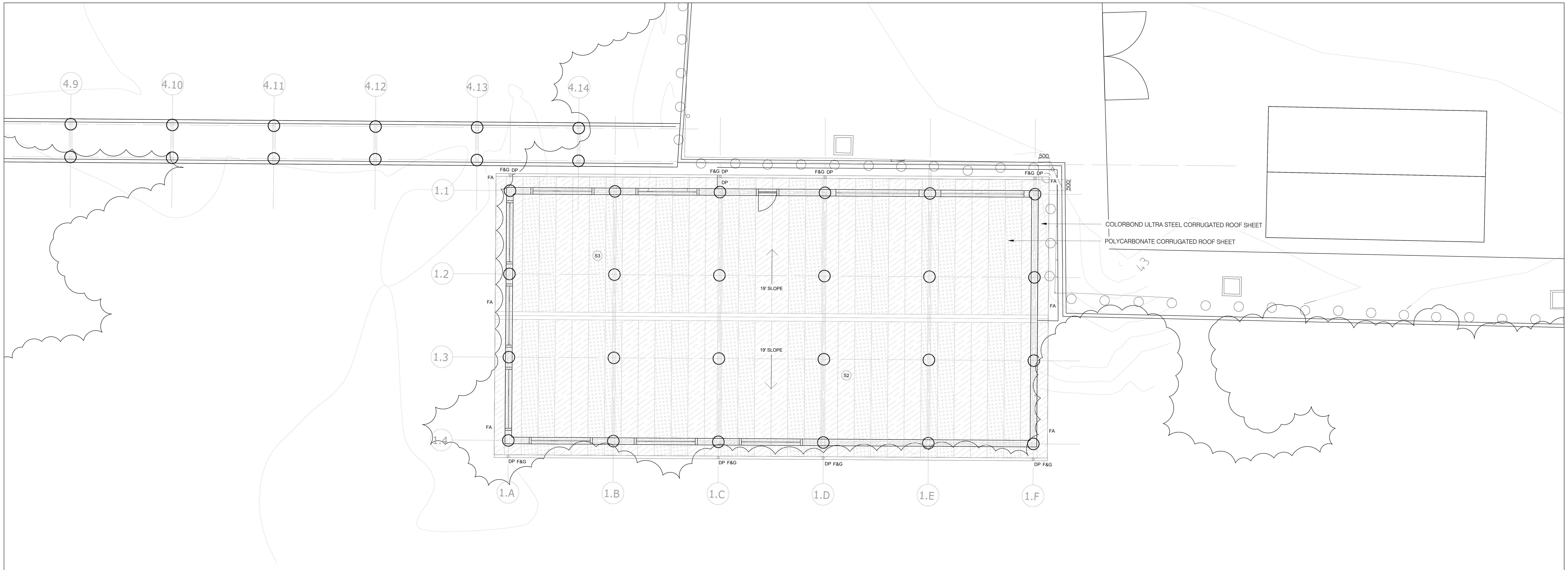
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE

1:100 @ A1 1:200 @ A3

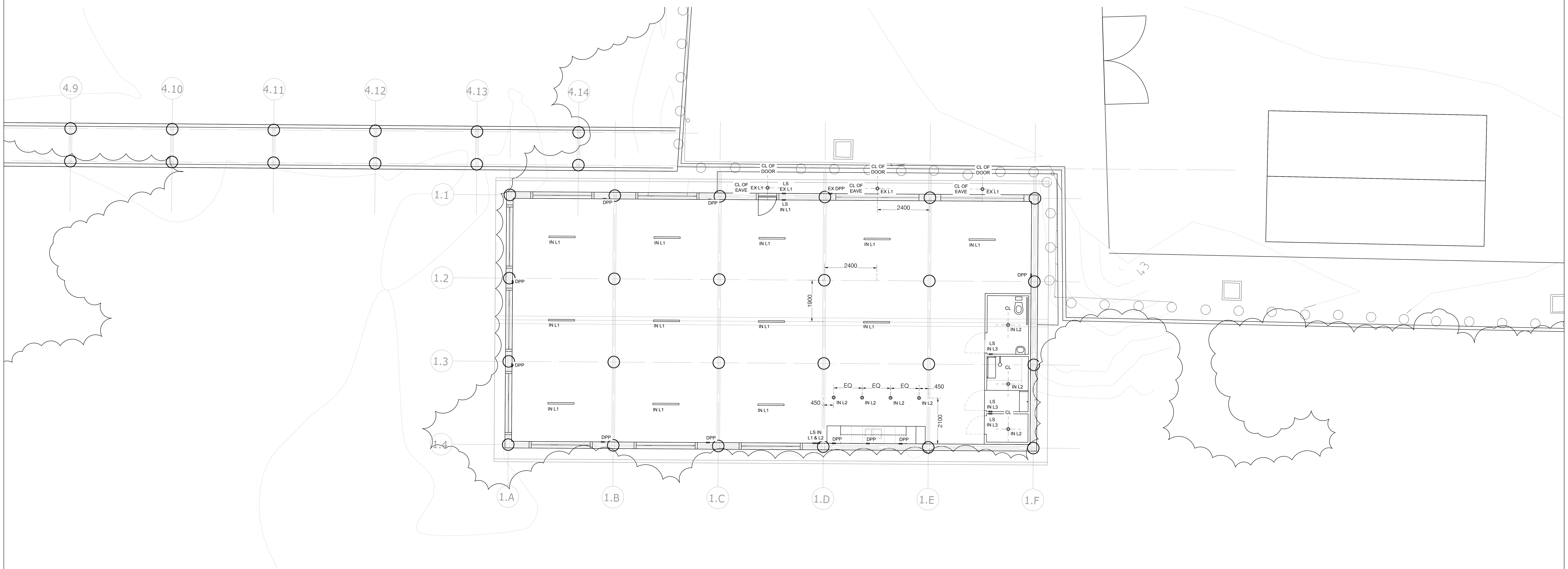
0 1 2 3 4 5[m]

DRAWING NO.: LA-102 | REVISION: -



OVERWATER STRUCTURE - BUILDING 1 ROOF PLAN

1:100



OVERWATER STRUCTURE - BUILDING 1 LIGHTING PLAN

1:100

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ENGINEER

tonkin

LEGEND

S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 1 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

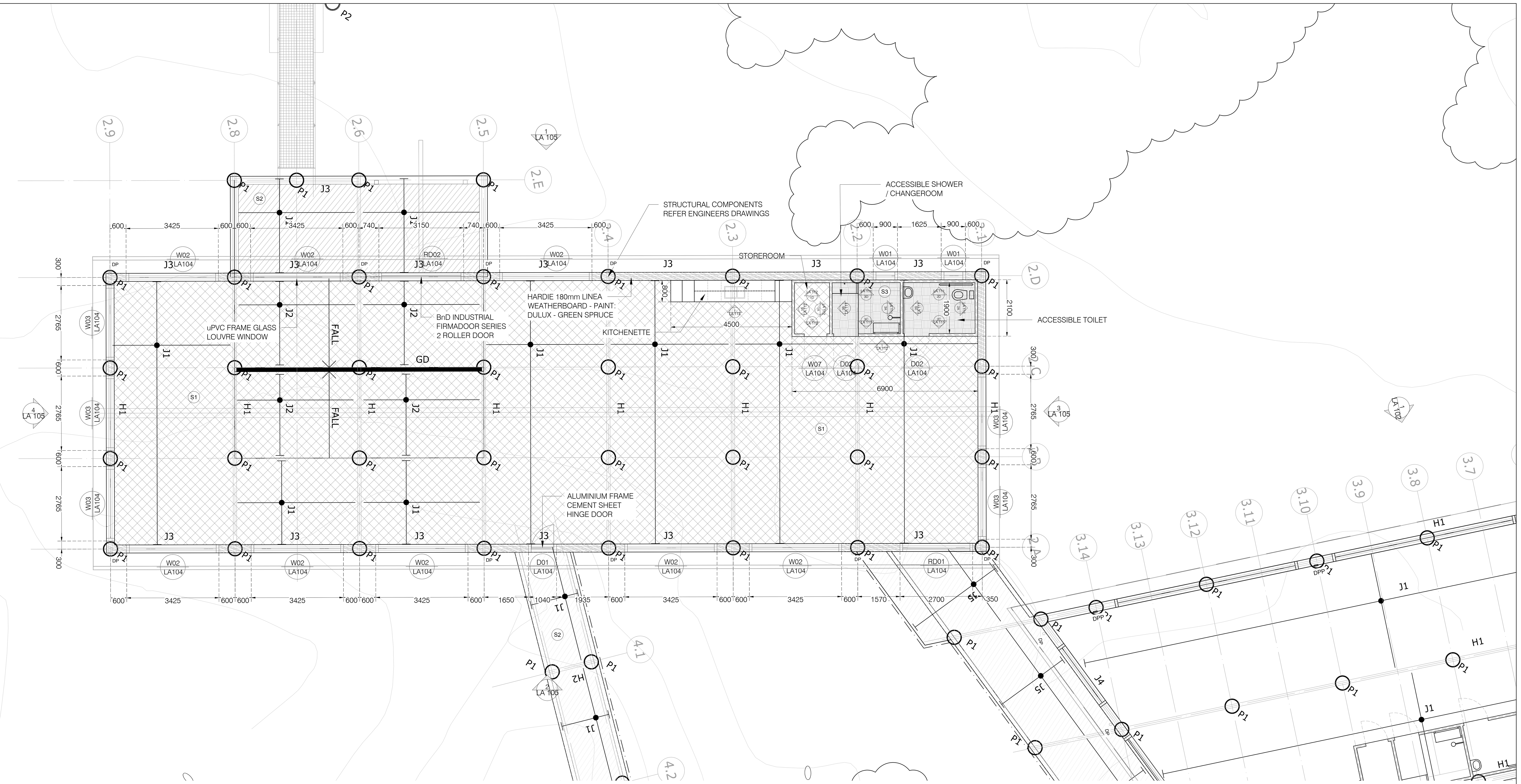
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

0 1 2 3 4 5[m]

N

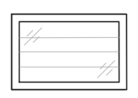
DRAWING NO. LA-103 | REVISION -



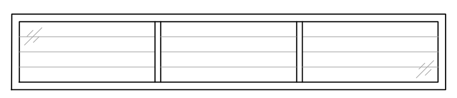
OVERWATER STRUCTURE - BUILDING 2

1:100

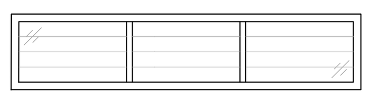
Overwater Structure - Building 2 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass louvre window	600mm x 900mm	1900mm	2500mm	N/A	2
W 02	uPVC Frame glass louvre window	900mm x 3430mm	1900mm	2500mm	N/A	8
W 03	uPVC Frame glass louvre window	900mm x 2770mm	1900mm	2500mm	N/A	5
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 2700mm	N/A	2500mm	N/A	1
RD 02	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3150mm	N/A	2500mm	N/A	1
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



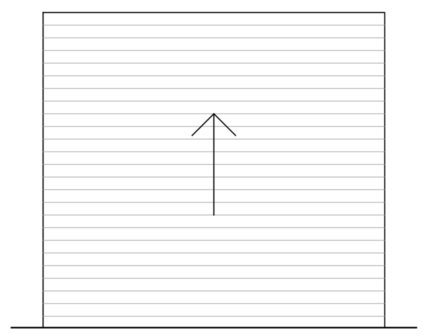
W01 Elevation
Scale: 1:20



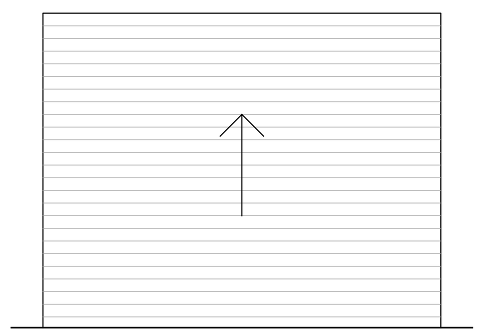
W02 Elevation
Scale: 1:20



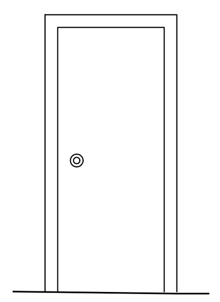
W03 Elevation
Scale: 1:20



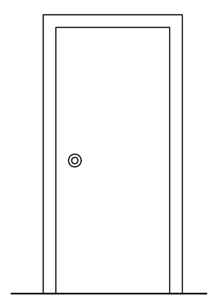
RD01 Elevation
Scale: 1:20



RD02 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
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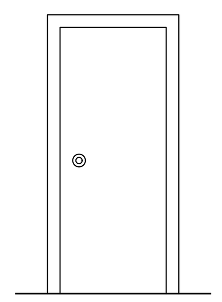

D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 2 - DOOR & WINDOW SCHEDULE

1:100

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ENGINEER

tonkin

LEGEND

Symbol	Description
P1	STRUCTURAL PILONS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
H1	STRUCTURAL HEADSTOCKS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J1	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J2	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J3	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J4	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J5	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S1	38mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S3	FLOORING: POLYSAFE QUATTRO PUR FLOORING MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE INSTALL AS PER MANUFACTURER DETAILS
	STRUCTURAL WALL SYSTEM REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING ENGINEER: TONKIN ENGINEERS
	INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM REFER SPEC FOR INTERNAL CLADDING ENGINEER: TONKIN ENGINEERS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 2 FLOOR PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

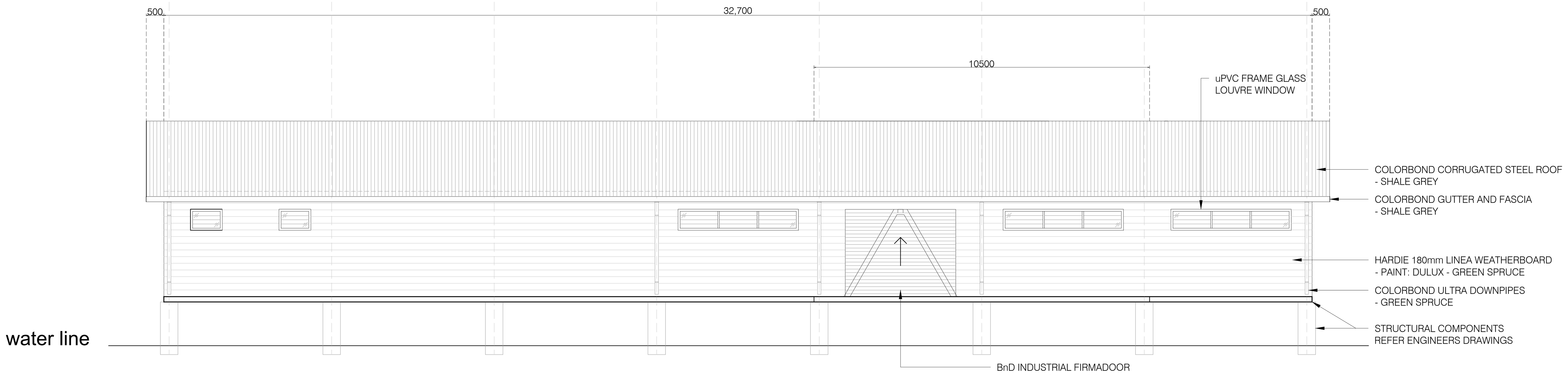
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

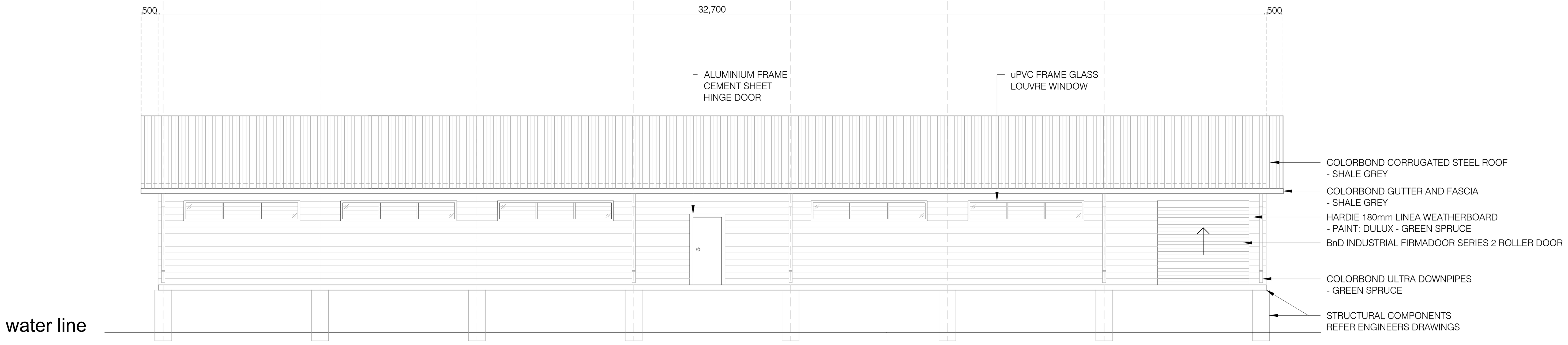
0 1 2 3 4 5[m]

N

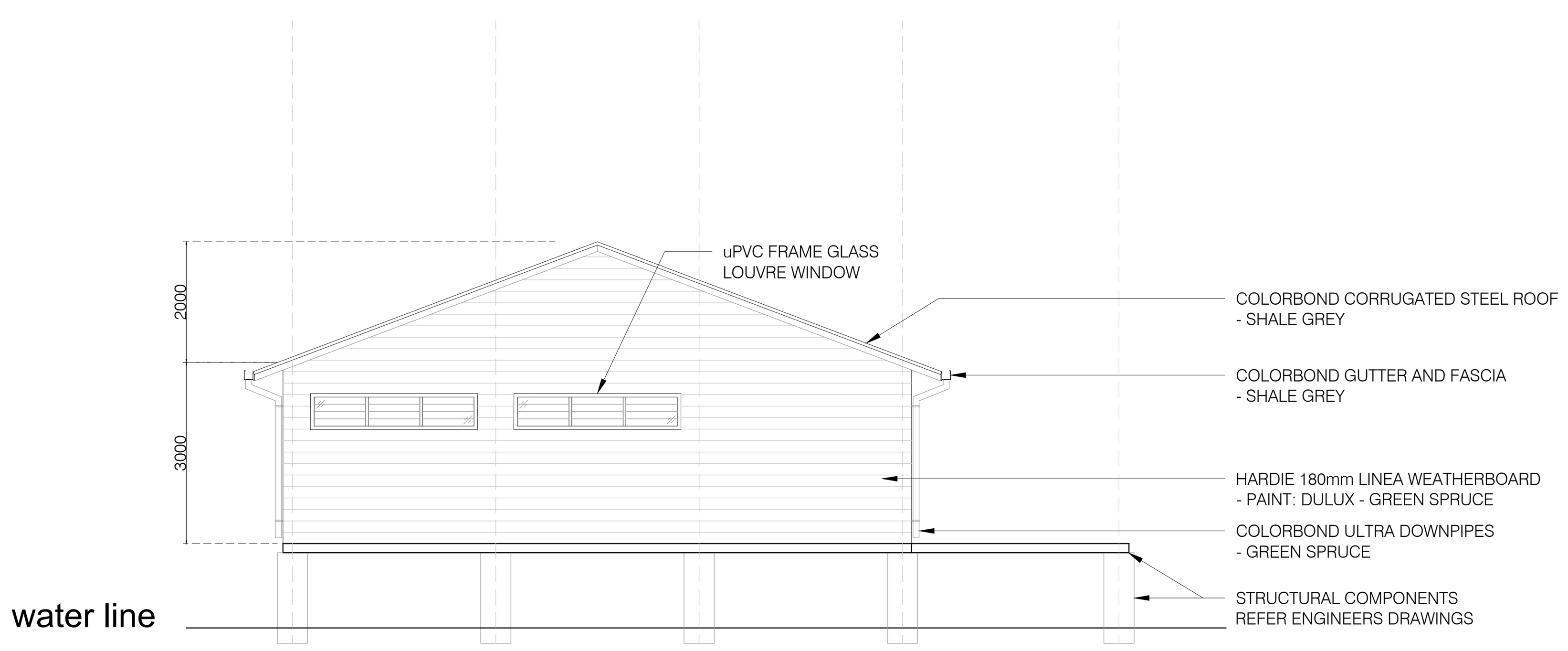
DRAWING NO. LA-104 | REVISION -



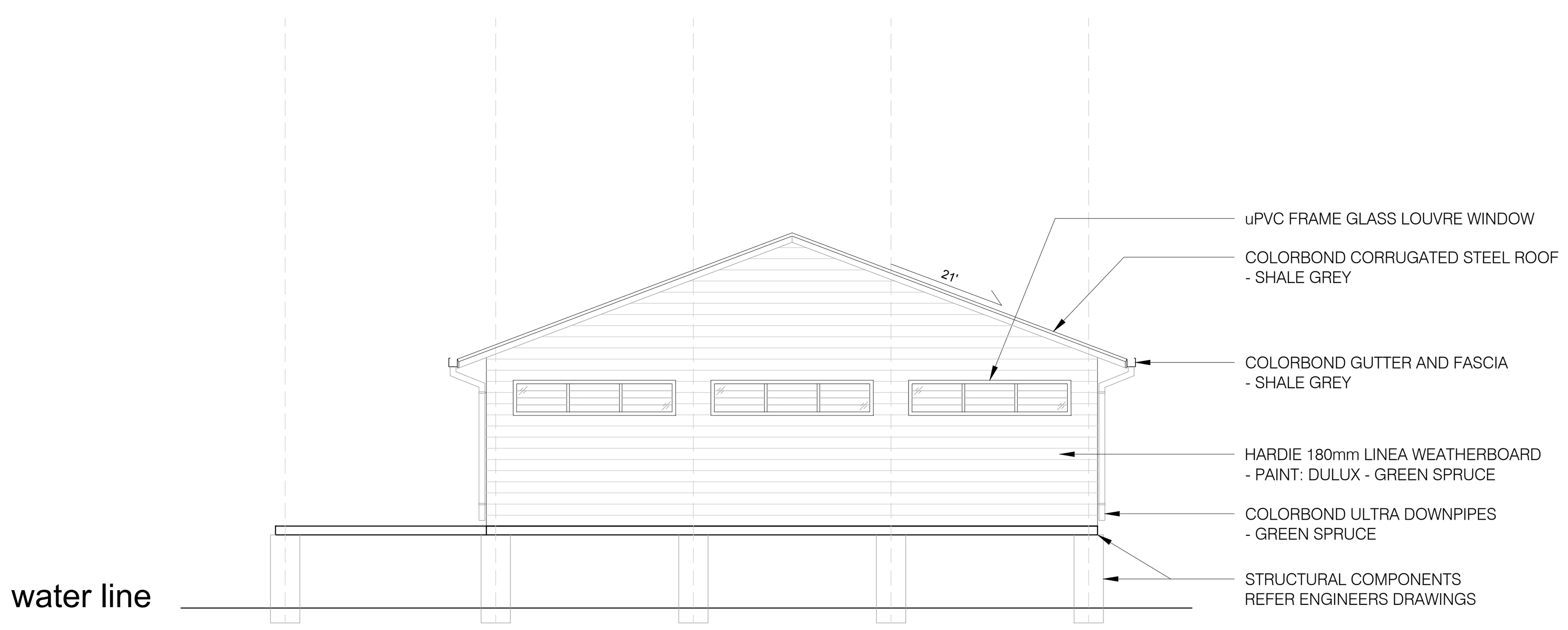
North Elevation



South Elevation



East Elevation



West Elevation

OVERWATER STRUCTURE - BUILDING 2 ELEVATIONS
1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

Paterson Design Studio
Landscape Architects / Urban Designers
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ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

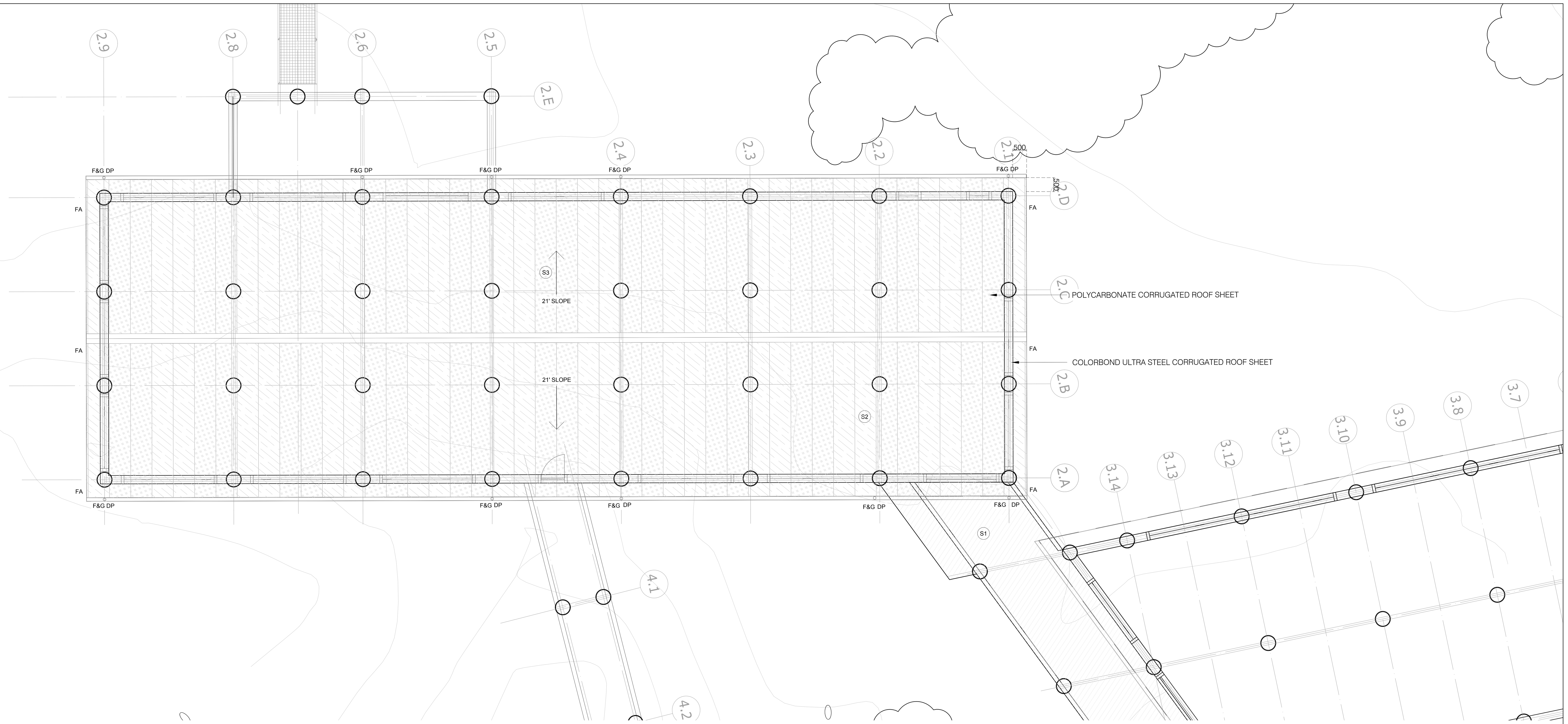
OVERWATER STRUCTURES BUILDING 2 ELEVATONS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

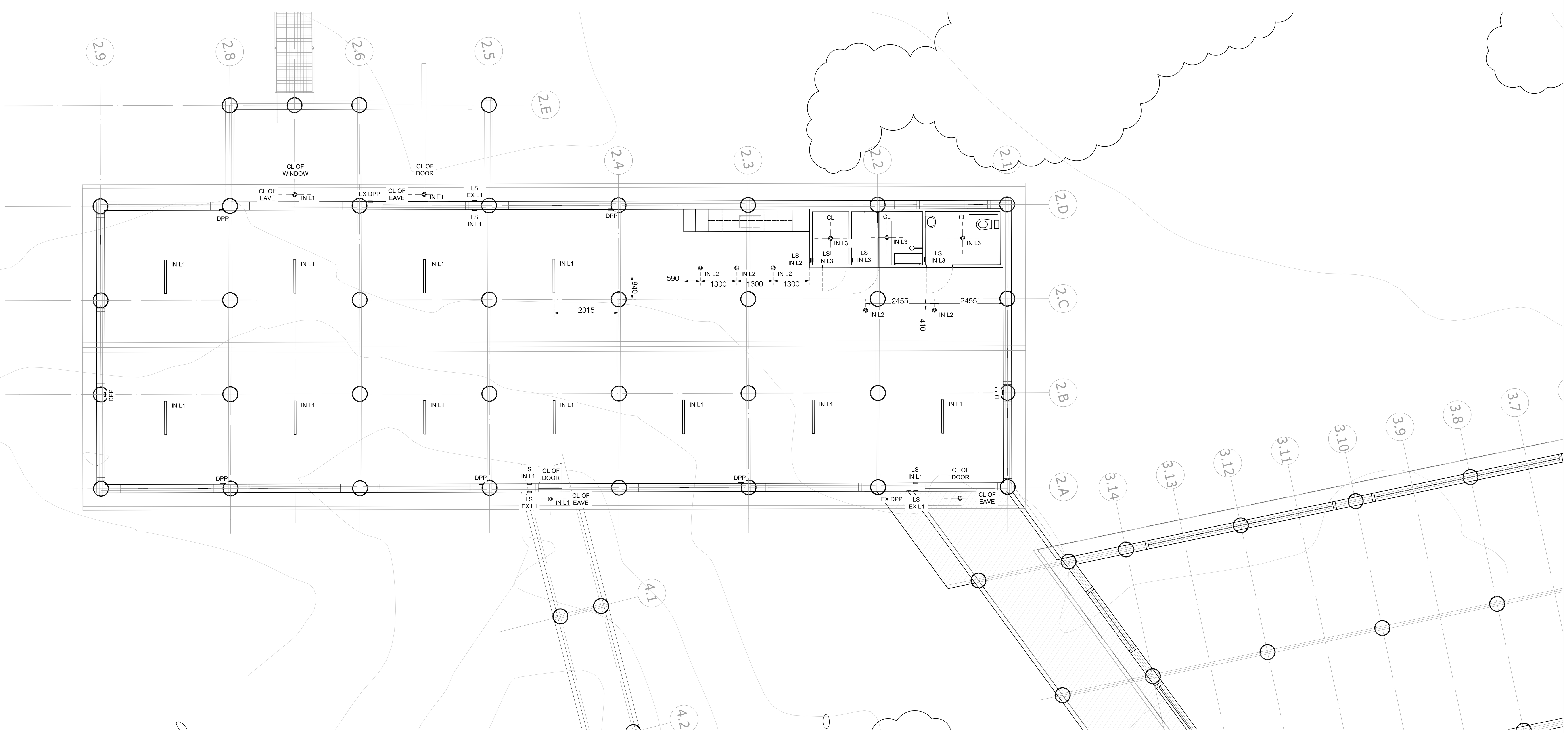
SCALE
1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

DRAWING NO.: LA-105
REVISION: -



OVERWATER STRUCTURE - BUILDING 2 ROOF PLAN

1:100



OVERWATER STRUCTURE - BUILDING 2 LIGHTING PLAN

1:100

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Landscape Architects / Urban Designers

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ENGINEER

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LEGEND

S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 2 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

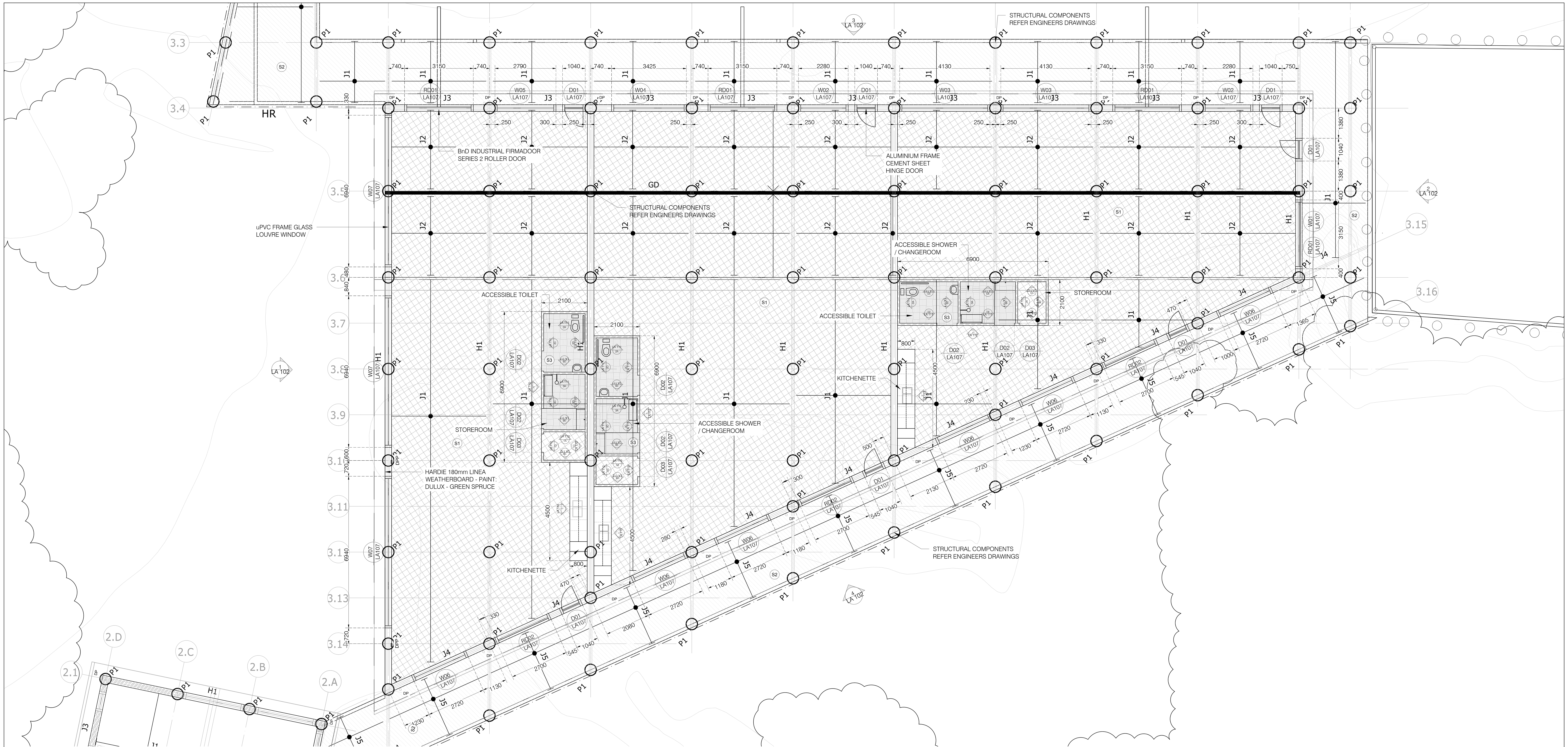
ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

0 1 2 3 4 5[m]

N

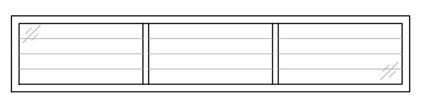
DRAWING NO.: LA-106 | REVISION: -



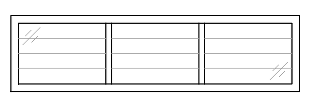
OVERWATER STRUCTURE - BUILDING 1

1:100

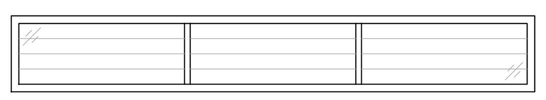
Overwater Structure - Building 3 - Door & Window Schedule						
Symbol	Door/Window Type	Size (Height & Width)	Sill height	Head height	Orientation	Quantity
External Doors & Windows						
W 01	uPVC Frame glass sliding window	600mm x 3150mm	2780mm	3380mm	N/A	1
W 02	uPVC Frame glass louvre window	600mm x 2280mm	1900mm	2500mm	N/A	2
W 03	uPVC Frame glass louvre window	600mm x 4130mm	1900mm	2500mm	N/A	2
W 04	uPVC Frame glass louvre window	600mm x 3425mm	1900mm	2500mm	N/A	1
W 05	uPVC Frame glass louvre window	600mm x 2800mm	1900mm	2500mm	N/A	1
W 06	uPVC Frame glass louvre window	600mm x 2720mm	1900mm	2500mm	N/A	6
W 07	uPVC Frame glass louvre window	600mm x 6940mm	1900mm	2500mm	N/A	3
W 08	uPVC Frame glass louvre window	985mm x 4985mm	4915mm	5900mm	N/A	9
RD 01	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 3150mm	N/A	2500mm	N/A	4
RD 02	BnD Industrial firmadoor series 2 - custom size roller door	2500mm x 2700mm	N/A	2500mm	N/A	3
D 01	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1
Internal Doors & Windows						
D 02	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 900mm	N/A	2100mm	L	2
D 03	Aluminium frame cement sheet hinge swing door - Stainless steel fixings	2100mm x 840mm	N/A	2100mm	L	1



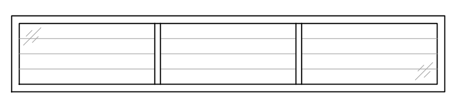
W01 Elevation
Scale: 1:20



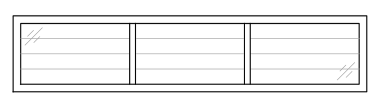
W02 Elevation
Scale: 1:20



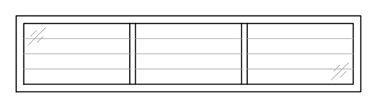
W03 Elevation
Scale: 1:20



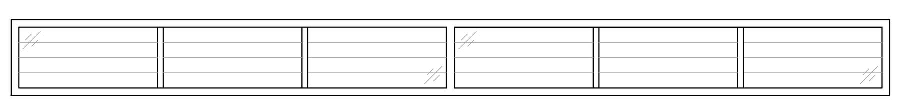
W04 Elevation
Scale: 1:20



W05 Elevation
Scale: 1:20

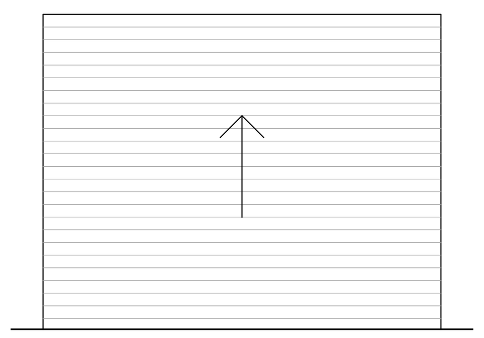


W06 Elevation
Scale: 1:20

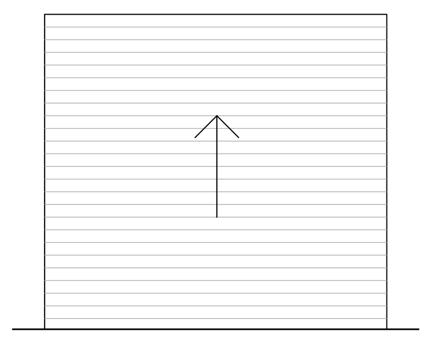


W07 Elevation
Scale: 1:20

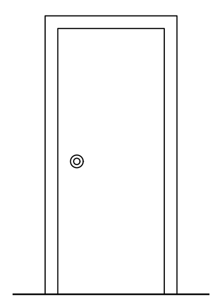
W08 Elevation
Scale: 1:20



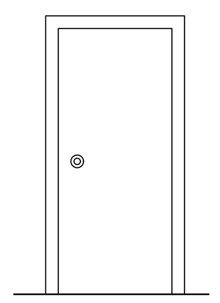
RD01 Elevation
Scale: 1:20



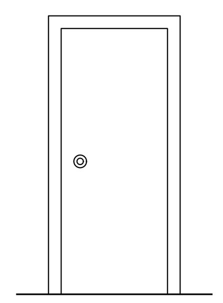
RD02 Elevation
Scale: 1:20



D01 Elevation
Scale: 1:20



D02 Elevation
Scale: 1:20



D03 Elevation
Scale: 1:20

OVERWATER STRUCTURE - BUILDING 3 - DOOR & WINDOW SCHEDULE

1:100

Paterson Design Studio
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Killarney Heights, NSW 2087. www.pdsdesign.com.au

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ENGINEER

tonkin

LEGEND

P1	STRUCTURAL PILONS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
H1	STRUCTURAL HEADSTOCKS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J1	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J2	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J3	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J4	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
J5	STRUCTURAL JOISTS REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S1	38mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S3	FLOORING: POLYSAFE QUATTRO PUR FLOORING MANUFACTURER: POLYFLOR - COLOUR: COOL PEBBLE INSTALL AS PER MANUFACTURER DETAILS
	STRUCTURAL WALL SYSTEM REFER SPEC FOR INTERNAL & EXTERNAL CLADDDING ENGINEER: TONKIN ENGINEERS
	INTERNAL NON LOAD BEARING CAVITY WALL SYSTEM REFER SPEC FOR INTERNAL CLADDING ENGINEER: TONKIN ENGINEERS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUC INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 3 FLOOR PLAN

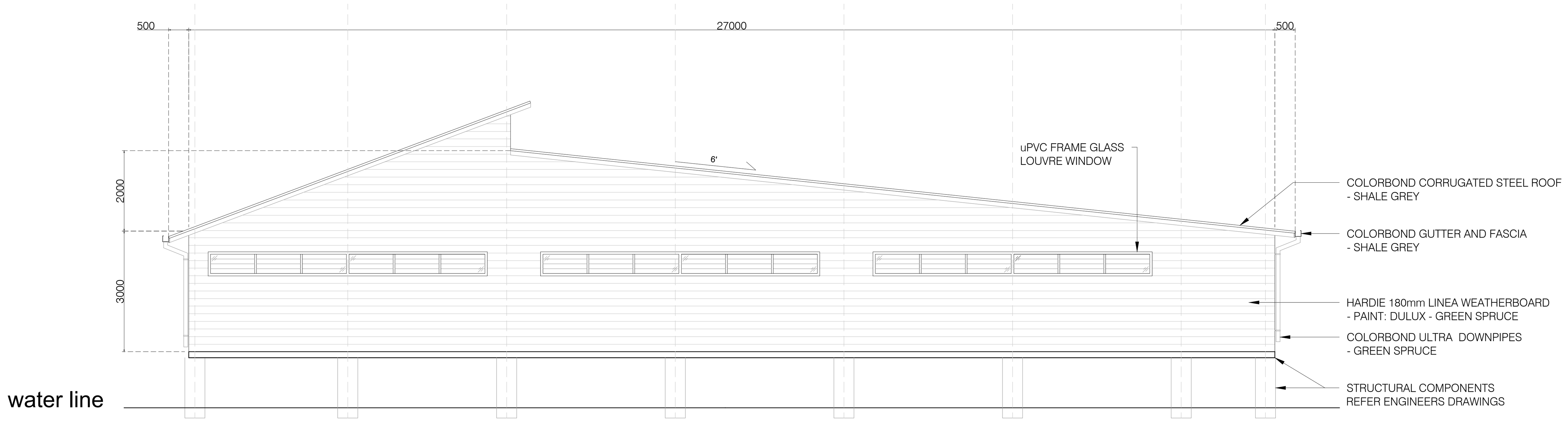
DESIGNED: DRAWN: DC CHECK: DC

ISSUE: CC ISSUE
DATE: 06.12.21

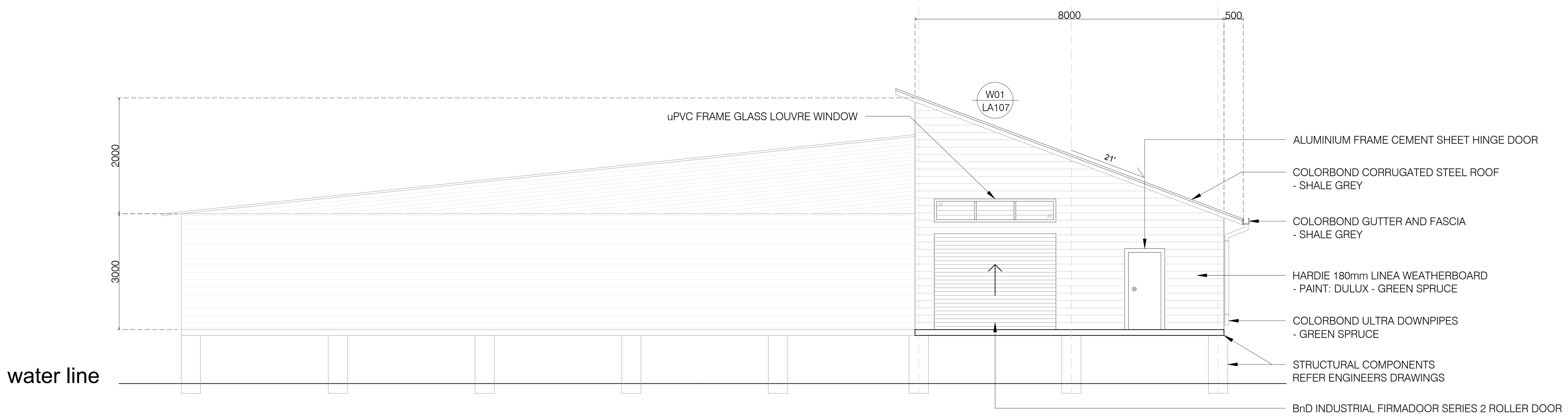
SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

N

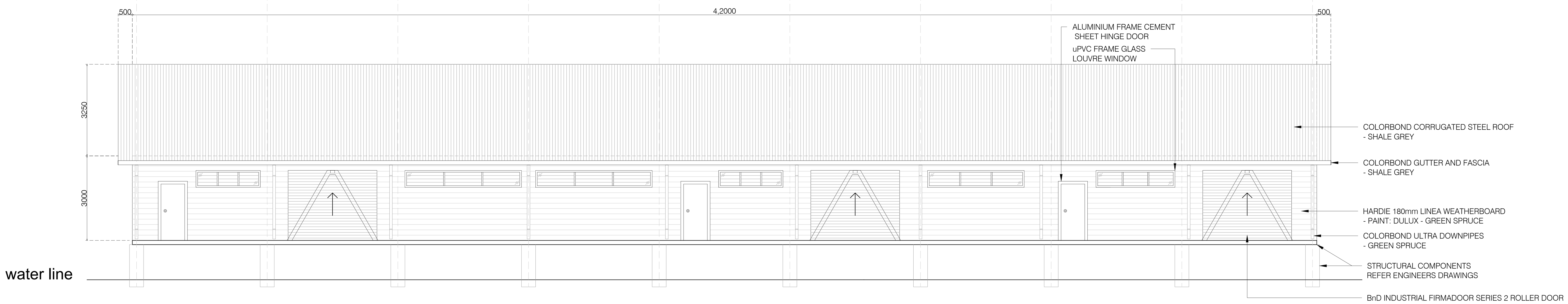
DRAWING NO. LA-107
REVISION -



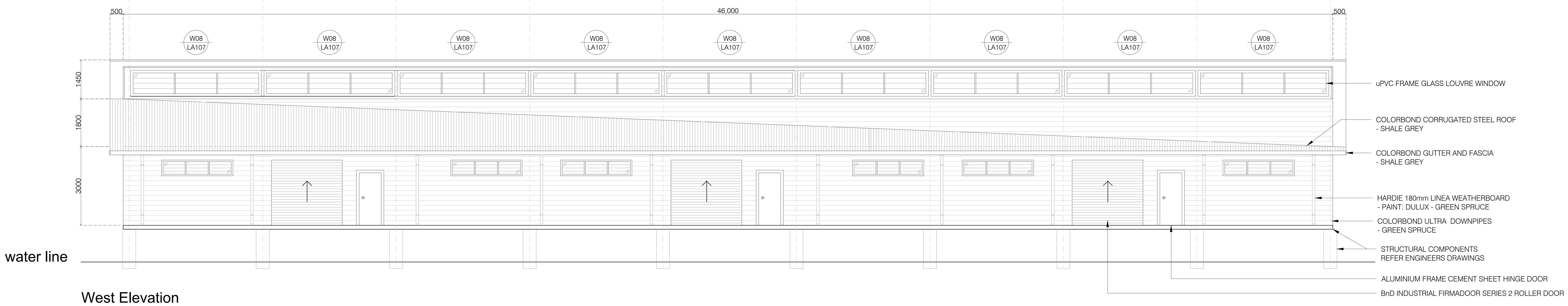
North Elevation



South Elevation



East Elevation



West Elevation

OVERWATER STRUCTURE - BUILDING 3 ELEVATIONS

1:100

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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Landscape Architects / Urban Designers
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ENGINEER

tonkin

LEGEND

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

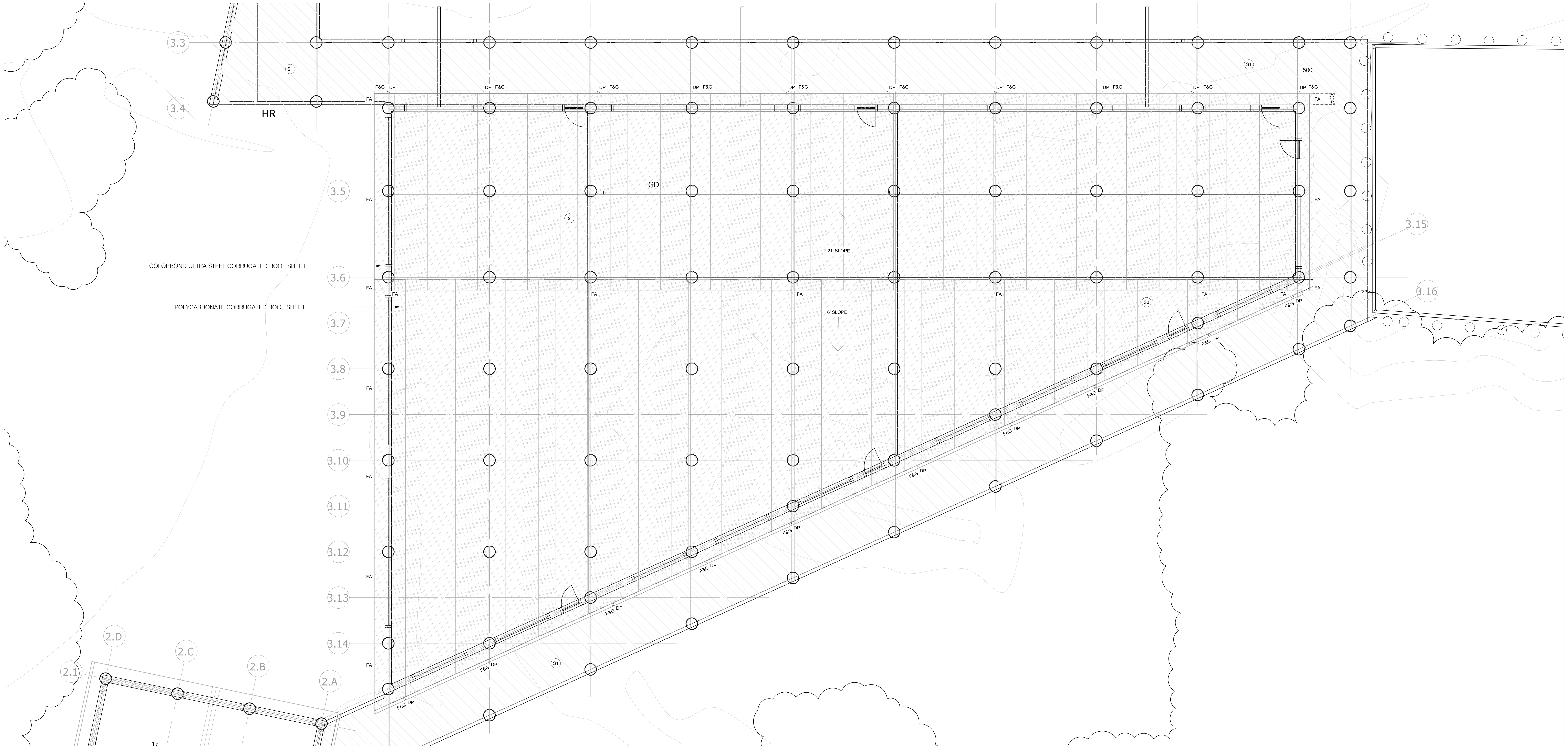
OVERWATER STRUCTURES BUILDING 3 ELEVATIONS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3
0 1 2 3 4 5[m]

DRAWING NO. LA-108 | REVISION -



OVERWATER STRUCTURE - BUILDING 3 - ROOF PLAN

1:100

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Landscape Architects / Urban Designers

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Killarney Heights, NSW 2087.

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ENGINEER

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LEGEND

S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
S2	COLORBOND ULTRA CORRUGATED ROOF SHEETS MANUFACTURER: COLORBOND - COLOR: SHALE GREY INSTALL AS PER MANUFACTURERS DETAILS
S3	CLEAR LEVEL 3 POLYCARBONATE CORRUGATED ROOF SHEETS MANUFACTURER: SOLASAFE - METALROOFING ONLINE INSTALL AS PER MANUFACTURERS DETAILS
DP	COLORBOND ULTRA DOWNPIPES MANUFACTURER: COLORBOND - COLOUR: GREEN SPRUCE INSTALL AS PER MANUFACTURER DETAILS
FA	ROOF FASCIA MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS
F&G	ROOF FASCIA & GUTTER MANUFACTURER: COLORBOND - COLOUR: SHALE GREY INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
-	01	CONSTRUCTION CERTIFICATE	DC	DC	06.12.21

CLIENT

NSW GOVERNMENT | Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES BUILDING 3 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE

DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

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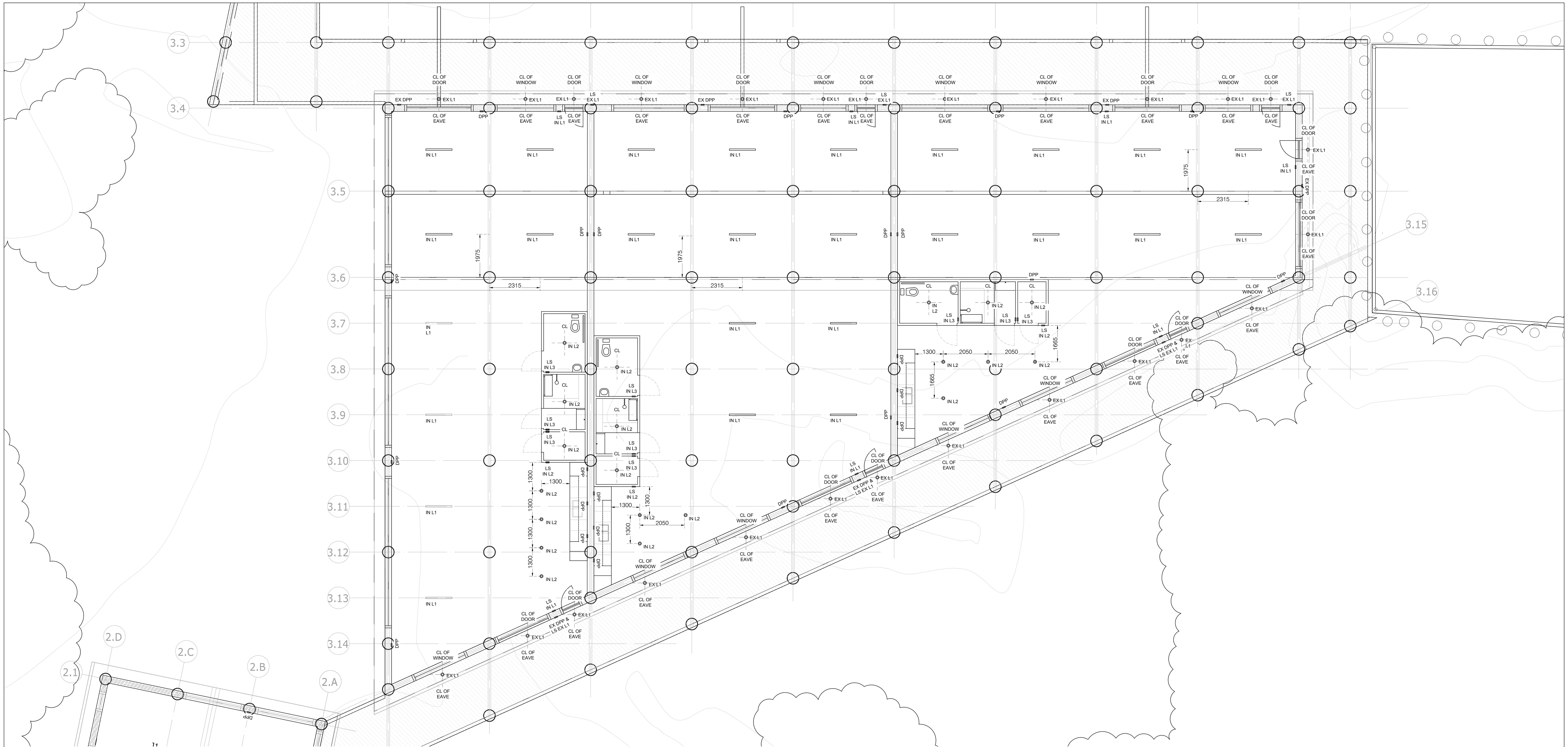
DRAWING NO.: LA-109

REVISION: -



OVERWATER STRUCTURE - BUILDING 3 - LIGHTING PLAN

1:100

Paterson Design Studio

Landscape Architects / Urban Designers

Paterson Design Studio PTY. LTD
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LEGEND

Symbol	Description
S1	43mm FRP 'WEBFORGE' MINI-MESH REFER ENGINEERS DRAWINGS ENGINEER: TONKIN ENGINEERS
IN L1	INTERIOR LIGHT 1 - BATTEN LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
IN L2	INTERIOR LIGHT 2 - CEILING LED LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
EX L1	EXTERIOR LIGHT 1 - MOTION SENSOR LED DOWN LIGHT MANUFACTURER: SUNLED ENERGY INSTALL AS PER MANUFACTURER DETAILS
LS IN L1	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS IN L2	INTERIOR LIGHT SWITCH - INTERIOR LIGHT 2 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
LS EX L1	EXTERIOR LIGHT SWITCH - EXTERIOR LIGHT 1 MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
DDP	CLIPSAL CLASSIC DOUBLE POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS
EX DDP	WEATHERSHEILD DOUBLE WATERPROOF POWERPOINT MANUFACTURER: CLIPSAL INSTALL AS PER MANUFACTURER DETAILS

REV	NO	DESCRIPTION	DWN	CHK	DATE
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CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY
OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES
BUILDING 3 DETAIL PLAN

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE

DATE: 06.12.21

SCALE: 1:100 @ A1 1:200 @ A3

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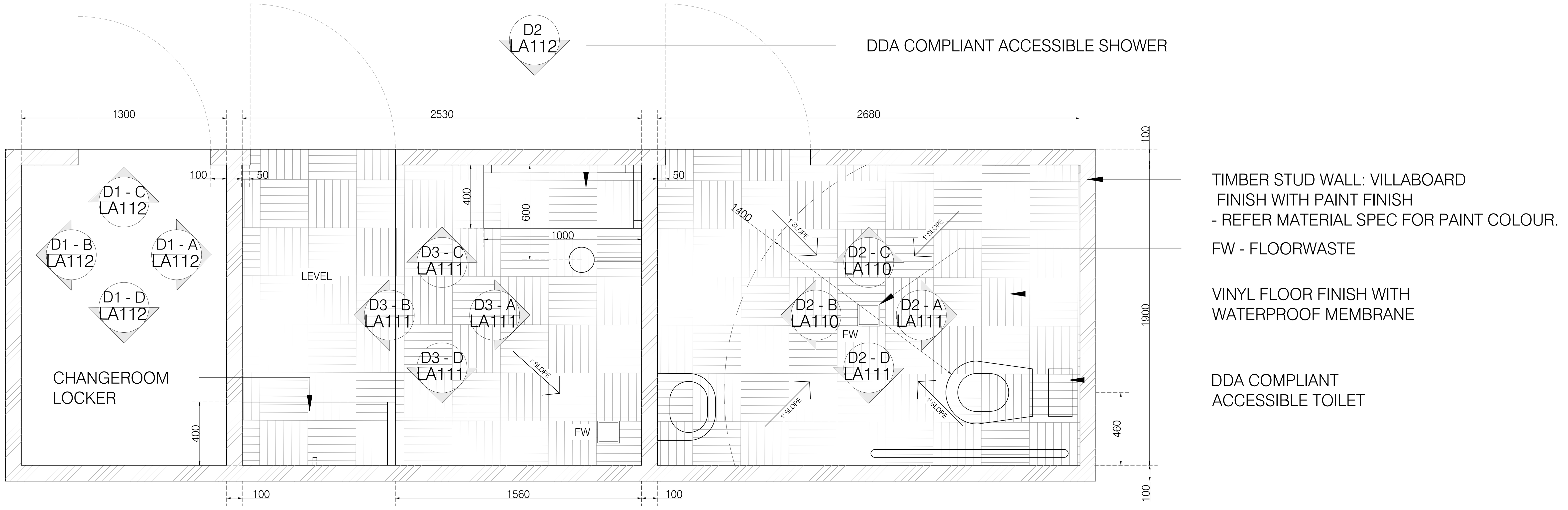
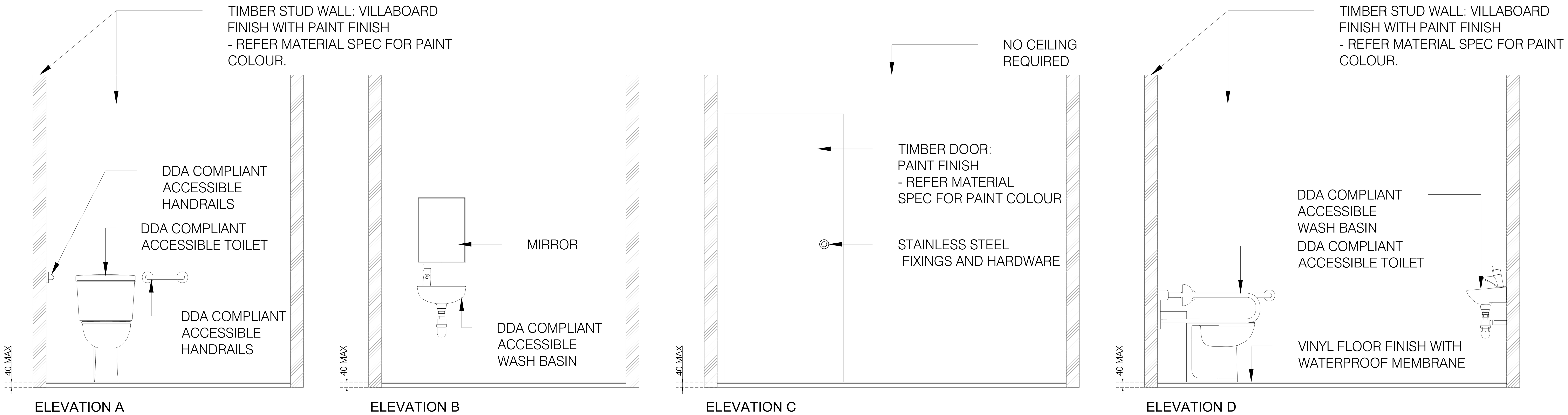
DRAWING NO. LA-110

REVISION -



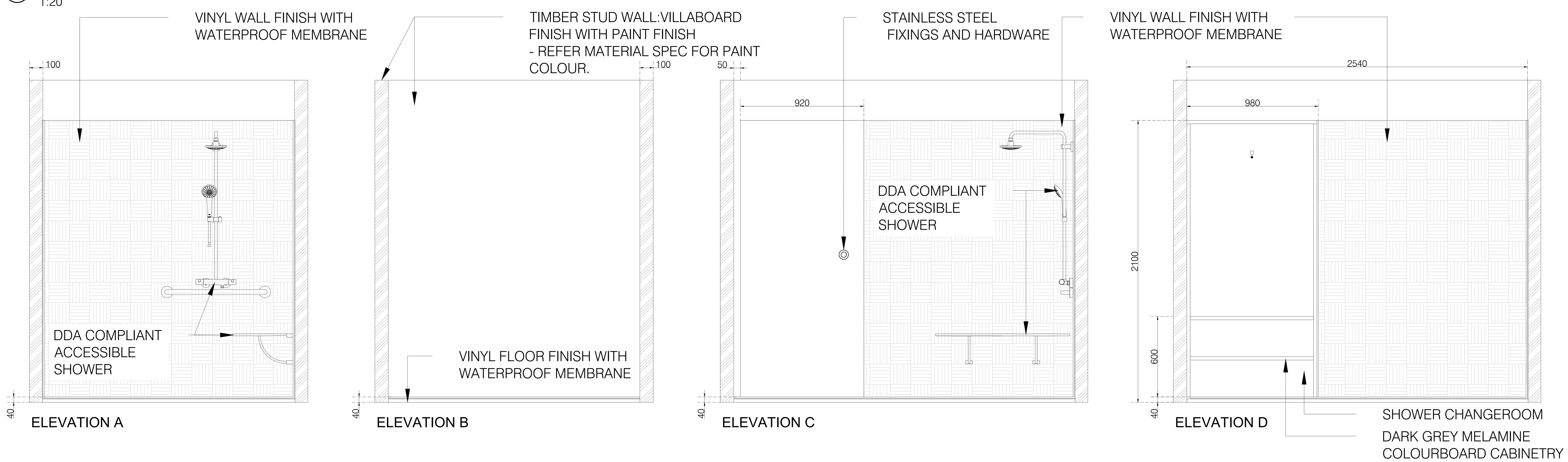
1 OVERWATER STRUCTURE - AMENITIES - AMENITIES BLOCK FLOOR PLAN

1:20



2 OVERWATER STRUCTURE - AMENITIES - TOILET ELEVATIONS

1:20



3 OVERWATER STRUCTURE - AMENITIES - SHOWER ELEVATIONS

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherboard 180mm
Texture: Smooth

1.2 PRE CLADDING:
Manufacturer: JamesHardie
Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
Manufacturer: Solasafe - Metal Roofing Online
Product: Clear Level 3 Polycarbonate Corrugated
Roof Sheets

1.5 GUTTER & FASCIA :
Manufacturer: Colorbond
Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

2.0 INTERNAL MATERIALS:

2.1 INTERNAL CLADDING:
Manufacturer: JamesHardie
Product: Villaboard lining
Product Code: 400360
Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

2.2 INTERNAL PAINT:
Manufacturer: DULUX
Product: DULUX Lexicon Quarter
Product Code: SW1E1

2.3 INTERNAL AMENITIES FLOORING & WALL FINISH
Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal flooring specified for each amenity room of each tenancy.
Texture: Smooth

Manufacturer: Polyflor
Product: Polysafe Quatro pur
Colour: Lunar Shell
Application: Internal wall finish specified for each amenity room of each tenancy.
Texture: Smooth

3.0 INTERNAL/EXTERNAL WINDOWS & DOORS:

3.1 EXTERNAL ROLLER DOORS:
Manufacturer: B&D Roller Doors
Product: Firmer Door Series 2 Industrial
Colour: DULUX Green Spruce

3.2 EXTERNAL PEDESTRIAN DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
Manufacturer: Caroma
Products: Accessible grab rails and mirror.
Accessible Toilet: Caroma Profile 4 Easy Height Connector Toilet Suite
Wash Basin: Caroma Urbane II Wall Basin
Accessible Grab Rails: Caroma Accessible Grab Rails
Mirror: 600 x 750 Contractor Polished Edge Series Mirror

4.2 ACCESSIBLE SHOWER:
Manufacturer: Caroma
Products:
Accessible Shower: Caroma Plus Starsafe II Accessible Shower Set
Shower Seat:Metlam Disabled ML991-CL Folding Shower Seat White Laminate
Accessible Grab Rails: Caroma Accessible Grab Rails

4.3 KITCHENETTE:
Manufacturer: Contractor to specify
Products:
Kitchen Cupboards:Drak grey melamine cabinetry.
Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

End specification

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CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES AMENITIES DETAILS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE | DATE: 06.12.21

SCALE
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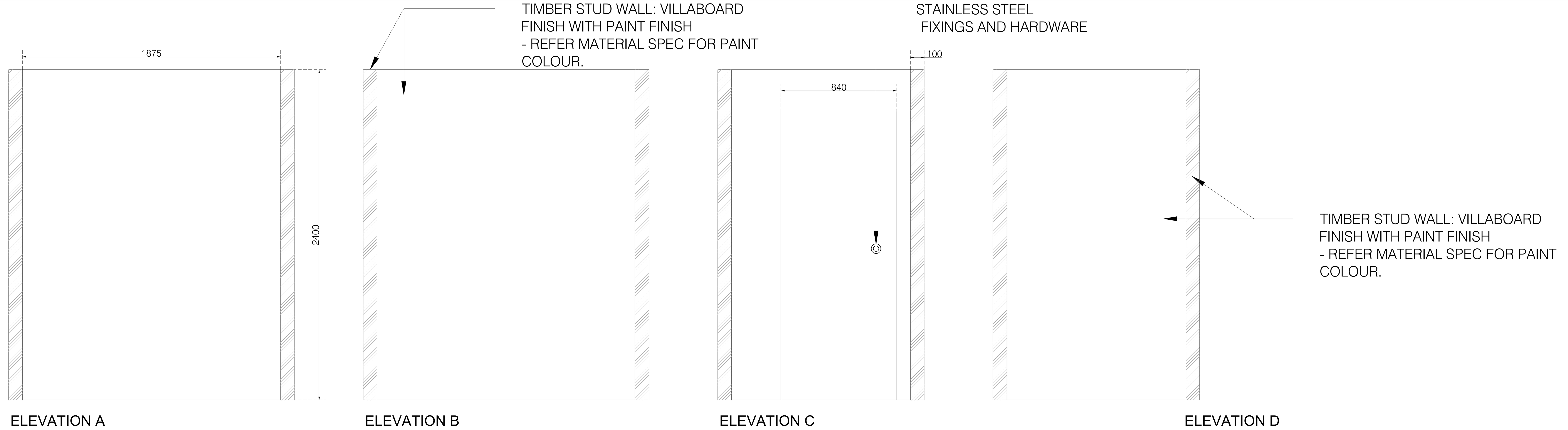
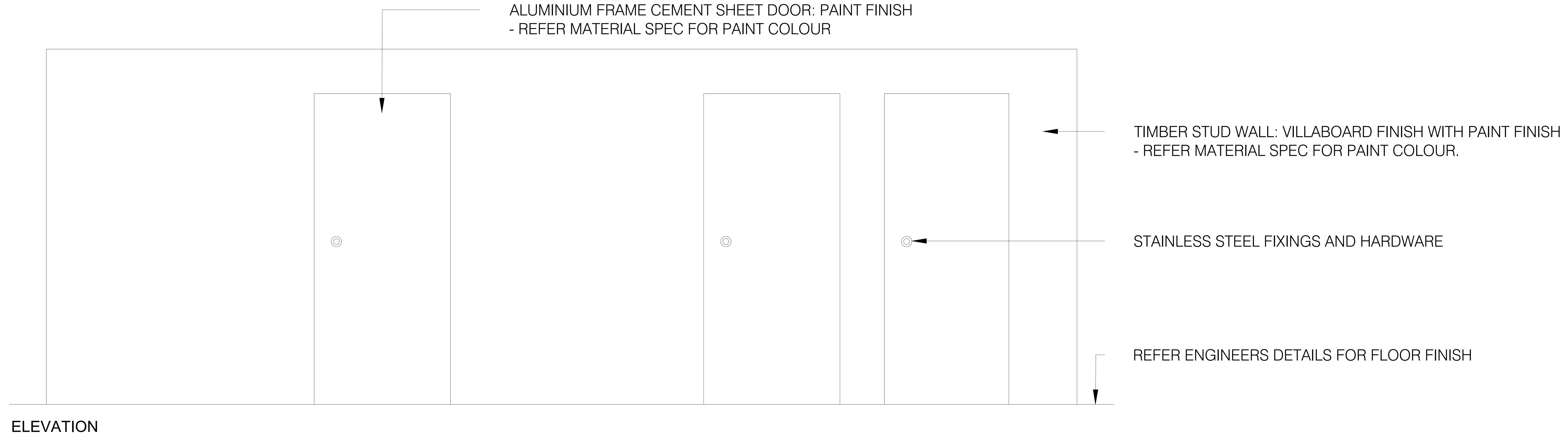
DRAWING NO. LA-111 | REVISION -



1 OVERWATER STRUCTURE - AMENITIES - STORE ROOM ELEVATIONS

1:20



2 OVERWATER STRUCTURE - AMENITIES - AMENITIES BLOCK ELEVATION

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
Manufacturer: JamesHardie
Product: Linea Weatherboard
Product Code: 403912
Product Specification: Linea Weatherbaord 180mm
Texture: Smooth

1.2 PRE CLADDING:
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Product: Hardie Wrap Weather Barrier
Product Code: 305664

1.3 EXTERNAL PAINT:
Manufacturer: DULUX
Product: Green Spruce
Product Code: S20C5

1.4 ROOFING:
Manufacturer: Colorbond
Product: Corrugated Colorbond Ultra Roof Sheets
Sheet Colour: Shale Grey

1.4.1 ROOFING:
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Product: Clear Level 3 Polycarbonate Corrugated Roof Sheets

1.5 GUTTER & FASCIA :
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Product: Standard Colorbond Gutter & Fascia Profile
Gutter & Fascia Colour: Shale Grey
Downpipes: Round PVC Downpipes
Downpipe Colour: DULUX Green Spruce

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Application: Internal wall cladding to clad all internal walls of each tenancy.
Texture: Smooth

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Product Code: SW1E1

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Colour: DULUX Green Spruce

3.3 EXTERNAL LOUVRE WINDOWS:
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Product: uPVC Frame Glass Louvre Window
Frame Colour: DULUX Green Spruce

3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

3.5 INTERNAL DOORS:
Manufacturer: Contractor to specify
Product: Aluminium Frame Cement Sheet Hinge Door
Colour: DULUX Lexicon Quarter

4.0 BUILDING AMENITIES:

4.1 ACCESSIBLE BATHROOM:
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4.2 ACCESSIBLE SHOWER:
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4.3 KITCHENETTE:
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Products:
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Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

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CLIENT

Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES AMENITIES DETAILS

DESIGNED:	DRAWN: DC	CHECK: DC

ISSUE: CC ISSUE

DATE: 06.12.21

SCALE: 1:20 @ A1 1:40 @ A3

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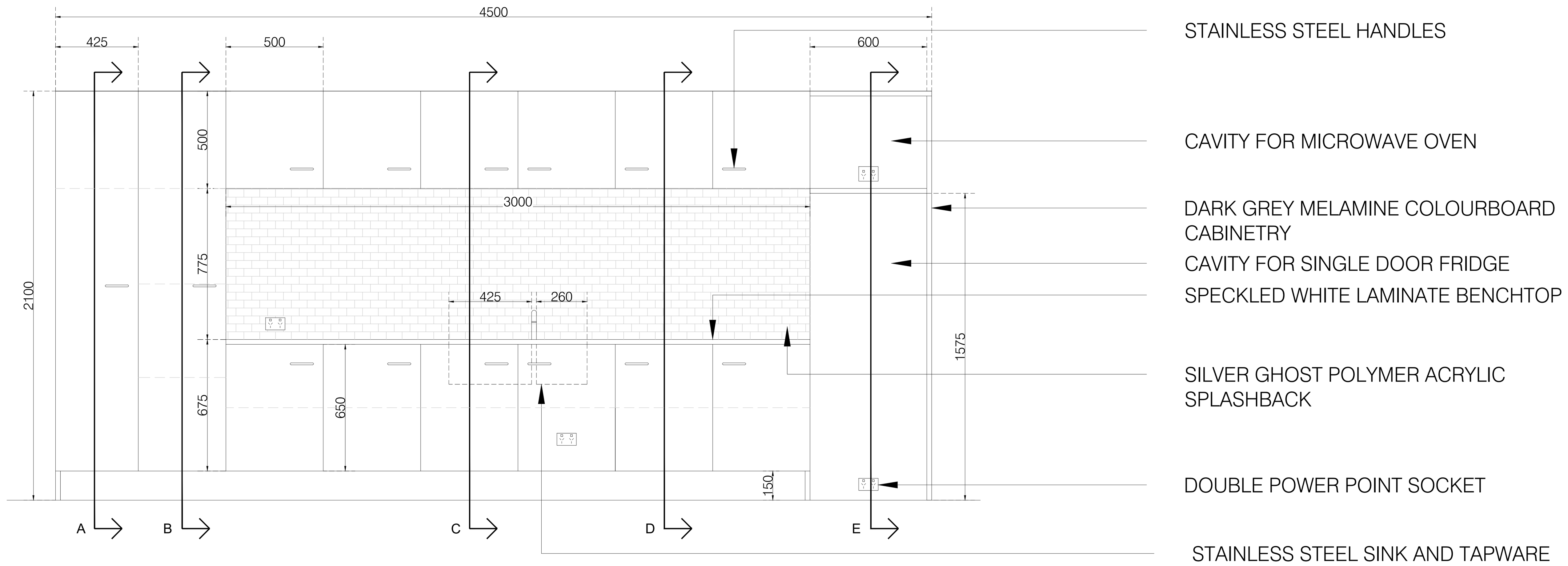
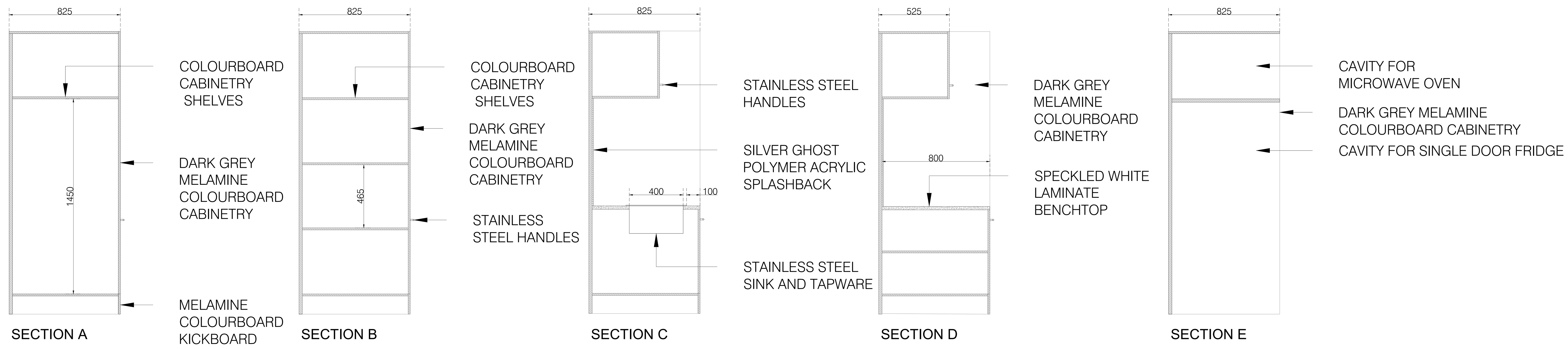
DRAWING NO.: LA-112

REVISION: -



1 OVERWATER STRUCTURE - AMENITIES - KITCHEN ELEVATION

1:20



2 OVERWATER STRUCTURE - AMENITIES - KITCHEN SECTIONS

1:20

MATERIAL SPECIFICATION: BUILDING WORKS

1.0 EXTERNAL MATERIALS:

1.1 CLADDING:
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Product Specification: Linea Weatherbaord 180mm
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3.4 EXTERNAL SLIDING WINDOWS:
Manufacturer: uPVC Window Solutions
Product: uPVC Frame Glass Sliding Window
Frame Colour: DULUX Green Spruce

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Colour: DULUX Lexicon Quarter

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Kitchen Benchtop: Marquee - Speckled white laminate benchtop.
Kitchen Splashback: Bellessi - Silver ghost polymer acrylic splashback.
Kitchen Sink & Tapware: Contractor to specify.
Kitchen handles: Stainless Steel.

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ENGINEER

tonkin

LEGEND

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CLIENT

NSW GOVERNMENT Transport for NSW

PROJECT

WOOLOOWARE BAY OYSTER LEASE

DRAWING TITLE

OVERWATER STRUCTURES KITCHENETTE DETAILS

DESIGNED: | DRAWN: DC | CHECK: DC

ISSUE: CC ISSUE

DATE: 06.12.21

SCALE: 1:20 @ A1 1:40 @ A3

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DRAWING NO.: LA-113

REVISION: -

Appendix L

Flooding Assessment

WOOLOOWARE BAY OYSTER LEASE MASTER PLAN, NSW

FLOODING BRIEFING NOTE
1 MARCH 2022

This Briefing Note discusses potential flooding issues to inform the preparation of the Woolooware Bay Oyster Lease Master Plan.

Background

The location of the Oyster Farm is given in Figure 1 while 1% AEP flood extents mapped by the 2014 Woolooware Bay Catchment Flood Study are given in Figure 2.

Figure 1 Site Location (Source: nearmap accessed 18 January 2022)

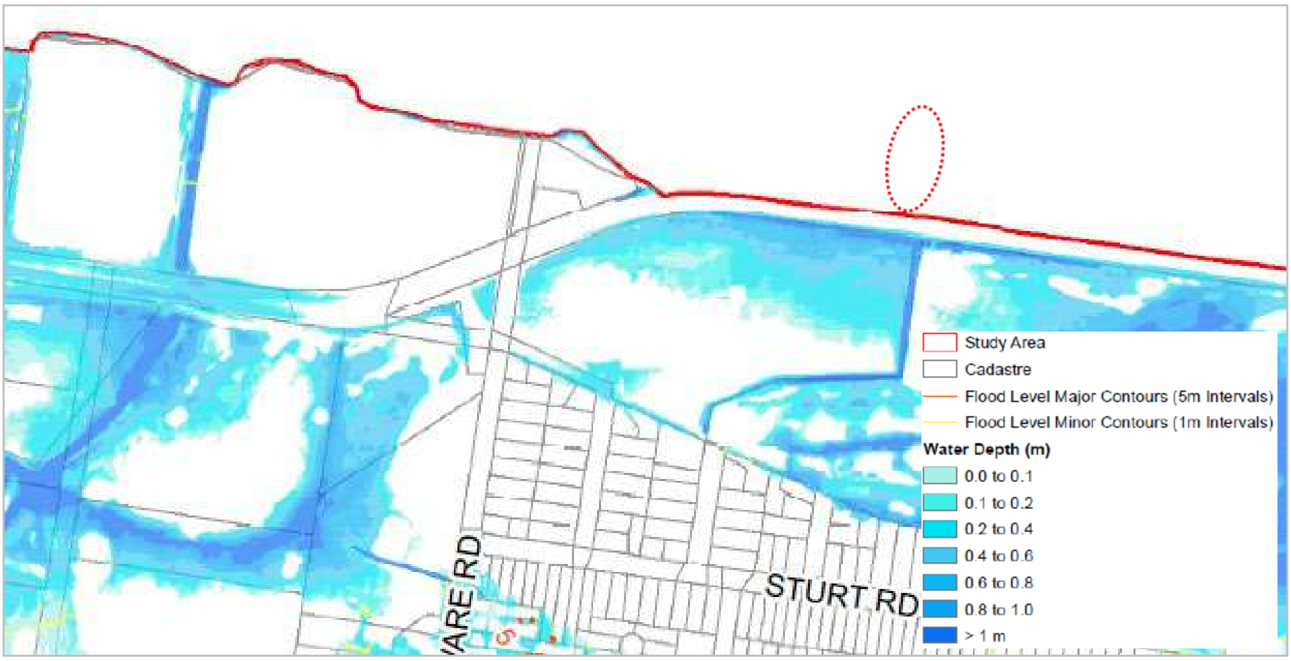


Figure 2 1% AEP Flood Depths (Source: Figure B5, WMAwater, 2014)

It is noted that the study area for the 2014 Woolooware Bay catchment flood study does not include the subject site.

Council Advice

Council has provided the following flooding comments in relation to pre DA conditions for the landside masterplan:

5. <u>Flooding</u>

The development is on land identified as flood affected under the 2011 Lower Georges River Floodplain Risk Management Study & Plan (FRMS&P). Furthermore, the subject site is affected by sea level rise under Council's 2016 Sea Level Rise Policy. Hence, the proposed development is subject to the flood related development controls outlined in the Chapter 40 of the Sutherland Shire Council 2015 Development Control plan (SSDCP 2015). The flood study defines flood levels in various events outlined below:

Flood Event	***Maximum Flood Levels (m AHD)***	***Maximum Flood Levels (m AHD)***
AEP		*1.50*
1% AEP		*1.70*
***1% AEP** with sea level rise*		***2.10***
PMF		*2.20*

The flooding at the subject site is resulting from the mainstream river flooding and the 1% AEP flood level is 2.10m AHD for 2070 sea level rise.

When referring to Section 5.4 and 5.6 of Chapter 40 of the SSDCP 2015, the desired "freeboard" for all habitable areas and storage area is 500mm and all the open car park requires to be at 1% AEP level. The electrical substation and sewer pump also requires to be at 1% AEP plus 500mm freeboard. Based on the submitted plans, it is not clear whether the finished floor level (FFL) of the buildings, storage area, electric substation and sewer pump and car parks meet the minimum requirement or whether they comply with the DCP controls.

To support a development application, a flood impact assessment (FIA) prepared by a suitably qualified engineer with experience in flood risk management (FRM) consulting must be submitted. The FIA must specifically address all relevant flood related development controls outlined under Chapter 40. Where required, the FIA must make recommended design changes for compliance with the controls.

Considering the site condition and nature of the development, mathematical modelling may be required as part of preparing the FIA. In this regard, the applicant is advised to contact appropriately qualified and experienced hydraulic engineers specialising in flood modelling and seeking their advice.

The FIA is be used to demonstrate that the proposed development complies with all the relevant flood related development controls outlined in the Chapter 40 of the SSDCP 2015.

As preliminary guidance it is recommended that following documents are to be submitted to support the DA:

- *A detail survey plan of the site and architectural drawings with FFLs of the future buildings, storage area, electric substation, sewer pump and car park area in metres AHD.*

- *A flood impact assessment (FIA) must be submitted to demonstrate that the proposed development complies with all the relevant flood related development controls outlined in the Chapter 40 of the SSDCP 2015.*

Flood Hazard Categories

The 2013 AEMHS Handbook 7 "Managing the floodplain: a guide to best practice in flood risk management in Australia "*has been developed with consideration of the National strategy for disaster resilience (COAG 2011), and the findings of recent State and national reviews following the multiple flood events of 2010 to 2012 that resulted in widespread flooding. It is intended to provide broad advice on all important aspects in managing flood risk in Australia"*.

The supporting document titled "Technical flood risk management guideline: Flood Hazard" includes a plot of flood hazard vulnerability curves (refer **Figure 3**) based on six hazard categories H1 – H6 as follows.

Zone H1 is safe for Small Vehicles and Zone H2 is safe for Large 4WD vehicles. This aligns with the guidance given in Table 6.7.2. Interim Flow Hazard Regimes for Vehicles in ARR2019 Book 6 Flood hydraulics Chapter 7 Safety Design Criteria.

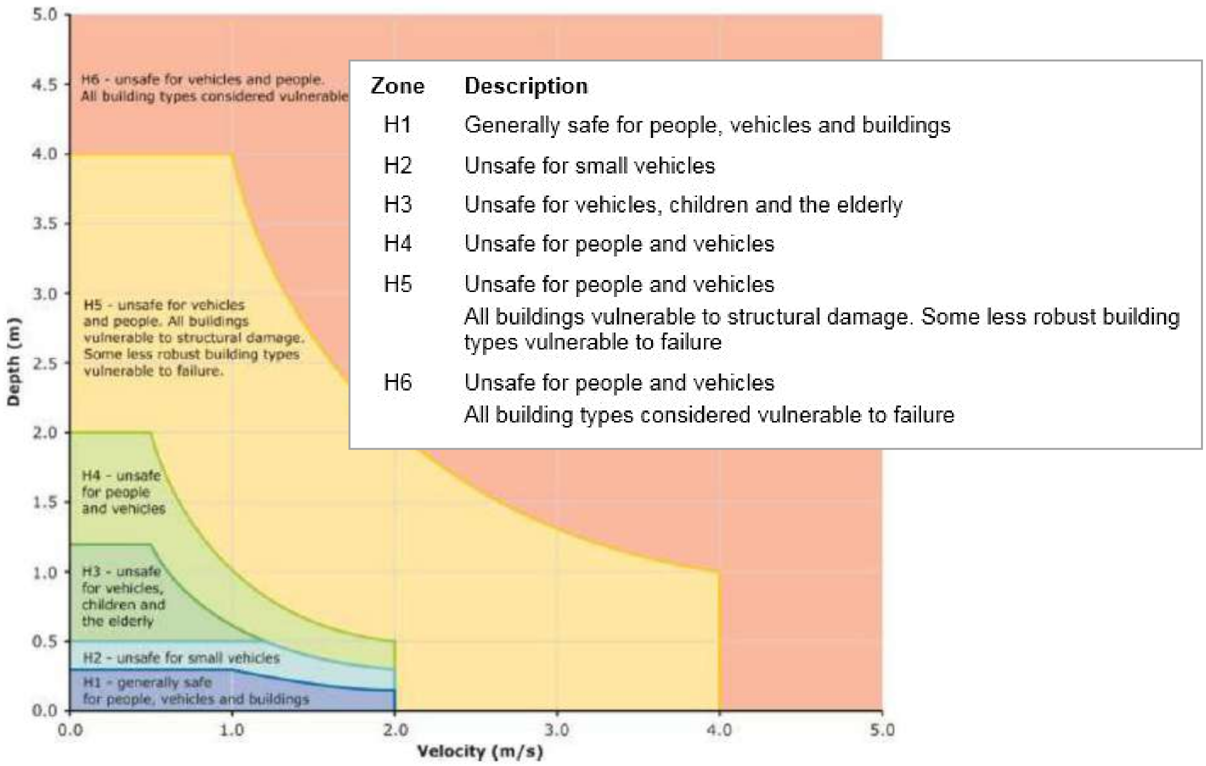


Figure 3 Flood Hazard Categories

Chapter 40 of the SSDCP 2015.

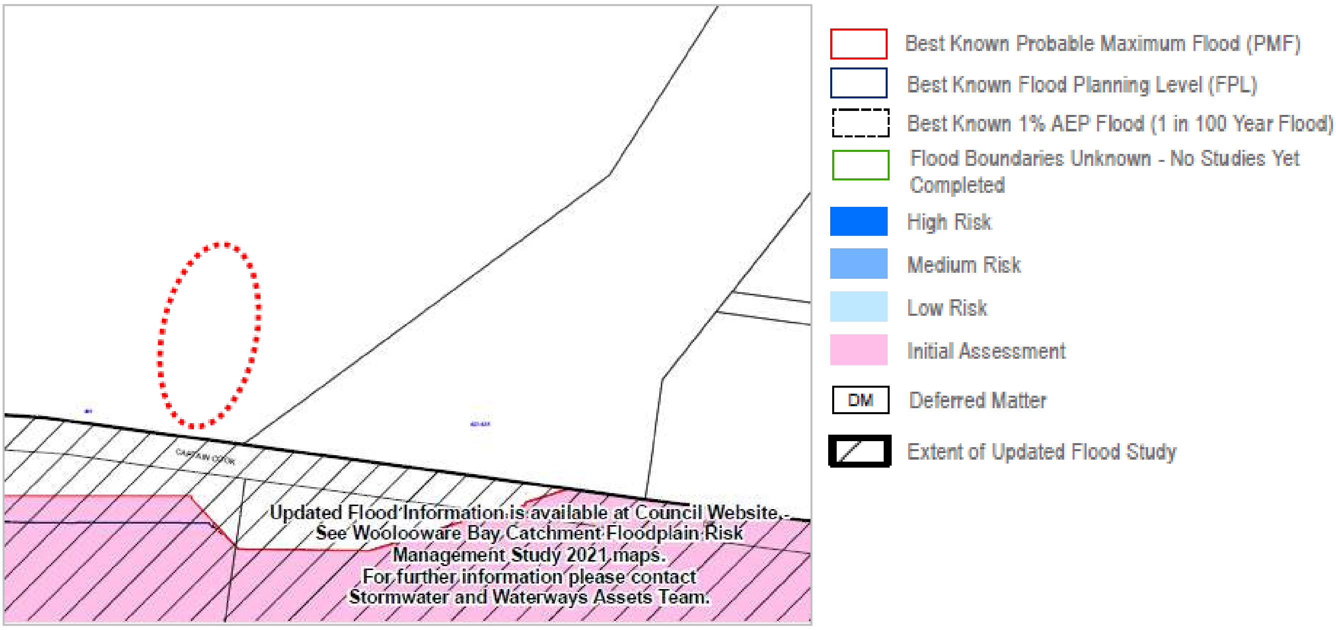


Figure 4 SSDCP 2015 Flood Risk Management – Extract from Map 64

It is noted that the project site is not mapped as High Risk, Medium Risk, Low Risk or Initial Assessment.

The controls in Chapter 40 of the SSDCP 2015 are directly applicable are set out in 5.1.

The following controls do not apply: 5.2, 5.3, 5.4, 5.5.

As a guide the following controls, in part, apply to Commercial and Industrial Development on Land mapped as Medium Flood Risk:

Floor Level

2. *Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 500mm freeboard.*

4. *Non-habitable floor levels shall be assessed on merit having regard to the 5% AEP level as well as privacy and amenity impacts*

While the DCP may require the floor level of all habitable areas to be at 2.6 m AHD this would be 0.4 m higher than the PMF level. Consequently, a floor level of 2.25 m AHD would not comply with the required freeboard but would be above the PMF level and would be flood-free which would exceed the intent of the requirement which is based, in our view, on locations where the PMF is more than 500 mm higher than the “1% AEP flood level”.

Car Parking and Driveway Access

1. *The minimum surface level of open car parking spaces or carports shall be no lower than the 1% AEP flood or the level of the crest of the road at the location where the site has access to the road.*

Figure 5 Driveway Access from Captain Cook Drive (Source: nearmap, Image 12/9/2021)

As disclosed by site plans and **Figure 5,** the driveway only provides access to vehicles driving east along Captain Cook Drive. Given that vehicles are not able to turn into the property from the westbound lanes not vehicles exiting the property to cross the median into the westbound lanes it is unclear as to the relevance of the crest of the road at the location where the site has access to the road. The driveway levels at the edge of Captain Cook Drive vary from 1.95 m AHD – 2.04 m AHD.

The 1% AEP flood level is 1.7 m AHD. Climate change increases this level by 0.4 m. The PMF level is 2.2 m AHD.

As disclosed in **Figure 3**, Zone H1 is safe for Small Vehicles and Zone H2 is safe for Large 4WD vehicles.

Under conditions where the flood velocity is < 1.0 m/s the upper limit of H1 and H2 zones are 0.3 m flood depth and 0.5 m flood depth respectively.

Based on a PMF level of 2.2 m AHD:

(i) small vehicles could safely exit the property in all floods up to the PMF if the car parks and internal access roads are no lower than 1.9 m AHD; and
(ii) Large 4WD vehicles could safely exit the property in all floods up to the PMF if the car parks and internal access roads are no lower than 1.7 m AHD.

If the minimum surface level of open car parking spaces is set at 1.95 m AHD (the lowest level of the road at the location where the site has access to the Captain Cook Drive) then all vehicles could safely exit the property and turn on to Captain Cook Drive in all floods up to the PMF noting that the internal access road and driveway set at this level would be inundated and drivers may need visual indicators (eg. bollards) to prevent them unintentionally driving off flooded internal roads into deeper water.

2. *Garages shall have a minimum finished floor level no lower than the 1% AEP flood plus 200mm freeboard.*

Noted but not expected to apply.

3. *The level of the driveway providing access between the road and parking space shall be no lower than 300mm below the 1% AEP flood or such that the depth of inundation during a 1% AEP flood is not greater than either the depth at the road or the depth at thecar parking space.*

Refer to comments under Condition No. 1.

4. *Basement garages and car parking areas with floor level below the 5% AEP flood or more than 0.8m below the 1% AEP flood level, shall have a pump-out system, adequatewarning systems, signage and exits.*

Not applicable

5. *Restraints or vehicle barriers shall be provided to prevent floating vehicles leaving a site during a 1% AEP flood. A flood depth of more than 200mm will cause serious water damageto a typical vehicle and a depth of 300mm is sufficient to cause a typical vehicle to float.*

Refer to Figure 3 and the comments under Condition No. 1 regarding the possible need for visual indicators (eg. bollards) to prevent drivers unintentionally driving off flooded internal roads into deeper water.

6. *The crest of the driveway providing access between the road and basement garages shall be a minimum of 200mm above the level of the 1% AEP flood.*

Not applicable

Evacuation

1. *Reliable access for pedestrians or vehicles shall be provided from the building commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level.*

If the floor level is already higher than the PMF level, then there is no need for any workers to evacuate to a higher level within the building.

2. *Adequate exits shall be available to allow safe and orderly evacuation without increased reliance upon the SES or other authorised emergency services personnel.*

Noted. It is intended that a Flood Emergency Response Plan would inform all workers of the flood risks and how to respond to flooding of the property.

4. *The development shall be consistent with any relevant flood strategy, Floodplain Risk Management Plan adopted by Council or similar plan.*

Given that the property lies outside the study area for the Woolooware Bay catchment flood study there appears to be no relevant Floodplain Risk Management Plan that covers the subject property.

5. *An engineer's report shall be provided to certify that an area of refuge is available if circumstances are possible where the evacuation of persons might not be achieved within an effective warning time*

Noted. If the floor level is already higher than the PMF level, then there is no need for any workers to evacuate to a higher level within the building.

Appendix M

Noise Estimator

Transport Roads & Maritime Services

Distanced Based Assessment (Construction Scenario)

Please pick from drop-down list in orange cells

Noise area category		R1
RBL or L_{A90} Background level (dB(A))	Day	40
	Evening	35
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	Day	50
	Day (OOHW)	45
	Evening	40
	Night	35
Scenario		Bridge works
Is there line of sight to receiver?		Yes

Steps for Screening Assessment:
1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
3. Select the scenario. If not found in drop-down list, refer to 'Source List' and select a representative scenario with similar plant combination.
4. Is there line of sight to receiver? Select the appropriate scenario from the drop down list .

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver' drop-down list. Solid barrier can be in the form of road cutting, solid construction hoarding, acoustic curtain, timber lapped and capped fence, shipping container, site office, etc. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

6. Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period . Consider background noise measurements to check assumption in Step #2 if:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver
8. Where night works are involved, identify sleep disturbance affected distance.
9. Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})												$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)						
			Noticeable			Clearly audible			Moderately intrusive			Highly intrusive						
		Affected distance (m)	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)
Undeveloped green fields, rural areas with isolated dwellings	Day	390							N	185	60	N	75	70	N, PC, RO	40	75	
	Day (OOHW)	565				N, R1, DR	390	50	N, R1, DR	185	60	N, R1, DR, PC, SN	75	70	N, PC, RO	40	75	
	Evening	815				N, R1, DR	565	45	N, R1, DR	265	55	N, R1, DR, PC, SN	125	65	N, PC, RO	40	75	
	Night	1165	N	1165	35	N, R2, DR	815	40	N, PC, SN, R2, DR	390	50	AA, N, PC, SN, R2, DR	185	60	N, PC, RO	40	75	170
	Highly Affected	40													N, PC, RO	40	75	
Developed settlements (urban and suburban)	Day	500							N	215	60	N	85	70	N, PC, RO	45	75	
	Day (OOHW)	740				N, R1, DR	500	50	N, R1, DR	215	60	N, R1, DR, PC, SN	85	70	N, PC, RO	40	75	
	Evening	1085				N, R1, DR	740	45	N, R1, DR	330	55	N, R1, DR, PC, SN	140	65	N, PC, RO	45	75	
	Night	1560	N	1560	35	N, R2, DR	1085	40	N, PC, SN, R2, DR	500	50	AA, N, PC, SN, R2, DR	215	60	N, PC, RO	45	75	200
	Highly Affected	45													N, PC, RO	45	75	
Propagation across a valley / over water	Day	685							N	280	60	N	100	70	N, PC, RO	45	75	
	Day (OOHW)	1035				N, R1, DR	685	50	N, R1, DR	280	60	N, R1, DR, PC, SN	100	70	N, PC, RO	45	75	
	Evening	1525				N, R1, DR	1035	45	N, R1, DR	440	55	N, R1, DR, PC, SN	170	65	N, PC, RO	45	75	
	Night	2005	N	2005	35	N, R2, DR	1525	40	N, PC, SN, R2, DR	685	50	AA, N, PC, SN, R2, DR	280	60	N, PC, RO	45	75	250
	Highly Affected	45													N, PC, RO	45	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

	Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	265				N	125	65	N, PC, RO	40	75
Hospital wards and operating theatres	Day	65	125							N, PC, RO	40	75
Place of worship	Day	55	265				N	125	65	N, PC, RO	40	75
Active recreation	Day	65	125							N, PC, RO	40	75
Passive recreation	Day	60	185				N	75	70	N, PC, RO	40	75
Industrial premise	Day	75	40							N, PC, RO	40	75
Offices, retail outlets	Day	70	75							N, PC, RO	40	75

	OOHW			$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	125				N, R1, DR	75	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
	Night	65	125	N	125	65	N, R2, NR	75	70	N, PC, SN, R2, DR	22	80	AA, N, PC, SN, R2, DR	7	90
Place of worship	Evening	55	265				N, R1, DR	185	60	N, R1, DR	75	70	N, R1, DR, PC, SN	22	80
	Night	55	265	N	265	55	N, R2, NR	185	60	N, PC, SN, R2, DR	75	70	AA, N, PC, SN, R2, DR	22	80
Active recreation	Evening	65	125				N, R1, DR	75	70	N, R1, DR	22	80	N, R1, DR, PC, SN	7	90
Passive recreation	Evening	60	185				N, R1, DR	125	65	N, R1, DR	40	75	N, R1, DR, PC, SN	13	85
Industrial premise	Evening	75	40				N, R1, DR	22	80	N, R1, DR	7	90	N, R1, DR, PC, SN	2	100
	Night	75	40	N	40	75	N, R2, NR	22	80	N, PC, SN, R2, DR	7	90	AA, N, PC, SN, R2, DR	2	100
Offices, retail outlets	Evening	70	75				N, R1, DR	40	75	N, R1, DR	13	85	N, R1, DR, PC, SN	4	95
	Night	70	75	N	75	70	N, R2, NR	40	75	N, PC, SN, R2, DR	13	85	AA, N, PC, SN, R2, DR	4	95

Non-residential receiver
Developed settlements (urban and suburban)

	Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	330				N	140	65	N, PC, RO	45	75
Hospital wards and operating theatres	Day	65	140							N, PC, RO	45	75
Place of worship	Day	55	330				N	140	65	N, PC, RO	45	75
Active recreation	Day	65	140							N, PC, RO	45	75
Passive recreation	Day	60	215				N	85	70	N, PC, RO	45	75
Industrial premise	Day	75	45							N, PC, RO	45	75
Offices, retail outlets	Day	70	85							N, PC, RO	45	75

	OOHW			$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	140				N, R1, DR	85	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
	Night	65	140	N	140	65	N, R2, NR	85	70	N, PC, SN, R2, DR	25	80	AA, N, PC, SN, R2, DR	8	90
Place of worship	Evening	55	330				N, R1, DR	215	60	N, R1, DR	85	70	N, R1, DR, PC, SN	25	80
	Night	55	330	N	330	55	N, R2, NR	215	60	N, PC, SN, R2, DR	85	70	AA, N, PC, SN, R2, DR	25	80
Active recreation	Evening	65	140				N, R1, DR	85	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
Passive recreation	Evening	60	215				N, R1, DR	140	65	N, R1, DR	45	75	N, R1, DR, PC, SN	14	85
Industrial premise	Evening	75	45				N, R1, DR	25	80	N, R1, DR	8	90	N, R1, DR, PC, SN	3	100
	Night	75	45	N	45	75	N, R2, NR	25	80	N, PC, SN, R2, DR	8	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	85				N, R1, DR	45	75	N, R1, DR	14	85	N, R1, DR, PC, SN	5	95
	Night	70	85	N	85	70	N, R2, NR	45	75	N, PC, SN, R2, DR	14	85	AA, N, PC, SN, R2, DR	5	95

Non-residential receiver Propagation across a valley / over water	Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 dB(A)					
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	440				N	140	65	N, PC, RO	45	75
Hospital wards and operating theatres	Day	65	170							N, PC, RO	45	75
Place of worship	Day	55	440				N	140	65	N, PC, RO	45	75
Active recreation	Day	65	170							N, PC, RO	45	75
Passive recreation	Day	60	280				N	85	70	N, PC, RO	45	75
Industrial premise	Day	75	45							N, PC, RO	45	75
Offices, retail outlets	Day	70	100							N, PC, RO	45	75

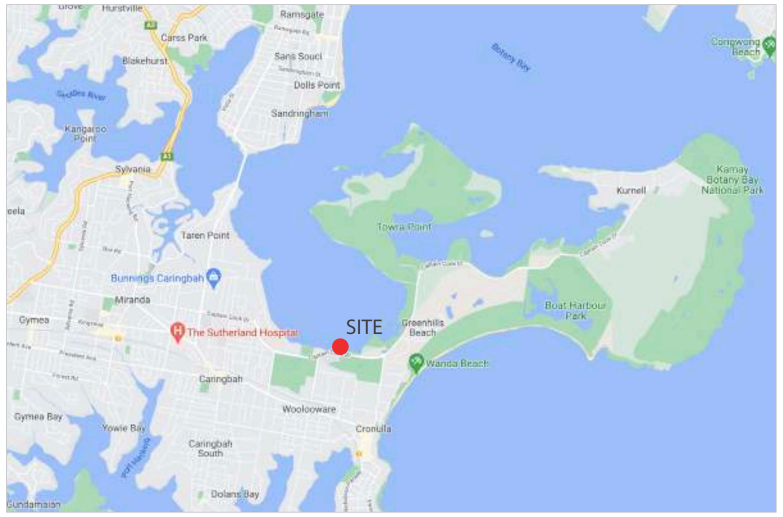
	OOHW			$L_{Aeq(15minute)}$ noise level above NML											
				< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	170				N, R1, DR	100	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
	Night	65	170	N	170	65	N, R2, NR	100	70	N, PC, SN, R2, DR	25	80	AA, N, PC, SN, R2, DR	8	90
Place of worship	Evening	55	440				N, R1, DR	280	60	N, R1, DR	85	70	N, R1, DR, PC, SN	25	80
	Night	55	440	N	440	55	N, R2, NR	280	60	N, PC, SN, R2, DR	85	70	AA, N, PC, SN, R2, DR	25	80
Active recreation	Evening	65	170				N, R1, DR	100	70	N, R1, DR	25	80	N, R1, DR, PC, SN	8	90
Passive recreation	Evening	60	280				N, R1, DR	170	65	N, R1, DR	45	75	N, R1, DR, PC, SN	14	85
Industrial premise	Evening	75	45				N, R1, DR	25	80	N, R1, DR	8	90	N, R1, DR, PC, SN	3	100
	Night	75	45	N	45	75	N, R2, NR	25	80	N, PC, SN, R2, DR	8	90	AA, N, PC, SN, R2, DR	3	100
Offices, retail outlets	Evening	70	100				N, R1, DR	45	75	N, R1, DR	14	85	N, R1, DR, PC, SN	5	95
	Night	70	100	N	100	70	N, R2, NR	45	75	N, PC, SN, R2, DR	14	85	AA, N, PC, SN, R2, DR	5	95

Appendix N

Visual Assessment

WOOLOOWARE BAY OYSTER FARM
LOT 2, CAPTAIN COOK DRIVE, WOOLOOWARE BAY NSW 2230
VISUAL IMPACT STUDY

DRAWING LIST



LOCATION PLAN

EXISTING IMAGE - WOOLOOWARE BAY OYSTER FARM

NOTE:
THE VISUAL IMPACT STUDY CONTAINED IN THIS PACKAGE IS BASED ON THE METHODOLOGY SET OUT BY TFNSW:
- GUIDELINES FOR LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT
- ENVIRONMENTAL IMPACT ASSESSMENT PRACTICE NOTE: EIA - N04 RMS / DECEMBER 2018

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Woolooware Bay Oyster Farm

The map illustrates the Oyster Farm site and its surrounding context with a mix of natural ecosystems and suburban environments co-existing in close proximity to each other.

The map shows 5 key positions from which the existing oyster farm can be seen. This is particularly important to study the visual impact the proposed design will have on the surrounding environment. The 5 locations represent the 5 areas pedestrians or the public will be able to view the overwater structures whether that be from a public forehsore park such as at Sandringham or from a boat within Woolooware Bay.

The 5 locations:
- 1: Towra Point Reserve
- 2: Woolooware Bay
- 3: Taren Point
- 4: San Souci Park/Sandringham Foreshore
- 5: Rocky Point Road Bridge

Woolooware Bay Oyster Farm

Visual Impact Study - Site Map

DATE 18.10.2021

DWG NO LA-2

REV -

CLIENT Transport NSW

ENGINEER Tonkin

Rev	Description	Date
A	For Information	18.10.2021

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Image 1:
The existing view of the current oyster farm overwater structures is taken from the water near Towra Point Reserve located North of the site on the inside Woolooware Bay. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

The proposed overwater structures for the new oyster farm precinct take the form of a dark green facade to blend in to the surrounding mangrove ecosystem.

Image 2:
The existing view of the current oyster farm overwater structures is taken from the water inside Woolooware Bay. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

The proposed overwater structures for the new oyster farm precinct take the form of a dark green facade to blend in to the surrounding mangrove ecosystem.

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Woolooware Bay Oyster Farm

Visual Impact Study - Existing View

DATE 18.10.2021

DWG NO LA-3

REV -

CLIENT Transport NSW

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Rev	Description	Date
A	For Information	18.10.2021

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Image 1:
The existing view of the current oyster farm overwater structures is taken from Taren Point located North West of the site inside Woolooware Bay. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

The proposed overwater structures for the new oyster farm precinct take the form of a dark green facade to blend in to the surrounding mangrove ecosystem.

Image 2:
The existing view of the current oyster farm overwater structures is taken from the Sandringham Foreshore located North of the site on the banks of the Georges River. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

The proposed overwater structures for the new oyster farm precinct take the form of a dark green facade to blend in to the surrounding mangrove ecosystem.

Woolooware Bay Oyster Farm

Visual Impact Study - Existing View

DATE 18.10.2021

Rev	Description	Date
A	For Information	18.10.2021

DWG NO LA-4

REV -

CLIENT Transport NSW

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Image 1:
The existing view of the current oyster farm overwater structures is taken from the Rocky Point Road Bridge located North West of the site as it crosses the Georges River. The existing structures are visible although extremely hard to see any detail other than the rough shape of the building and the colour.

The proposed overwater structures for the new oyster farm precinct take the form of a dark green facade to blend in to the surrounding mangrove ecosystem.

Concluding Statement:

The footprint of the proposed works, the replacement of existing white buildings with dark green structures and the height, form and design of the new buildings, set within the mangroves, make the development unintrusive and a minimal impact on the landscape character of the setting.

Apart from water views from boats, most viewpoints and properties are distant and from these the project will have a negligible visual impact, if not a slight beneficial improvement due to the use of dark colours to replace the existing light coloured buildings.

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Woolooware Bay Oyster Farm

Visual Impact Study - Existing View

DATE 18.10.2021			DWG NO LA-5	REV -	CLIENT Transport NSW
Rev A	Description For Information	Date 18.10.2021	Tel. 02 9452 4911 mob. 0419 501 681	admin@ pdsdesign.com.	ENGINEER Tonkin

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Appendix O

Key Stakeholder Consultation

David Doyle
Transport for NSW
Project Manager
Woolooware Oyster Precinct Redevelopment
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Dear Mr Doyle

The NSW Shellfish Committee comprising oyster industry, NSW Farmers Association, wild shellfish harvest and agencies has been kept up to date with the remediation and redevelopment of the sole remaining oyster industry land base in Georges River/Botany Bay.

Oyster farming is a sustainable and viable activity producing high quality seafood and creating employment and economic opportunities. In what was the birthplace of oyster farming in Australia, NSW Shellfish Committee advocates that the retention and expansion of the oyster industry in Woolooware Bay and Quibray Bay is a priority outcome.

In addition to the production of high quality seafood, oyster production provides significant environmental services to maintain and improve water quality and support species diversity and abundance in and around oyster cultivation. Oyster industry best management practices are detailed in the 2021 edition of the NSW Oyster Industry Sustainable Aquaculture Strategy which also highlights water quality protection and an industry "good neighbour" policy. These standards compliment the need to protect the adjacent Aquatic Reserve and its values.

The redevelopment of the site also supports the ground breaking selective breeding program of Sydney Rock Oysters for disease resistance. The advances in QX disease resistance breeding have been possible because of continuous access to this site since 2005. DPI, CSIRO, University of Sydney, University of Technology Sydney as well as other universities undertake oyster research programs from this site as it provides both access to leases and support from industry to manage experiments. The outcomes of this research support the broader NSW aquaculture industry. This has been raised in importance this year with the detection of QX oyster disease in Port Stephens for the first time.

NSW Shellfish is very supportive of the work undertaken by Transport for NSW to remediate and redevelop the Woolooware oyster land base into what will become a world class aquaculture precinct.

Kind regards
Shauna Murray

Chair NSW Shellfish Committee

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Appendix P

Heritage Searches and PACHCI Assessment

27 January 2021

Joseph Fanous
Senior Manager
Environment & Sustainability
Safety, Environment and Regulation
Transport for NSW

Dear Mr Fanous

Preliminary assessment results for Overwater Structures at Oyster Farm, Woolooware Bay based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).

The project, as described in the Stage 1 assessment checklist (see attached), was assessed as being unlikely to have an impact on Aboriginal cultural heritage.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Transport for NSW procedure.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact me and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Transport for NSW *Unexpected Archaeological Finds Procedure*.

For further assistance in this matter do not hesitate to contact me.

Yours sincerely / faithfully

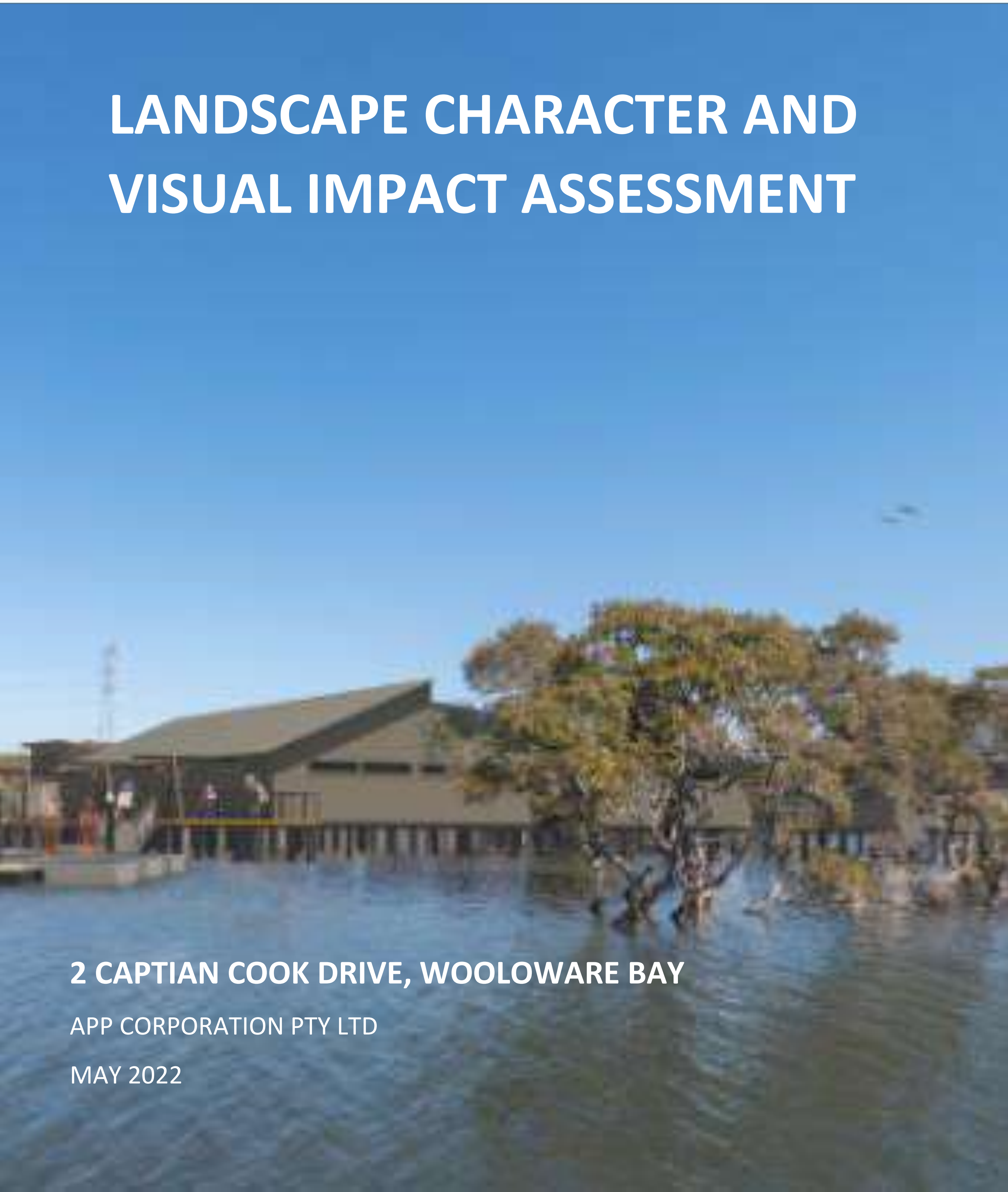
Noni Ross
Aboriginal Cultural Heritage Advisor – Sydney Region

Appendix Q

Landscape Character and Visual Impact Assessment

APP | Property and Infrastructure Specialists

LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT



2 CAPTIAN COOK DRIVE, WOOLOWARE BAY

APP CORPORATION PTY LTD

MAY 2022

Contents

Landscape Character and Visual Impact Assessment

1.0 Introduction

This Landscape Character and Visual Impact Assessment (VIA) has been undertaken by APP Corporation's Landscape Architects, for inclusion in the Review of Environmental Factors (REF) which seeks approval for works to the existing Oyster Farm (the Proposal).

The purpose of this VIA is to provide a qualitative and quantitative assessment of the potential impacts resulting from the existing Oyster Farm's (the Property) proposed improvements. This VIA will address the landscape character impact and the visual impact the proposal has on the Property & its broader Lease Area.

This VIA follows the general report structure recommended within Transport for NSW 'Guideline for landscape character and visual impact assessment'. As such, the body of this VIA report shall describe the existing landscape character, assess the Proposal against the current visual quality, and provide recommendations for required mitigation measures.

2.0 Proposal Overview

2.1 Proposal Description

The Oyster Farm is located at 2 Captain Cook Dr, Woolooware NSW 2230, just off Captain Cook Drive, within the southern-most region of Woolooware Bay. The existing Oyster Form built form is positioned within the dominant Grey Mangrove Forest community within this region. As highlighted within Figure 1, the property stretches over 9000 hectares and contributes to the New South Wales oyster aquaculture industry.

As noted previously within the REF, the Proposal is seeking to demolish and replace a number of the existing overwater structures such as buildings and commercial infrastructure, so that the existing oyster aquaculture use can continue to operate within the alignment of modern / current industry standards. No change to the existing use of the Property is sought as part of the proposed activity.

There has been a concerted effort to minimise the visual impact of the Proposal, through the implementation of design vernacular which is sensitive to the natural environment. This is proposed through the repurposing of existing materials such as wharfs, pier structures and other building materials. Colourways and overall development appearance is also being highly regulated; dark green colour tones and the moderation of building scale are to result in unobtrusive design language. The identified primary features of the proposal are summarised in Table 1 below.

Table 1 Proposal Overview

Item	Description
Water-Based Features	
Over-Water Buildings	Stage 1: • Construction of Building 3 • Constructed on steel piles above water Stage 2: • Construction of Buildings 1 and 2 • Constructed on steel piles above water
Over-Water Walkways	• Walkways 1, 2, 3 • Constructed on steel piles above water • Constructed FRP mesh to allow for light penetration • Handrails
Floating Pontoons	• Construction of two proprietary system pontoons
Land-Based Features	
Buildings	• Land-baseded future buildings are subject to future development applications and are proposed to be industrial warehouse structures.
Pedestrian Access	• Pedestrians to access the over-water structures via three designated walkways.

Figure 1 Property Location (Google, 2022)

Figure 2 Existing Property Composition (Google, 2022)

2.2 Existing Natural Environment

The property is bound by Grey Mangrove Forest ecological typology, which is the primary and dominant type of vegetation in is proximity. This vegetation typology exists, predominantly, to the East, West and South of the Proposal. The Northern aspect of the Proposal is largely vegetation free and exposed to the shallow, open waters of Woolooware Bay.

To the Northeast of the Proposal is Towra Point Nature Reserve, which extends North by roughly 4km. The site is therefore located within the Refuge Zone of the Towra Point Aquatic Reserve.

2.3 Existing Built Form

As represented in Figure 3, the existing built form constitutes a variety of commercial buildings, structures and infrastructure positioned in an almost linear alignment between Captain Cook Drive and Woolooware Bay. These are located both on-land and over-water. The buildings are generally 1-2 stories in height and comprised of an assortment of materials including painted and bare metal, and other types of cladding. Most of these materials are brightly coloured or tonal in appearance and largely visible from at least 200m away within Woolooware Bay.

The existing water-based oyster farm infrastructure consists of linear-aligned timber posts extending roughly 500-1000mm above the surface of the water, highlighted in Figure 4.

Figure 3 ***Viewing south towards the existing oyster farm, as taken from a drone just north of the proposal within Woolooware Bay (PDS, 2021)***

Figure 4 View North from the Proposal Site towards Woolooware Bay (PDS, 2021)

Figure 5 Viewing North towards the Proposal Site, from Captain Cook Drive (Planners to Reference image)

2.4 Aboriginal and European Heritage

It is noted that an Aboriginal Cultural Heritage review was conducted, and the outcomes of that review were provided by letter from a Transport for NSW Aboriginal Cultural Heritage Advisor. Outcomes of this review can be found within this REF.

3.0 Landscape Character & Visual Impact Assessment

3.1 Urban Design Principles

Urban design principles have been integrated within the design of the Proposal and include several key design considerations. This design vernacular is required to achieve development outcomes which are sensitive to the Proposal locale, as highlighted below:

- The design, form and order of existing structurers on-site is to inform future development and built form, this would include buildings / structures, pontoons, walkways, and aquaculture infrastructure.
- Colour palette and tones for proposed materials must respond to the collective existing maritime, vegetation and aquatic landscape character.
- The Proposal must include works that improve accessibility, wayfinding and visitor services.
- Approaching the site from land (Captain Cook Drive) or water (Woolooware Bay) must be considered in the design for built form / structures, to maximise visual amenity and align with the existing urban and natural environments.
- Proposed development must contribute and compliment the visual amenity.
- Landscape treatment / landscape works to the Proposal must occur to soften its appearance from the aforementioned approaches.

3.2 Evaluation

The Landscape Character & Visual Impact Assessment is designed to evaluate the Proposal against the existing urban form, the natural environment and to the context of local surrounds. In an urban context, the term 'landscape' refers to both the built and natural environment and is key in determination of the character and function of a place – the area in which the Proposal is located. Within an ephemeral context this includes all elements within public realm, private and shared spaces, and the interrelationship between these elements and the people who use them.

To assess the Proposals potential landscape character outcome, its major features have been considered in terms of their 'magnitude of change' or simply put the extent of visual impact resulting from the change.

The resulting magnitude assigned considers direct impacts on the landscape, such as the removal of structures and tree canopies, as well as indirect impacts such as changes to the function of an area. The magnitude of change can result in adverse or positive visual impacts and is defined in below in Table 2 below.

Table 2 *Landscape Magnitude of Change (TfNSW, 2020) (Planning NSW, 2016)*

Landscape Magnitude of Change	Description of Impact
Considerable reduction or improvement	A substantial portion of the landscape is changed. This may include substantial changes to new areas and infrastructure, vegetation cover (trees and canopy), the use of the public realm, accessibility, permeability, wayfinding, comfort and amenity, activation and safety.
Noticeable reduction or improvement	A portion of the landscape is changed. This may include some low to medium noticeable changes to new areas and infrastructure, vegetation cover (trees and canopy), the use of the public realm, accessibility, permeability, wayfinding, comfort and amenity, activation and safety.
No perceived reduction or improvement	There is no perceived change in the landscape quality. Does not alter or not noticeably alter new areas and infrastructure, vegetation cover (trees and canopy), the use of the public realm, accessibility, permeability, wayfinding, comfort and amenity, activation and safety.

The likely Magnitude of Change resulting from key elements of the Proposal has been provided in Table 3 below.

Table 3 *Proposal Magnitude of Change*

Item	Landscape Magnitude of Change	Comment
Water-Based Features		
Over-Water Buildings	Noticeable reduction or improvement	Demolition & re-build of over-water buildings considerable visual improvement and higher contributor to surrounding landscape character. Proposed built form / structures contemporary in order, form and design. Proposal materiality will support and accommodate the oyster aquaculture landscape character. The proposed colour, design and order of the Proposal structures to improve the developments ephemeral relationship, from both land and water.
Over-Water Walkways	Noticeable reduction or improvement	The proposal's open-water walkways considered a visual improvement to the development via the updated design of the steel piles and the use of darker, semi-transparent materials like FRP mesh, which allow light penetration pass-through.

Item	Landscape Magnitude of Change	Comment
		The modernisation of over-water walkways will provide safe and compliant access and passage system through the development.
Floating Pontoons	Considerable reduction or improvement	Floating pontoons proposed along perimeter of the site are a considerable change to existing landscape character when viewed from both land and water.
Land-Based Features		
Buildings	Noticeable reduction or improvement	Demolition & re-build of land-based buildings considerable visual improvement and higher contributor to surrounding landscape character. Proposed built form / structures contemporary in order, form, and design. Proposal materiality will support and accommodate the oyster aquaculture landscape character. The proposed colour, design, and order of the Proposal structures to improve the development's ephemeral relationship, between both land and water.
Pedestrian Access	No perceived reduction or improvement	Proposed upgrade of pedestrian access infrastructure through site considered low impact to surrounding landscape character.

Note: The Construction of the Proposal building, and infrastructure is proposed to be staged following the commencement of demolition works, to support continued aquaculture activities.

3.3 Methodology

The methodology adopted for this Visual Impact Assessment is guided by policy and guidelines outlined in the 'Guideline for Landscape Character and Visual Impact Assessment' (Transport for NSW, 2020).

The following has been undertaken for this assessment:

- Hybrid on-site and desktop study using aerial mapping resources, site photos and other accessible imagery etc, to identify the visual catchment of the Proposal and thus the likely virtual receivers.
- Required reporting due diligence: preliminary desktop study > ground-truthing > investigative reporting.
- Supporting technical investigations:
    - Landscape Visualisation Study
    - Building Design Package
    - Visual Impact Study.

- Assess and describe existing build and natural environment, to establish a baseline.
- Identifying user groups who may experience a visual impact (sensitive visual receivers).
- Visual Impact Assessment using the Roads & Maritime 'Impact Grading Matrix' to evaluate visual impact, to industry standards.

Two primary measures have been used to determine the potential impacts the proposed works/structures will have on the existing environment, which are:

1. Sensitivity of the character; and
2. Magnitude of the proposal.

Each measure is described and defined below.

3.3.1 Sensitivity

For ease of reference, the 'Guideline for Landscape Character and Visual Impact Assessment' (Transport for NSW, 2020) definition of 'Sensitivity' in the context of Visual Impact Assessment has been provided below in Figure 6.

> *Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change. For example, a pristine natural environment is likely to be more sensitive to a change of the nature of a four-lane motorway than a built-up industrial area.*
>
> *The design quality of the proposed development does not make the area less sensitive to change but instead affects the magnitude of the impact…*

Figure 6 Definition of Sensitivity (TfNSW, 2020)

Figure 7 below is an excerpt sourced from the 'Landscape Institute and Institute of Environmental Management and Assessment' (LIIEMA, 2013). These impact definitions have been employed to identify and calculate the impact to identify visual receiver sensitivity.

High	Private residents at home with prolonged viewing opportunities, heritage properties and landscapes
Moderate	Commercial properties, travellers on road, rail or other transport routes with an interest in their environment
Low	Low transient type spaces and people at their place of work whose attention is on their work
Negligible	Bushland, rural area and other properties with little to no viewing potential

Figure 7 Visual Impact Definitions (LIIEMA, 2013)

Thus - The higher the visual quality of the landscape, the greater the significance and impact of introducing new development and therefore the higher the sensitivity.

3.3.2 Magnitude

For ease of reference, the 'Guideline for Landscape Character and Visual Impact Assessment' (Transport for NSW, 2020) definition of 'Magnitude' in the context of Visual Impact Assessment has been provided below in Figure 8.

> *Magnitude refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition. For example, a large interchange would have a very different impact on landscape character than a localised road widening in the same area. A more distant bridge would have a lesser magnitude than one nearer to residents. A vegetated embankment facing a parkland would have less contrast than a retaining wall in the same location. Magnitude will also need to consider cumulative impact, which is a consideration of the result of the incremental impact of the proposal when added to other past, current and known likely future activity.*

Figure 8 Definition of Magnitude (TfNSW, 2020)

Impacts on Landscape Character is determined using the Roads & Maritime Impact Grading Matrix, represented in Figure 9 (Transport for NSW, 2020). Rankings for 'Sensitivity' and 'Magnitude' are combined to generate the impact in the body of the table.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High Impact	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low Impact	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 9 Roads & Maritime Impact Grading Matrix (TfNSW, 2020)

3.4 Viewpoint Analysis

4 Key Viewpoints have been identified as potentially being impacted by the Proposal, as represented within Figure 10: Viewpoint Locations (APP, 2022). The Key Viewpoint's sensitivity to change resulting from the Proposal have been assessed.

Viewpoint #	Location
1	Views towards Proposal George's River West
2	Views towards Proposal George's River East
3	Views towards Proposal from Captain Cook Drive, West-Bound
4	Views towards Proposal from Captain Cook Drive, East-Bound

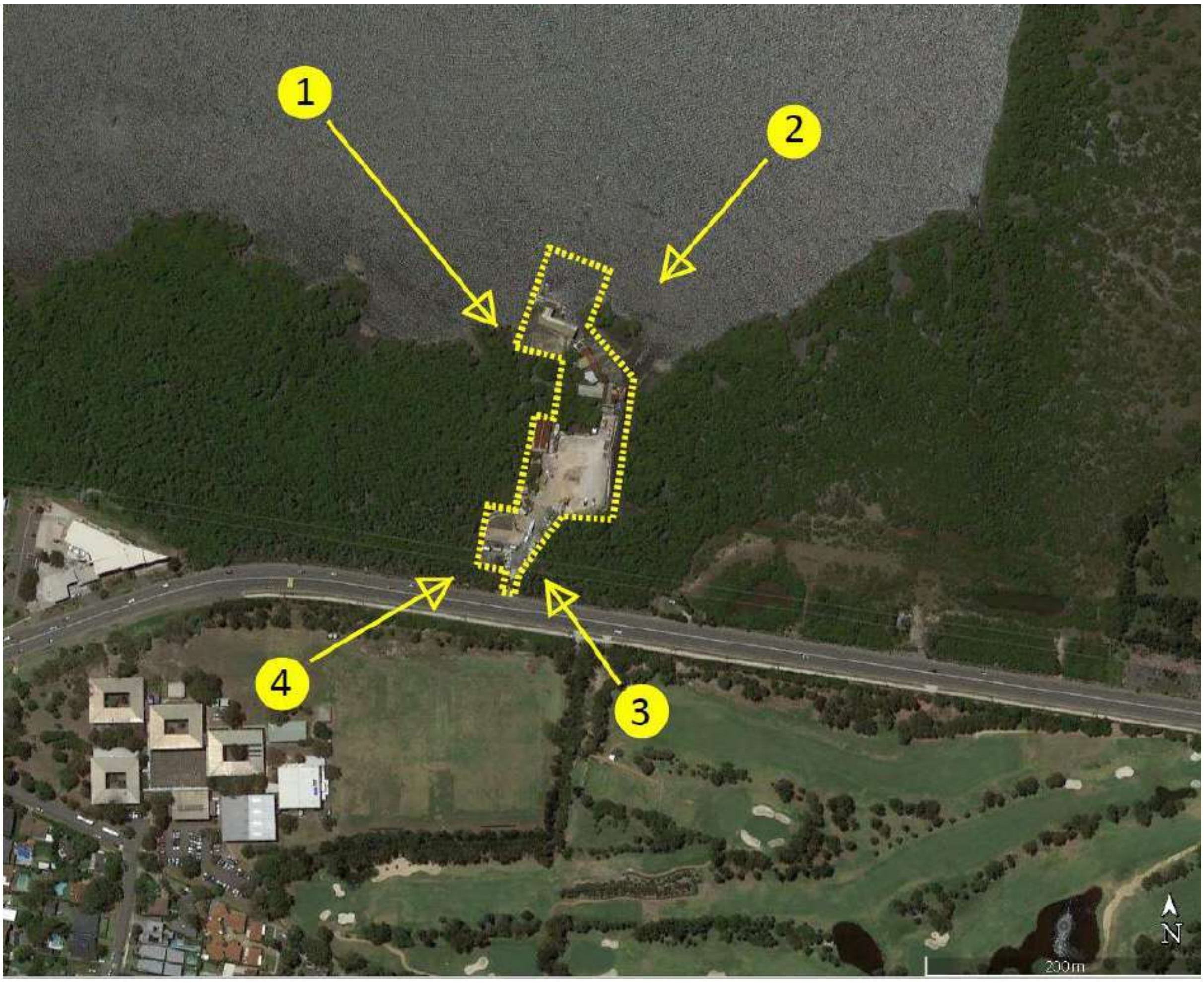


Figure 10 Viewpoint Locations (APP, 2022)

Figure 11: Viewpoint 1 – Views toward Proposal Site from George's River West (PDS, 2021)

Figure 12 Viewpoint 1 – Views toward Proposal Site from George's River West: Photomontage (PDS, 2021)


Figure 13 Viewpoint 2 – Views toward Proposal Site from George's River East (PDS, 2021)


Figure 14 Viewpoint 2 – Views toward Proposal Site from George's River East: Photomontage (PDS, 2021)

Figure 15 Viewpoint 3 – Views toward Proposal Site from Captain Cook Drive, West-Bound (Google, 2022)

Figure 16 Viewpoint 4 – Views toward Proposal Site from Captain Cook Drive, East-Bound (Google, 2022)

View #	Description & Visual Impact	Sensitivity	Magnitude	Impact
1	<u>Existing Condition</u> Views towards the Proposal from Viewpoint 1 are dominated by the current overwater structures that form the Woolooware Bay Oyster Farm. Several derelict structures present, some partially obstructed by Mangrove vegetation. The structures are typically very light in tone / appearance and contrast with Mangrove vegetation and dark water, thus are dominant within the landscape. <u>Proposal Visual Impact</u> The Proposal development provides a uniform design vernacular and palette of materials selected, in sensitivity to the natural landscape character. New paving and other site infrastructure works have been chosen to complement and integrate into the existing natural environment. The Proposal will be similar in tone to the existing Grey Mangrove Forest. The potential visual impact is considered Low.	Moderate	Negligible	Low Impact
2	<u>Existing Condition</u> Views towards the Proposal from Viewpoint 1 are dominated by the current overwater structures that form the Woolooware Bay Oyster Farm. Several derelict structures present, some partially obstructed by Mangrove vegetation. The structures are typically very light in tone / appearance and contrast with Mangrove vegetation and dark water, thus are dominant within the landscape. <u>Proposal Visual Impact</u> The proposed maritime infrastructure is an overall larger structure than the existing. The proposed maritime infrastructure will sit low within the aquatic landscape. The proposed maritime infrastructure will blend in with the dominant Grey Mangrove Forest.	Moderate	Negligible	Low Impact

View #	Description & Visual Impact	Sensitivity	Magnitude	Impact
	The potential visual impact of the new wharf is considered Low.			
3	Existing Condition Views towards the Proposal Site from Viewpoint 3 are significantly impeded or blocked due to the dense vegetation lining Captain Cook Drive. When travelling West along Captain Cook Drive there is minimal to no chance of being able to see the Proposal / view into the Site. Proposal Visual Impact The proposed maritime infrastructure will sit low within the terrestrial landscape. The proposed maritime infrastructure will blend with the dominant Grey Mangrove Forest. The potential visual impact is considered negligible.	Negligible	Negligible	Negligible Impact
4	Existing Condition Views towards the Proposal Site from Viewpoint 3 are significantly impeded or blocked due to the dense vegetation lining Captain Cook Drive. When travelling East along Captain Cook Drive there is minimal to no chance of being able to see the Proposal / view into the Site. Proposal Visual Impact The proposed maritime infrastructure will sit low within the terrestrial landscape. The proposed maritime infrastructure will blend with the dominant Grey Mangrove Forest. The potential visual impact is considered negligible.	Negligible	Negligible	Negligible Impact

The Proposal seeks to replace the existing dilapidated development with newer infrastructure which is more sensitive to the natural landscape in which it is located. The existing bright and rundown elements are to be replaced with a more coordinated materials palette that complements the existing Grey Mangrove Forest and other natural dark elements within this locus. As such, the proposed works will have an overall Negligible to Low Impact.

Views into the Proposal Site from Captain Cook Drive are all but impassable due to dense native vegetation blocking views from Viewpoint receivers.

As noted within the Arborist report, the native vegetation lining Captain Cook Drive will not be impacted by the Proposal, thus the visual impact for visual receivers from these viewpoints will remain largely unchanged.

4.0 Mitigation and Management

4.1 Construction

The following safeguard measures should be implemented during the construction phase(s) to minimise visual impacts:

Impact	Environmental safeguards	Responsibility	Timing
Visual	Avoid unnecessary loss or damage to vegetation adjacent to the proposal by protecting trees prior to construction and/or trimming vegetation to avoid total removal.	Contractor	Pre-Construction
Visual	Site amenities, plant and equipment, and waste skips would be locked, and if possible, placed on barges out of hours.	Contractor	Construction
Visual	Minimise temporary visual impacts by maintaining a clean and tidy worksite.	Contractor	Construction
Visual	Restore any areas that are impacted by construction with appropriate landscape treatments.	Contractor	Construction / Maintenance & Site Establishment

The demolition of existing structures & infrastructure, and construction of the Proposal will have short-term impacts on the existing character of the site. Site amenities, material stockpiles, and delivery and dispatch vehicles may be visible from viewpoints across Captain Cook Drive and from the waters of Woolooware Bay, however, this impact is considered a negligible impact.

4.2 Operation

The following operational measures should be implemented to minimise the short-term and long-term visual impacts:

Impact	Environmental safeguards	Responsibility	Timing
Visual	Rehabilitation planting to be undertaken as early as possible to replace vegetation that provided screening to sensitive visual receivers.	Contractor	Construction
Visual	If visually significant vegetation takes place unplanned, prepare documentation as soon as possible to mitigate and reduce the visual influence.	Contractor	Construction

Visual	Consistent landscape maintenance works to be undertaken to ensure the health and effectiveness of existing planting to help buffer the removal of any existing landscape items.	Contractor	Construction Maintenance Site Establishment

The Operational, long-term visual impacts were assessed by the architect and included the following considerations:

- The footprint of the proposed works.
- Replacement of existing bright buildings with dark green, homogenous structures.
- Height, form and design of the new buildings, to visually co-exist with the surrounding native vegetation.

The 4 viewpoints assessed are considered the most critical due to proximity to the Proposal, however from these viewpoints the Proposal will have an overall negligible visual impact. Moreover, the Proposals colour palette may result in an improved (lesser) visual impact due to the proposed design vernacular and colour of the Proposal.

5.0 Conclusion

The assessment of the impacts of the proposed development on local landscape and visual quality has been carried out in accordance with the following TfNSW Guidelines:

- 'Beyond the Pavement: urban design approach and procedures for road and maritime infrastructure planning, design and construction' (RMS, 2020)
- Guideline for Landscape Character and Visual Impact Assessment - Environmental Impact Assessment Practice Note EIA-NO4 (RMS, 2018).

The assessment has found that the proposal would have an acceptable impact on landscape and visual quality when viewed from Woolooware Bay and from its foreshore. It is considered that with regard to visual and landscape impacts the proposal is worthy of support.

Appendix R

Construction and Demolition Waste Management Plan

Woolooware Bay Oyster Farm

Commercial Development

CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

20/05/2022
Revision A

Client

Transport NSW

Architect

Paterson Design Studio

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SCOPE

A Waste Management Plan (WMP) is to be submitted with all development applications for new and change-of-use developments that will generate construction, demolition and operational waste.

This WMP applies only to the **construction** and **demolition** phases of the proposed development. The requirements outlined in this WMP must be implemented on site during construction and demolition and may be subject to review upon any change to the design. Construction and demolition waste management requirements will also be subject to review as part of the Construction Management Plan.

The waste management for the **operational** phase of the development is not addressed in this report. An operational WMP has been provided separately.

REVISION REFERENCE

Revision	Date	Prepared by	Reviewed by	Description
A	20-05-2022	T. McPherson	A. Armstrong	Final

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LIST OF TABLES

1 INTRODUCTION

1.1 Background

EFC has been tasked to prepare the following waste management plan for Transport NSW for the management of construction and demolition waste generated by the commercial development located at Woolooware Bay Oyster Farm.

Waste management strategies and auditing are a requirement on construction sites to promote strong sustainability outcomes. It is EFC's belief that a successful waste management strategy contains three key objectives:

i. ***Promote responsible source separation*** to reduce the amount of waste that goes to landfill, by implementing convenient and efficient waste management systems

ii. ***Ensure adequate waste provisions and robust procedures*** that will cater for potential changes during the operational phase of the development

iii. ***Comply*** with all relevant Australian Standards, council codes, policies, and guidelines.

1.2 Site Summary

The proposed development falls under the LGA of Sutherland Shire Council. The site is currently occupied by the existing Oyster Farm Tenancy with a new hardstand area that connects the over-water tenancies from Captain Cook Drive.

The proposal consists of:

- 5 x inland tenancies with a total GFA of 293.8m^2
- 3 x overwater tenancies with a total GFA of 1277.33m^2

All figures and calculations are based on area schedules as advised by our client and shown on architectural drawings.

1.3 Site Location

The site is located at Lot 2, Captain Cook Drive, Woolooware Bay NSW 2230 as shown in Figure.1 (boundaries are indicative only). The site has frontages and vehicular access via Captain Cook Drive.

Source: Google Images

1.4 Legislation and Guidance

Information provided in this WMP comes from a wide range of construction and demolition waste management guidance at the local, state, and federal levels. The primary sources of guidance include:

- Sutherland Shire Development Control Plan 2015
- Australian Government, Department of Sustainability, Environment, Water, Population and Communities. *Construction and Demolition Waste Guide – Recycling and Re-use Across the Supply Chain*. (2014, November).
- NSW Waste Avoidance and Resource Recovery (WARR) Strategy 2014-2021
- NSW Waste Classification Guidelines 2014
- Australia's National Waste Policy 2018

1.5 Waste Diversion Targets

To quantify and measure this sustainable approach to waste management, the NSW WARR Strategy 2014-2021 outlines specific targets in order to clarify the state's long-term goals and priorities. These targets were supported by industry, community, state, and local governments during the Strategy's consultation phase, and include:

- Increasing construction and demolition recycling rates to 80%
- Increasing waste diverted from landfill to 75%
- Reducing litter by 40%
- Reduce illegal dumping incidents by 30%

1.6 Report Objectives

Throughout this report, EFC aims to encourage where practical, having regard to the design, the nature of the material to be demolished and the site constraints, the following waste management practices for the duration of the demolition and construction stages of the development:

- Re-use of excavated material on-site and disposal of any excess to an approved site;
- Green waste mulched and re-used on-site as appropriate, or recycled off-site;
- Bricks, tiles and concrete re-used on-site as appropriate, or recycled off-site;
- Plasterboard waste returned to supplier for recycling;
- Framing timber re-used on site or recycled off-site;
- Windows, doors and joinery recycled off-site;
- All asbestos, hazardous and/or intractable wastes are to be disposed of in accordance with WorkCover Authority and EPA requirements;
- Plumbing, fittings and metal elements recycled off site;
- Ordering accurate quantities of materials and prefabrication of materials where possible;
- Re-use of formwork;
- Careful source separation of off-cuts to facilitate re-use, resale or recycling.

1.7 Limitations

This report has been prepared by EFC for the sole purpose of providing a Construction and Demolition Waste Management Plan (C&D WMP) to support a development application. The report is provided with the following limitations:

- This report is for the sole use of Transport NSW (including their officers, employees and advisers) and should not be used or relied upon by any other party without prior written consent from EFC;

- Drawings, estimates and information contained in this report have been prepared by analysing information, plans and documents supplied by the client, or nominated third parties. Any assumptions based on the information contained in the report are outside the control of EFC;

- The calculations presented in the report are estimates only. The amount of waste generated will be dependent on the approach taken by site management, including the levels of training and education offered to site staff and the actions and attitudes of staff themselves.

- The site manager will make adjustments as required based on actual waste volumes (e.g., if waste volumes are greater than estimated, then waste storage capacity and collection frequencies will increase accordingly) and increase the amount of waste storage and collection frequency accordingly;

- The report has been prepared with all due care and attention; however, no assurance or representation is made that the WMP reflects the actual outcome. EFC will not be liable to for any plans or outcomes that are not suitable for purpose, whether as a result of incorrect or unsuitable information or otherwise;

- EFC offer no warranty or representation of accuracy or reliability of the WMP unless specifically stated;

- Examples of equipment provided in this report should be reviewed by the appropriate equipment supplier who will assess the correct equipment for supply. Reference to any other business or product besides EFC and EFC equipment is for information purposes only, and is not officially endorsed or recommended by EFC.

2 GENERAL WASTE MANAGEMENT PROVISIONS

2.1 Stakeholder Roles and Responsibilities

All stakeholders have a responsibility for their own environmental performance and compliance with all legislation.

The Construction Contractor will be responsible for implementing this WMP, although site staff have a responsibility to ensure their own compliance at all times. Where possible, an Environmental Management Representative (EMR) should also be appointed for the project to help ensure compliance. The following table demonstrates the primary roles and responsibilities of the respective stakeholders:

Table 1: Stakeholder Roles and Responsibilities

Roles	Responsibilities
Construction Site Management	• Organise waste collections as required; • Organise replacement or maintenance requirements for bins; • Investigate and ensure prompt clean-up of illegally dumped waste materials; • Notify the Principal Certifying Authority (Council) of the appointment of waste removal, transport or disposal contractors for waste tracking purposes; • Ensure waste related equipment is well maintained; • Ensue accurate calculations so only the required amount of materials are ordered; • Ensure segregation of materials to maximise reuse and recycling; • Check waste sorting and storage areas routinely for cleanliness, hygiene, contamination and OH&S issues; • Ensure all monitoring and audit results are well documented and are carried out as specified in the WMP; • Ensure effective signage, communication and education is provided to site staff/contractors; • Provide staff/contractors with equipment manuals, training, health and safety procedures, risk assessments, and PPE to control hazards associated with all waste management activities; • Assess any manual handling risks and prepare a manual handling control plan for waste and bin transfers;
Site Staff/Contractors	• Ensure adequate separation and disposal of waste streams in compliance with the WMP; • Abide by all relevant OH&S legislation, regulations, and guidelines; • Attend training and inductions as required; • Clean and transport bins as required; • Carry out daily visual inspections of waste storage areas; • Organise, maintain and clean the waste storage areas;
Environmental Management Representative (EMR)	• Approach and establish the local commercial reuse of materials where reuse on-site is not practical; • Establish separate skips and recycling bins for effective waste segregation and recycling purposes; • Ensure staff and contractors are aware of site requirements; • Provision of training of the requirements of the WMP and specific waste management strategies adopted for the development; • Contaminated waste management and approval of off-site waste transport, disposal locations and check licensing requirements; • Arrange assessment of suspicious potentially contaminated materials, hazardous materials and liquid waste; • Monitor, inspect and report requirements.
Waste Collection Contractors	• Provide a reliable and appropriate waste collection service; • Provide feedback to construction site management regarding contamination of waste streams; • Work with construction site management to customise waste systems where possible.

2.2 Monitoring and Reporting

It is recommended that the following measures be taken to improve demolition and construction waste management in future and to provide more reliable waste generation figures:

- Compare projected waste quantities with actual waste quantities produced.
- Conduct waste audits of current projects (where feasible).
- Note waste generated and disposal methods.
- Look at past waste disposal receipts.
- Record this information to help in waste estimations for future waste management plans.

Records of waste volumes recycled, reused or contractor removed are to be maintained. Additionally, dockets/receipts verifying recycling/disposal in accordance with the WMP must be kept and presented to Council or the EPA if and when required.

Daily visual inspections of waste storage areas will be undertaken by site personnel and inspection checklists/logs recorded for reporting to the Site Manager on a weekly basis or as required. These inspections will be used to identify and rectify any resource and waste management issues.

Waste audits are to be carried out by the Building Contractor to gauge the effectiveness and efficiency of waste segregation procedures and recycling/reuse initiatives. Where audits show that the above procedures are not carried out effectively, additional staff training should be undertaken and signage re-examined.

All environmental incidents are to be dealt with promptly to minimise potential impacts. An incident register must be maintained on-site at all times and should include the contact details of the 24-hour EPA Pollution line. Likely incidents to occur during the construction and demolition stage of the development may involve fuel or chemical spills, seepage or mishandling of hazardous waste, or unlicensed discharge of pollutants to environment.

2.3 Opportunities for Reuse and Recycling

There are many opportunities to reduce the volume of waste generated during demolition and construction. Adaptive reuse of building materials should be encouraged, with significant consideration given to methods of reusing or recycling materials onsite as well as sourcing used or recycled materials from elsewhere to be used on site.

The site should facilitate where practical reuse and recycling by 'deconstruction', whereby various materials are carefully dismantled and sorted. Any unwanted reusable materials can be taken to a second-hand building centre, reducing waste disposal costs.

Materials that are individually wrapped should also be avoided where possible, with preference given for materials that can be delivered in returnable packaging such as timber pallets.

The table below gives examples of potential reuse and recycling options for the materials likely to be used/generated in construction and demolition at this development:

Table 2: Potential Reuse/Recycling Options for Construction Materials

Material	Reuse/Recycling Potential
Asphalt	Hot in-place recycling or reprocessed into Reclaimed Asphalt Pavement (RAP).
Bricks	Cleaned and/or rendered for reuse, crushed for fill, sold or provided to a recycled materials yard
Cardboard Packaging	Recycled at a paper/cardboard recycling facility
Carpet	Cleaned and reused for the same purpose, reused in landscaping or garages/sheds, recycled at an appropriate processing facility
Concrete, Masonry, Spoil	Reused on-site as fill, levelling or crushed for road base
Doors, Windows, Fittings	Reused in new or existing buildings or sent to second-hand supplier
Glass	Recycled at a glass recycling facility, aggregate for concrete production, crushed for termite barrier, reused as glazing
Green Waste (Organics)	Mulched, composted for reuse, trees chipped for use in landscaping or removed carefully and reused onsite or sold
Hardwood Beams	Reused as floorboards, fencing, furniture or sent to second-hand timber supplier
Insulation Material	Reprocessed to remove impurities and reused for the same purpose or as off-cuts, compressed for ceiling tile manufacture
Metal, Steel/Copper Pipe	Recycled at a metal recycling facility, melted into secondary materials for structural steel, roofing, piping etc. copper sold for re-use
Other Timber	Reused in formwork, ground into mulch for garden or sent to second-hand timber supplier
Plasterboard	Crushed for reuse in manufacture of new plasterboard, returned to supplier or used in landscaping
Plastics	Reused as secondary materials for playgrounds, park benches etc.
Roof Tiles	Cleaned and reused, crushed for reuse for landscaping and driveways or sold or provided to a recycled materials yard
Soil	Stockpiled onsite for reuse as fill
Synthetic & Recycled Rubber	Reused for the same purpose or reprocessed for use in manufacture/construction of safety barriers, speed humps
Topsoil	Stockpiled onsite for reuse in landscaped areas

2.4 Management of Hazardous Waste Materials

For the purpose of this report, hazardous waste materials include any waste that poses a hazard or potential harm to human health or the environment, particularly asbestos waste and asbestos containing material (ACM). The general advice provided in this report is superseded by any specific hazardous materials or remediation control plans prepared for the project.

During the construction phase of the development, there must be a commitment to engage qualified and certified contractors to remove all contaminated/hazardous materials (e.g., asbestos) and dispose of all contaminated/hazardous waste at an appropriately licenced facility, where applicable.

In the event that any contaminated or hazardous materials are unexpectedly uncovered during demolition or excavation works, the Site Manager is to stop work immediately in that location and contact the relevant hazardous waste contractor prior to further works being undertaken in the area.

The following general mitigation measures will apply:

- Contaminated material stockpiled on site will be minimised as far as possible and should be stored on HDPE liner, in a bunded location which is protected from inclement weather;
- Sediment fences should be installed around the base of stockpiles and the stockpiles should be covered. Where excavated material requires validations, samples should be taken for NATA laboratory testing as per the requirements of the contamination assessment prior to restoration works, backfilling exercises and disposal;
- Any trucks carrying contaminated materials should be securely and completely covered immediately after loading the materials (to prevent windblown emissions and spillage) and must be licensed by the NSW Environmental Protection Authority (EPA);
- Decontamination of all equipment prior to demobilisation from the site is important so that contaminated materials are not spread off-site.

2.5 Management of Asbestos

Airborne asbestos is a health hazard. Illegal dumping of asbestos may lead to increased exposure to asbestos fibres. As a result, the movement of asbestos must be monitored to ensure it does not harm the environment or human health.
During the demolition phase of the development, there must be a commitment to engage qualified and certified contractors to remove all contaminated/hazardous materials (e.g., asbestos) and dispose of all contaminated/hazardous waste at an appropriately licenced facility, where applicable.

NSW
Removal must be by a professional licensed by SafeWork NSW.
Asbestos waste must be tracked when transported from its place of generation to its final destination. WasteLocate is NSW EPA's online system for tracking asbestos waste within NSW.

Under clause 79 of the *Protection of the Environment Operations (Waste) Regulation 2014*, waste operators, transporters, and waste and recycling facilities must use WasteLocate when consigning, transporting or accepting more than 100kg of asbestos waste, or more than 10 square metres of waste asbestos sheeting, in any single load. For more information, visit www.asbestos.nsw.gov.au

Technical Support – Amtac Professional Services – 1800 420 380 or WasteLocate@QR2id.com

In the event that any contaminated or hazardous materials are unexpectedly uncovered during demolition or excavation works, the Site Manager is to stop work immediately in that location and contact the relevant hazardous waste contractor prior to further works being undertaken in the area.

The following general mitigation measures will apply:

- Contaminated material stockpiled on site will be minimised as far as possible and should be stored on HDPE liner, in a bunded location which is protected from inclement weather;
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- Any trucks carrying contaminated materials should be securely and completely covered immediately after loading the materials (to prevent windblown emissions and spillage) and must be licensed by the NSW Environmental Protection Authority (EPA);
- Decontamination of all equipment prior to demobilisation from the site is important so that contaminated materials are not spread off-site.

2.6 Management of Excavation Waste

For the purpose of this report, excavation waste consists of any unwanted material generated from excavation activities such as a reduced level dig, site preparation and levelling and the excavation of foundations, basements, tunnels and service trenches. This will typically consist of soil and rock. The general advice provided in this report is superseded by any specific hazardous materials or remediation control plans prepared for the project.

All excavated material generated on this site may be re-used in the landscaping or used on other sites as fill material, provided no contamination is present. If sandstone is found to be present, this may be sold or incorporated into the building design.

The following measures and safeguards will apply to the development for excavated material:

- Wherever practical, excavation material will be reused as part of the development;
- Excavation material that is not natural (virgin) material will be transported to an approved landfill site or off-site recycling depot;
- A waste classification assessment of the fill material should be undertaken prior to it being acceptable for waste disposal purposes;
- Transportation routes for excavation material removed from site will be identified and used.

3 SITE SPECIFIC WASTE MANAGEMENT PROVISIONS

3.1 Demolition Waste Volumes and Management

The demolition stage of the development provides the greatest opportunity for waste minimisation and resource recovery. The first thing that should be considered is whether it is possible to reuse existing buildings or parts of buildings for the proposed use. With careful on-site sorting and storage and by staging work programs it is possible to reuse many materials, either on or off-site.

The existing building at this site will consist of upgrades to the existing works and demolition of selected structures. Where possible, materials will be reused, such as crushing concrete for use as clean fill. However, the majority of the components of the building will either be reused for the same purpose or disposed of offsite.

A demolition contractor will be engaged during this phase of the project. The contractor will be responsible for ensuring all demolition activities are planned and undertaken in accordance with relevant waste minimisation policies and DA requirements.

The table below illustrates the anticipated volumes of materials generated at this development during the demolition stage. Volumes have been advised by our client.

Table 3: Demolition Waste Conversion

Material	Volume (m3)	*Tonnes (t)	**Appx. Percentage Recovered
Excavation Material	250	250	99.8%
Green waste	50	7.5	80%
Bricks	N/A	N/A	100%
Tiles	N/A	3	100%
Concrete	10	1095	100%
Timber	200	6.8	33%
Plasterboard	10	2	50%
Metals	7	21.5	100%
Asbestos	0.2	0	0%
Fibre Reinforced Polymer	0	0	0%
Totals	**1072**	**1385.9**	

**The conversion of materials from volume to tonnes is based on the information provided in a consultation paper published by WA Department of Water and Environmental Regulation <https://www.der.wa.gov.au/images/documents/our-work/consultation/current-consultation/Consultation%20Sheet%20-Approved%20method%20for%20recyclers.pdf>*

***The percentage of recycled demolition waste is estimated by BINGO, and is based on the average quantities of materials received and recovered at their facilities.*

The table below illustrates how the demolition materials will be managed, and estimates percentage of materials diverted from landfill.

Table 4: Demolition Waste Management

			How Waste will be Managed			
Type of Material	**Less than 10m³**	**Estimated Tonnage**	**Reuse On-Site**	**Recycle**	**Landfill**	**Estimated Tonnage of Material Diverted from Landfill**
Excavation Material	☐	250	☒	☐	☒	249.4
Green Waste	☐	7.5	☒	☒	☒	6
Tiles	☐	3	☒	☒	☐	3
Concrete	☐	1095	☒	☒	☐	1095
Timber	☐	6.8	☐	☒	☒	2.3
Plasterboard	☐	2	☐	☒	☒	1.6
Metals	☐	21.5	☒	☒	☐	21.5
Asbestos	☒	0	☐	☐	☒	0
Other Waste	☐	0	☐	☐	☐	0
	Total	**1385.9**				**1378.7**
Total Diversion of Waste from Landfill (Minimum 80%)						**99.5%**

3.2 CONSTRUCTION WASTE VOLUMES AND MANAGEMENT

Waste generated during the construction stage of the development will be managed by the principal contractor and sub-contractors, with materials being reused and recycled wherever possible. Where neither reuse nor recycling are possible, waste will be disposed of as general waste at a licensed landfill site.

Recyclable material generated during construction will largely consist of off-cuts and discarded bricks, timber, steel, concrete, tiles, plasterboard, and piping, as well as packaging materials.

It is important to note that source separation of waste on-site may offer cost savings when compared to the disposal of mixed waste at landfill sites. Further cost savings may be achieved through the use of reusable and recycled-content materials and by reusing materials salvaged from the demolition stage of the development.

The table below illustrates the anticipated volumes of materials generated at this development during the construction stage. Volumes have been advised by our client.

Table 5: Construction Waste Conversion

Material	Volume (m3)	*Tonnes (t)	**Approx. Percentage Recovered
Excavation Material	N/A	N/A	99.8%
Green waste	N/A	N/A	80%
Bricks	N/A	N/A	100%
Tiles	0.15	0.15	100%
Concrete	36.5	54.75	100%
Timber	2.52	0.4788	33%
Plasterboard	N/A	N/A	50%
Metals	4.3	2.15	100%
Other waste	52	15.6	0%
Totals	**95.5**	**73.1**	

**The conversion of materials from volume to tonnes is based on the information provided in a consultation paper published by WA Department of Water and Environmental Regulation <https://www.der.wa.gov.au/images/documents/our-work/consultation/current-consultation/Consultation%20Sheet%20-Approved%20method%20for%20recyclers.pdf>*

***The percentage of recycled waste is estimated by BINGO, and is based on the average quantities of materials received and recovered at their facilities.*

The table below illustrates how the construction materials will be managed, and estimates percentage of materials diverted from landfill.

Table 6: Construction Waste Management

			How Waste will be Managed			
Type of Material	Less than 10m³	Estimated Tonnage	Reuse On-Site	Recycle	Landfill	Estimated Tonnage of Material Diverted from Landfill
Tiles	☐	0.2	☒	☒	☐	0.2
Concrete	☐	54.8	☒	☒	☐	54.8
Timber	☐	0.5	☒	☒	☒	0.16
Metals	☐	2.2	☒	☒	☐	2.2
Other	☐	15.6	☒	☒	☒	4.7
	Total	**73.1**				**61.9**
Total Diversion of Waste from Landfill (Minimum 80%)						**84.6%**

3.3 Recycling Directory

Construction and demolition materials removed from site will need to be managed in accordance with the provisions of current legislation and may include segregation by material type classification in accordance with NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* and disposal at facilities appropriately licensed to receive the particular materials.

Please find the below recommendations for recycling drop off locations for all materials likely to be generated at this development. Only the nearest locations are provided. See www.businessrecycling.com.au for additional locations:

	Business Name	Suburb	Distance (km)
Excavation Material	Breen Resources Pty ltd	Kurnell	5.9
	BINGO Recycling Centre	Mortdale	15
	Get Fast Waste Bins	Mortdale	14
Green waste	Remondis Australia	Taren Point	2.9
	Get Fast Waste Bins	Mortdale	14
	Banksmeadow Recycling	Banksmeadow	19
Bricks	Remondis Australia	Taren Point	2.9
	Breen Resources Pty ltd	Kurnell	5.9
	BINGO Recycling Centre	Mortdale	15
Tiles	Remondis Australia	Taren Point	2.9
	BINGO Recycling Centre	Mortdale	15
	Get Fast Waste Bins	Mortdale	14
Concrete	Remondis Australia	Taren Point	2.9
	Breen Resources Pty ltd	Kurnell	5.9
	BINGO Recycling Centre	Mortdale	15
Timber	Remondis Australia	Taren Point	2.9
	Breen Resources Pty ltd	Kurnell	5.9
	Get Fast Waste Bins	Mortdale	14
Plasterboard	Remondis Australia	Taren Point	2.9
	Breen Resources Pty ltd	Kurnell	5.9
	BINGO Recycling Centre	Mortdale	15
Metals	Remondis Australia	Taren Point	2.9
	Breen Resources Pty ltd	Kurnell	5.9
	BINGO Recycling Centre	Mortdale	15

3.4 Site-Specific Operational Measures

Training/Site Inductions

All staff employed during the demolition and construction stages of the development must undertake site-specific induction training regarding the procedures for waste management. Employees of the head contractor will undertake a specific induction outlining their duties and how they are to enforce the waste management procedures.

Induction training will include the following at a minimum:

- Legal obligations;
- Emergency response procedures on site;
- Waste storage locations and separation of waste;
- Litter management in transit and on site;
- The implications of poor waste management practices;
- Correct use of general-purpose spill kits;
- Responsibility and reporting (including identification of personnel responsible for waste management and individual responsibilities).

Materials Selection and Ordering

- Selection of all materials will be undertaken by architectural designers;
- Prefabrication of materials off-site where possible;
- Materials requirements are to be accurately calculated to minimise waste from over-ordering;
- Materials ordering process is to aim at minimisation of materials packaging;
- Material Safety Data Sheets (MSDS) are to accompany all materials delivered to site, where required, to ensure that safe handling and storage procedures are implemented.

Waste Avoidance Opportunities

- Limiting unnecessary excavation;
- Selection of construction materials taking into consideration to their long lifespan and potential for reuse;
- Ordering materials to size and ordering pre-cut and prefabricated materials;
- Reuse of formwork;
- Planned work staging;
- Use of naturally ventilating buildings to reduce ductwork;
- Reducing packaging waste on-site by returning packaging to suppliers where possible, purchasing in bulk and requesting cardboard or metal drums rather than plastics;
- Requesting metal straps rather than shrink wrap and using returnable packaging such as pallets and reels;
- Reduction of PVC use;
- Use of low VOC (volatile organic compounds) paints, floor coverings and adhesives;
- Use of fittings and furnishings that have been recycled or incorporate recycled materials;
- Use of building materials, fittings and furnishings with consideration to their longevity, adaptation, disassembly, reuse and recycling potential.

Site Procedures

- Excavated materials will be used onsite where practical;
- Green waste will be mulched and reused in landscaping either onsite or offsite;
- Concrete, tiles and bricks will be reused or recycled offsite;
- Steel will be recycled offsite; all other metals will be recycled where economically viable;
- Framing timber will be reused on-site or recycled off-site;
- Windows, doors and joinery will be recycled off-site where possible;
- Plumbing, fittings and joinery will be recycled off-site where possible;
- Plasterboard will be re-used in landscaping on-site or returned to the supplier for recycling where possible;
- All used crates will be stored for reuse unless damaged;
- All glass that can be economically recycling will be;
- All solid waste timber, brick, concrete, rock, plasterboard and other materials that cannot be reused or recycled will be taken to an appropriate facility for treatment to recover further resources or for disposal to landfill in an approved manner;
- All asbestos, hazardous and/or intractable wastes are to be disposed of in accordance with WorkCover Authority and EPA requirements;
- Provision for the collection of batteries, fluorescent tubes, smoke detectors and other recyclable resources will be provided on site;
- Beverage container recycling will be provided on-site for employee use;
- All waste and recycling will be disposed of via council approved systems.

3.5 Location and Design of Waste Management Facilities

General Requirements

All waste management facilities onsite should:

- Be conveniently located to enable easy access for on-site movement and collection;
- Be incorporated with other loading/unloading facilities;
- Have sufficient space for the quantity of waste generated and careful source separation of recyclable materials;
- Have sufficient space to contain any on-site treatment facilities, such as compaction equipment;
- Have adequate weather protection and, where required, be enclosed or undercover;
- Be secure and lockable;
- Be well-ventilated and drained to the sewer;
- Be clearly sign-marked to ensure appropriate use.

Waste and Recycling Receptacles

A sufficient quantity of skip bins should be provided for the separate storage of each type of C&D material generated on site. This will assist in maximising source separation and resource recovery, while reducing the costs and quantity of materials disposed of at landfill.

The size of the receptacles should be appropriate to the nature of waste generated and the available storage area. In general, the following options would be acceptable:

Bin Size	Access	Dimensions
2.5m	Top loading	H: 1.0m L: 2.0m W: 1.2m
3m	Drop door walk-in	H: 1.0m L: 2.4m W: 1.5m
4m	Drop door walk-in	H: 1.2m L: 2.6m W: 1.6m
5m	Drop door walk-in	H: 1.4m L: 3.0m W: 1.6m
6m	Double doors walk-in	H: 0.9m L: 4.0m W: 2.0m

Source: Aussie Bins

If the developer chooses to adopt a traditional waste management strategy, whereby waste is deposited into comingled skip bins to be sorted offsite, a single skip bin would be considered sufficient for purpose. However, if the site is to pursue source separation, dedicated skips for the following materials are recommended:

- Timber;
- Plasterboard;
- Concrete;
- Bricks;
- Scrap metal;
- General waste.

Separate receptacles for the safe disposal of hazardous waste types (i.e. light bulbs, batteries, etc) will also be provided where applicable. Where possible, additional bins will be provided in common areas for the collection of commingled recyclables such as beverage containers (glass, plastic, aluminium), paper products, recyclables food containers, etc. Specialised bins for cigarette butts should also be provided.

Safety and Signage

The following safety measures should be considered for the waste storage area:

- Location should not interfere with sight lines of drivers entering or leaving the site;
- Skip bins should be clearly visible and located in well-lit areas;
- Safe paths of travel should be designated using reflective tape, barriers and cones;
- Skip bins must be secured and must not be over-filled to reduce risk of injury through bins moving and falling objects.

Standard signage will be installed in all waste areas, with all skip bins colour coded and labelled appropriately on all sides to allow clear identification of the type of waste to be deposited into each bin.

Refer to the EPA's website for standard construction waste and recycling signs:

www.epa.nsw.gov.au/wastetools/signs-posters-symbols.htm

Space and Siting Requirements

The waste storage area will be located adjacent to the entrance to the site to enable access and allow sufficient space for the required skip bins and servicing requirements. The storage area will also be flexible in order to cater for change of use throughout demolition and construction works.

Where space is restricted, dedicated stockpile areas will be allocated onsite, with regular transfers to the dedicated skip bins for sorting and collections.

The position of the designated waste holding area onsite may change according to building works and the progression of the development. Access, visual amenity and WHS will always be integral to the selection of waste storage area locations. Any stockpile locations will take into account slope and drainage factors to avoid contamination of stormwater drains during rain events.

Servicing and Transport

The frequency of waste removal from site will be determined by the volume of materials deposited into the dedicated skip bins. Skip bins will be monitored on a daily basis by the Construction Site Manager to ensure they do not overflow. If skip bins are reaching capacity, removal and replacement should be organised for within 24 hours.

All skip bins leaving the site will be covered with a suitable tarpaulin to reduce spillage of waste while in transit.

All waste collection for construction works will be conducted between approved hours as per Council requirements (typically between 7am and 7pm Monday to Friday, and between 7am and 1pm on Saturdays). All waste generated on site will be transported to an approved and appropriately licensed resource recovery facility and/or landfill site.

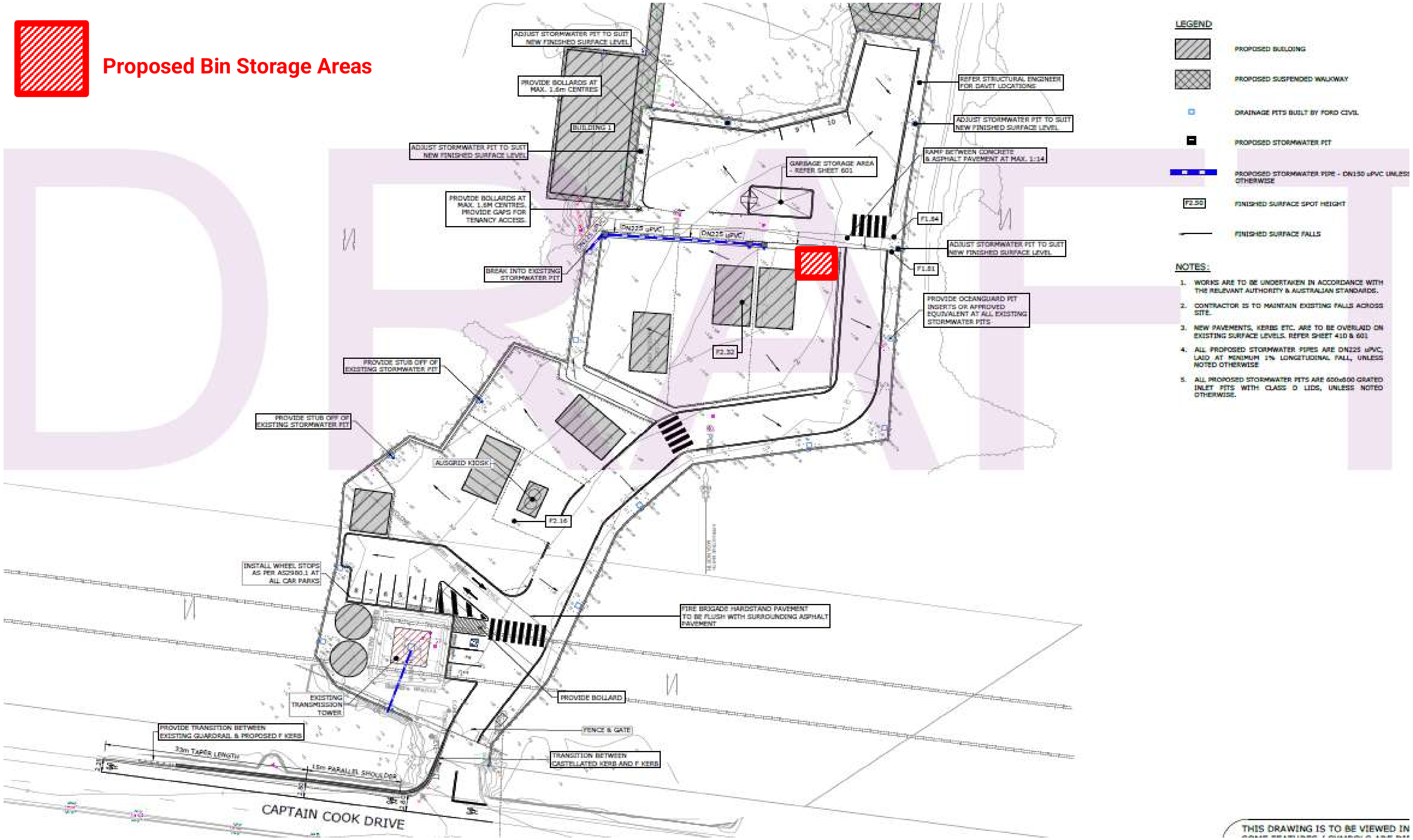
3.6 Architectural Plans

Existing Structures

Proposed Bin Storage Area

Source: Google Images

Proposal



Source: Paterson Design Studio, Drawing No. 401, Rev 0, 22nd December 2021 – Siteworks Plan.

Woolooware Bay Oyster Farm

Commercial Development

OPERATIONAL WASTE MANAGEMENT PLAN

1/06/2022
Report No. 4003
Revision B

Client

Transport for NSW

Architect

Tonkin

Tonkin.com.au

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REVISION REFERENCE

Revision	Date	Prepared by	Reviewed by	Description
A	19-05-2022	T. McPherson	A. Armstrong	Draft
B	01-06-2022	T. McPherson	A. Armstrong	Final

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GLOSSARY OF ABBREVIATIONS AND TERMS

TERM	DESCRIPTION
Bin-carting Route	Travel route for transferring bins from the storage area to a nominated collection point
Collection Area/Point	The identified position or area where general waste or recyclables are loaded onto the collection vehicle
Composter	A container/machine used for composting specific food scraps
DA	Development Application
DCP	Development Control Plan
EPA	Environmental Protection Authority
HRV	Heavy Rigid Vehicle described by AS 2890.2-2002 Parking facilities – Off-street commercial vehicle facilities
L	Litre(s)
LEP	Local Environmental Plans guide planning decisions for local government areas
Liquid Waste	Non-hazardous liquid waste generated by commercial premises that must be connected to sewer or collected for treatment and disposal by a liquid waste contractor (including grease trap waste)
Mobile Garbage Bin(s) (MGB)	A waste container generally constructed of plastic with wheels with a capacity in litres of 120, 240, 360, 660, 1000 or 1100
MRV	Medium Rigid Vehicle described by AS 2890.2-2002 Parking facilities – Off-street commercial vehicle facilities
Onsite Collection	When the collection vehicle enters the property and services the development within the property boundary from a designated loading area
Owners Corporation	An organisation or group of persons that is identified by a particular name and acts, or may act, as an entity
SRV	Small Rigid Vehicle described by AS 2890.2-2002 Parking facilities – Off-street commercial vehicle facilities
WHS	Workplace Health and Safety
Wheel-in wheel-out service	A type of waste collection service offered by local councils where the council waste collection personnel enter the premises to collect the bins and returns them to the property

1 ACKNOWLEDGEMENT OF COUNTRY

We acknowledge Australia's First Nations People as the Traditional Custodians of this land. We pay respect to ancestors and Elders, past and present. We honour Aboriginal and Torres Strait Islander people and their connection to land, waters and seas, and their vital contribution to the vibrant nation that we share, Australia.

2 INTRODUCTION

Elephants Foot Consulting (EFC) has been engaged to prepare the following waste management plan for the operational management of waste generated by the commercial development located at Woolooware Bay Oyster Farm.

Waste management strategies and audits are required for new developments in order to support the design and sustainable performance of the building. It is EFC's belief that a successful waste management strategy contains three key objectives:

i. ***Promote responsible source separation*** to reduce the amount of waste that goes to landfill by implementing convenient and efficient waste management systems.

ii. ***Ensure adequate waste provisions and robust procedures*** that will cater for potential changes during the operational phase of the development.

iii. ***Comply*** with all relevant council codes, policies, and guidelines.

To achieve these objectives, this operational waste management plan (OWMP) identifies the different waste streams likely to be generated during the operational phase of the development, as well as how the waste will be handled and disposed, details of bin sizes/quantities and waste rooms, descriptions of the proposed waste management equipment used, and information on waste collection points and frequencies.

It is essential that this OWMP is integrated into the overall management of the building and is clearly communicated to all relevant stakeholders.

2.1 SCOPE OF REPORT

This operational waste management plan (OWMP) only applies to the **operational** phase of the proposed development; therefore, the requirements outlined in this OWMP must be implemented during the operational phase of the site and may be subject to review upon further expansion of, and/or changes to the development.

The waste management of the **construction** and **demolition** phases of the development are not addressed in this report. A construction and demolition WMP will need to be provided separately. EFC can supply this if required.

2.2 REPORT CONDITIONS

The purpose of this report is to document an OWMP as part of a development application, which is supplied by EFC with the following limitations:

- Drawings, estimates and information contained in this OWMP have been prepared by analysing the information, plans and documents supplied by the client and third parties including Council and other government agencies. The assumptions based on the information contained in the OWMP is outside the control of EFC,
- The figures presented in the report are an estimate only – the actual amount of waste generated will be dependent on the occupancy rate of the building/s and waste generation intensity as well as the building management's approach to educating tenants and staff members regarding waste management operations and responsibilities,
- The building manager will adjust waste management operations as required based on actual waste volumes (e.g., if waste is greater than estimated) and increase the number of bins and collections accordingly,
- The report will not be used to determine or forecast operational costs or prepare any feasibility study or to document any safety or operational procedures,
- The report has been prepared with all due care; however, no assurance is made that the OWMP reflects the actual outcome of the proposed waste facilities, services, and operations, and EFC will not be liable for plans or results that are not suitable for purpose due to incorrect or unsuitable information or otherwise,
- EFC offer no warranty or representation of accuracy or reliability of the OWMP unless specifically stated,
- Any manual handling equipment recommended in this OWMP should be provided at the recommendation of the appropriate equipment provider who will assess the correct equipment for supply,
- Design of waste management equipment and systems must be approved by the supplier,
- EFC cannot be held accountable for late changes to the design after the OWMP has been submitted to Council,
- EFC will provide specifications and recommendations on bin access and travel paths within the OWMP; however, it is the architect's responsibility to ensure the architectural drawings meet these provisions,
- EFC are not required to provide information on collection vehicle swept paths, head heights, internal manoeuvring or loading requirements. It is assumed this information will be provided by a traffic consultant,
- Council are subject to changing waste and recycling policies and requirements at their own discretion.

This OWMP is only finalised once the draft watermark has been removed. If the draft watermark is present, the information in the OWMP is not confirmed.

3 LEGISLATION & GUIDANCE

Waste management and resource recovery regulation in Australia is administered by the Australian Constitution, Commonwealth laws, and international agreements. State and territory governments maintain primary responsibility for controlling development and regulating waste. The following legislation has been enacted in New South Wales, and provides the lawful underpinnings of this OWMP.

- NSW Environmental Planning & Assessment Act 1979
- NSW Protection of the Environment Operations Act 1997
- NSW Waste Avoidance & Resource Recovery Act 2001

At the local level, councils or Local Government Areas (LGAs) require OWMPs to be included in new development applications. This OWMP is specifically required by:

- Sutherland Shire Development Control Plan 2015
- Sutherland Shire Local Environmental Plan 2015

The primary purpose of a development control plan (DCP) is to guide development according to the aims of the corresponding local environmental plan (LEP). The DCP must be read in conjunction with the provisions of the relevant LEP.

Information provided in this OWMP comes from a wide range of waste management guidance at the local, state, and federal levels. The primary sources of guidance include:

- *Waste Collection for New Multi-Unit Dwellings and Residential Flat Buildings 2017*
- NSW Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities 2012
- NSW Better practice guide for resource recovery in residential developments 2019
- NSW Waste Avoidance and Resource Recovery (WARR) Strategy 2014-2021
- NSW Waste Classification Guidelines 2014
- Australia's National Waste Policy 2018

3.1 COUNCIL OBJECTIVES

Sutherland Shire is committed to sustainable resource management and waste minimisation. As such, Council aims to:

- Ensure appropriate waste storage and collection facilities.
- Maximise source separation and recovery of recyclables.
- Ensure waste management systems are intuitive for occupants and are readily accessible.
- Ensure appropriate resourcing of waste management systems, including servicing.
- Minimise risk to health and safety associated with handling and disposal of waste and recycled material, and ensure optimum hygiene is achieved.
- Minimise adverse environmental impacts associated with waste management.
- Discourage illegal dumping by providing on site storage and removal services.
- Enable collection service providers to efficiently collect waste and recyclables with minimum disruption and impact on the community.
- Ensure bin storage areas do not dominate the streetscape.
- To assist in achieving State Government waste minimisation targets as set out in the Waste Avoidance and Resources Recovery Act 2001 and NSW Waste Avoidance and Resource Recovery Strategy 2014-21.

4 DEVELOPMENT OVERVIEW

The proposed development falls under the LGA of Sutherland Shire Council. The proposed development comprises of upgrades and restructure of the Woolooware Bay Oyster Farm. This will incorporate:

- 4 x inland tenancies with a total GFA of 235.04m^2
- 3 x overwater tenancies with a total GFA of 1277.33m^2

All figures and calculations are based on area schedules as advised by our client and shown on architectural drawings.

4.1 SITE LOCATION

The site is located at Lot 2, Captain Cook Drive, Woolooware Bay NSW 2230 as shown in Figure.1 (boundaries are indicative only). The site has frontages and vehicular access via Captain Cook Drive.

Figure 1. Site Location

Source: Google Maps

5 OYSTER FARM WASTE MANAGEMENT

The following section outlines best practice waste management for the development, including waste generation estimates and waste disposal and collection procedures.

5.1 WASTE GENERATION ESTIMATES

The NSW EPA's *Better practice for Waste Management and Recycling in Commercial and Industrial Facilities 2012* has been referenced to calculate the total number of bins required for the anticipated tenants. Calculations are based on generic figures, and waste generation rates may differ according to the tenants' actual waste management practice.

The following table shows the estimated volume (L) of general waste and recyclables that will be generated by the development.

The total GFA of the retail component has been divided into thirds to take into account the waste generation of future possible tenancies. It is assumed that retail tenancies will share waste bins, the waste storage room, and the waste collection service.

The following estimates are based on a seven-day operating week.

Table 1: Estimated Waste and Recycling Volumes – Commercial and Retail

Rate Used	GFA m^2	Waste Generation Rate ($L/100m^2/Day$)	Generated Waste (L/Week)	Recycling Generation Rate ($L/100m^2/Day$)	Generated Recyclables (L/Week)
All Retail	504.12	80	2823.1	70	2470.2
Services	1008.25	55	3881.7	10	705.8
TOTALS	**1512.37**		**6705**		**3176**
Bins and Collections		Bin Size (L)	1100	Bin Size (L)	1100
		Bins/Week	6.1	Bins/Week	2.9
		Collections/Week	2	Collections/Week	2
		Total Bins	**4**	Total Bins	**2**

5.2 BIN SUMMARY

Based on the estimated waste generated by the tenancies and staff members, the recommended bin quantities and collection frequencies are as follows:

General Waste: 4 x 1100L MGBs collected **2 x weekly *(or when required).***

Recycling: 2 x 1100L MGBs collected **2 x weekly *(or when required).***

Bin sizes, quantities, and/or collection frequencies may be modified by the building manager once the proposed development is operational. Building management will be required to negotiate any changes to bins or collections with the collection service provider. Seasonal peak periods such as public and school holidays should also be considered.

5.3 WASTE DISPOSAL PROCEDURES

Each tenancy will have smaller bin receptacles to store waste and recyclables for a minimum of 1-days' worth of capacity. The retail tenancies will be responsible for their back of house waste management bins during daily operations.

On completion of each trading day or as required, nominated staff or contracted cleaners will transport all general waste and recyclables from these receptacles to the larger bins within the bin collection room and place into the appropriate bin receptacles (see APPENDIX A.1).

5.4 WASTE COLLECTION PROCEDURES

The following subsections below display the collection procedures for the various types of wastes generated below:

5.4.1 GENERAL WASTE AND RECYCLING

A private waste collection contractor will be engaged to service the retail waste and recycling bins per an agreed schedule. On the day of service, a private waste collection vehicle will enter the site from Captain Cook Drive and park adjacent to the bin collection room. The building caretaker or nominated staff will provide the driver with access to the bin collection room. The collection vehicle will service the bins, and return them once emptied via. Collection at grade point.

5.5 OTHER WASTE MANAGEMENT CONSIDERATIONS

Based on the types of tenancies anticipated for this development, the following waste management practices are recommended.

5.5.1 KITCHEN, OFFICE TEA ROOMS AND FOOD PREPARATION AREAS

Any food preparation area, including kitchens and office tea rooms will be provided with dedicated source separation bins including a general waste bin and a recycling bin. Cleaners or nominated staff will be responsible for monitoring these bins and emptying them as required.

5.5.2 BATHROOMS

Washroom facilities should be supplied with collection bins for paper towels (if used). Sanitary bins for female restroom facilities must also be arranged with an appropriate contractor.

5.5.3 LIQUID WASTE

Liquid wastes such cleaning products, chemicals, paints, and cooking oil, etc., will be stored in a secure space that is bunded and drained to a grease trap in accordance with State government authorities and legislation.

5.5.4 OYSTER SHELLS

Oyster shells will be produced as a by-product from regular harvesting. It is understood that these shells are crushed, and sold to landscape architects by the tenancy manager. Oyster shells are crushed and typically stored within bags, which can be stored for future market products, or stored to be placed into skip bins on an ad-hoc basis and transported to a solid-fill resource recovery facility.

5.5.5 SEDIMENT BAGS

As oyster batches are harvested and cleaned, they are washed with salt water to clean the source from sediments and discharge. It is at the responsibility of the tenancy manager to filter these sediments and discharge into sediment bags to be disposed of in an appropriate sediment bin, and transported to a resource recovery facility for appropriate disposal.

5.5.6 OYSTER BASKETS

Oyster baskets are composed of metal, which oysters attach to as a substrate. These baskets will be washed to prevent biofouling, and then stored in the additional space within the bin collection room. This metal/plastic waste will be transported to the appropriate resource recovery facility to be disposed of correctly by the tenancy manager.

5.5.7 PROBLEM WASTE

The building manager is responsible for making arrangements for the disposal and recycling of problem waste streams with an appropriate contractor. Problem wastes cannot be placed in general waste as they can have adverse impacts to human health and the environment if disposed of in landfill. Retail and Commercial tenants will need to liaise with the building manager when disposing of problem waste streams.

Problem waste streams include:

- Chemical Waste
- Liquid wastes
- Oyster Baskets
- Lightbulbs
- eWaste
- Batteries
- Sediment waste

6 STAKEHOLDER ROLES & RESPONSIBILITIES

The following table demonstrates the primary roles and responsibilities of the respective stakeholders:

Table 2: Stakeholder Roles and Responsibilities

Roles	Responsibilities
Tenancy Management	• Ensure all waste service providers submit monthly reports on all equipment movements and waste quantities/weights; • Organise internal waste audits/visual assessments on a regular basis • Purchase any on-going waste management equipment or maintenance of equipment once building is operational; and • Manage any non-compliances/complaints reported through waste audits.
Operator/Cleaning Staff	• Coordinate general waste and recycling collections; • Clean and transport bins as required; • Organise replacement or maintenance requirements for bins; • Organise, maintain and clean the waste holding area; • Organise bulky goods collection when required • Investigate and ensure prompt clean-up of illegally dumped waste materials. • Prevent storm water pollution by taking necessary precautions (securing bin rooms, preventing overfilling of bins) • Abide by all relevant WH&S legislation, regulations, and guidelines; • Provide staff/contractors with equipment manuals, training, health and safety procedures, risk assessments, and PPE to control hazards associated with all waste management; • Assess any manual handling risks and prepare a manual handling control plan for waste and bin transfers; • Ensure site safety for residents, children, visitors, staff and contractors; and • Ensure effective signage, communication and education is provided to occupants, tenants, maintenance staff, and cleaning contractors.
Retail Tenants	• Manage the back of house storage of generated waste and recycling during daily operation. • Correctly separate waste and recycling streams; bag general waste and ensure recyclables are not bagged. • Flatten cardboard within the recycling bin. • If required, arrange for storing used and unused cooking oil in a bunded area, • Organise grease interceptor trap servicing, • Ensure dry basket arrestors are provided to the floor wastes in the food preparation, and • Ensure the suitable storage for chemicals, pesticides and cleaning products waste back of house.
Waste Collection Contractor	• Provide a reliable and appropriate waste collection service; • Provide feedback to building managers and staff members regarding contamination of recyclables; and • Work with building managers to customise waste systems where possible.
Gardening/ Landscaping Contractor	• Remove all garden organic waste generated during gardening maintenance activities for recycling at an offsite location.
Developer	• Purchase all equipment required to implement this OWMP prior to the occupation of the building to be provided to the strata/ owners corporation.

7 SOURCE SEPARATION

Better practice waste management includes the avoidance, reuse, and recovery of unwanted items, which can be achieved through source separation. The table below outlines what is typically included in various waste streams and how they can be managed. Refer to your local council for a list of accepted materials. Planet Ark can be accessed online to find other facilities that recover unwanted items.

Table 3: Operational Waste Streams

Waste Stream	Description	Typical Destination	Waste Stream Management
General Waste	The remaining portion of the waste stream that is not recovered for re-use, processing, or recycling. May include soft plastics, food scraps, polystyrene, etc.	Landfill	Waste should be bagged before placing in the designated waste bins.
Recycling	A mixture of items that are commonly recycled usually segregated through a MRF. Typically include food and beverage containers (e.g., aluminium, glass, steel, hard plastics, cartons). Also included cardboard and paper products.	Resource Recovery Centre	Recycling must not be bagged, and instead should be placed loosely in the designated recycling bins. Cardboard should be flattened before placing in the designated cardboard bin.
Green Waste	Green waste consists of unwanted organic materials that are easily biodegradable and/or compostable (e.g., lawn clippings, branches)	Resource Recovery Centre	Landscape Maintenance Contractors will remove the green waste from site during scheduled maintenance. Green waste will be collected in council or private contractor bins and removed from site.
Food Waste	Food waste consists of unwanted or uneaten kitchen scraps that are easily compostable/biodegradable (e.g., vegetable peels, fruit rinds, coffee grounds).	Composting facility or Landfill	Food waste can be composted on-site, off-site, or else included in the general waste stream.
Electronic Waste	Discarded e-waste, electronic components and materials such as computers, mobile phones, keyboards, etc.	Resource Recovery Centre	Commercial tenants arrange for recycling of their own e-waste.
Bulky Items	Items that are to too large to place into general rubbish collection. This includes disused and/or broken furniture, mattresses, white goods, etc.	Resource Recovery Centre or Landfill	Tenants are responsible for removal of their bulky items.
Sanitary Waste	Feminine hygiene waste generated from female bathrooms.	Incineration or Landfill	Sanitary bins are serviced by sanitary waste contractor.
Other	Other recyclable items that require special recovery may include ink cartridges, batteries, chemical waste, fluorescent tubes, etc.	Resource Recovery Facility	Tenancy management arranges collection by appropriate recycling services when required.

8 EDUCATION

Educational materials encouraging correct separation of general waste and recyclables must be provided to each tenant and staff member. This should include the correct disposal process for bulky waste such as old furniture, large discarded items, and other materials including electronic and chemical wastes. It is recommended that the building caretaker provides information in multiple languages to support correct behaviours, and to minimise the possibility of contamination in communal waste bins.

8.1 SIGNAGE

Signage and education are essential components to support best practice waste management including resource recovery, source separation, and diversion of waste from landfill.

Signage should include:

- Clear and correctly labelled waste and recycling bins,
- Instructions for separating and disposing of waste items. Different languages should be considered,
- Locations of, and directions to, the waste storage areas with directional signs, arrows, or lines,
- The identification of all hazards or potential dangers associated with the waste facilities, and
- Emergency contact information should there be issues with the waste systems or services in the building.

The building manager is responsible for waste room signage including safety signage. Appropriate signage must be prominently displayed on doors, walls and above all bins, clearly stating what type of waste or recyclables is to be placed in each bin.

All signage should conform to the relevant Australian Standards.

8.2 POLLUTION PREVENTION

Building management shall be responsible for the following to minimise dispersion of site litter and prevent stormwater pollution to avoid impact to the environment and local amenity:

- Promoting adequate waste disposal into the bins
- Securing all bin rooms (whilst affording access to staff/contractors)
- Prevent overfilling of bins, keep all bin lids closed and bungs leak-free
- Taking action to prevent dumping or unauthorised use of waste areas
- Require collection contractor/s to clean up any spillage when clearing bins

9 WASTE ROOMS

The areas allocated for waste storage and collection areas are detailed in the table below, and are estimates only. Final areas will depend on room and bin layouts.

Table 4: Waste Room Areas

Level	Waste Room Type	Equipment and MGBs	Estimated Area Required (m^2)	Actual Area Provided (m^2)
GF	Bin Collection Room	4 x 1100L MGBs (General waste) 2 x 1100L MGBs (Recycling)	17	

EFC recommends bins sizes, collection frequencies and/or equipment for best practice waste management at this site, however EFC also acknowledges there are a range of other suitable options that may alter waste room requirements (e.g., floor area, accessibility, head height, etc.)

The waste room areas have been calculated based on equipment requirements and/or bin dimensions with an additional 70% of bin GFA factored in for manoeuvrability.

In addition, all doorways and passageways facilitating the movement of bins and/or bulky waste items must be at least 1500mm wide. The following table provides further waste room requirements.

Table 5: Waste Room Requirements

Waste Room Type	Waste Room Requirements
Bin Collection Area	• Bins must not be stacked in rows that are more than two bins deep
Bulky Goods Waste Storage Room	• May be a dedicated room or screened area within another waste room • Must be in close proximity to the collection area. • Area must also be allocated for the segregation of e-waste, gas bottles, cardboard, etc. • Doorway should be a minimum of 1500mm wide.
Bin Collection Room	• In order to ensure staff safety, all bins should be arranged so they can be accessed without moving another bin

10 BIN MOVING PATHS

The building caretaker is responsible for the transportation of bins as required from their designated operational locations to the bin holding room as required and returning them once emptied to resume operational use.

Transfer of bins should minimise manual handling where possible, as bins become heavy when full. The building manager must assess manual handling risks and provide any relevant documentation to key personnel.

The routes along the bin moving path should;

- Allow for a continuous route that is wholly within the property boundary.
- Be free from obstruction and obstacles such as steps and kerbs.
- Be constructed of solid materials with a non-slip surface
- Be a minimum of 300mm wider than the largest bin used onsite.
- If bins are moved manually, the route must not exceed a grade of 1:14.
- If a bin moving device is used, the route cannot exceed the maximum operating grade of the device. This is typically a grade of 1:4, however this will vary depending on the model of bin moving device acquired for the site.

The developer is responsible for suppling all equipment required for moving bins this includes any bin lifters, bin moving devices and waste transfer bins. This equipment must be new and appropriate for the site. The developer should contact a bin-tug, trailer or tractor consultant to provide equipment recommendations.

Once the site is operational (and the developers is no longer involved) the building proprietors/strata/ owners corporation will be responsible for maintaining, repairing and replacing waste management equipment.

11 CONSTRUCTION REQUIREMENTS

Waste room construction must comply with the minimum standards as outlined in the *Sutherland Shire development Control Plan,* in order to minimise odours, deter vermin, protect surrounding areas, and make it a user-friendly and safe area.

The *NSW Better Practice Guide for Resource Recovery in Residential Developments (2019)* also states that better practice bin storage areas should achieve more than the minimum compliance requirements, which are as follows:

- Ensuring BCA compliance, including ventilation. Where required, ventilation system must comply with AS1668.4-2012 The use of ventilation and air conditioning in buildings.
- Ensuring storage areas are well lit (sensor lighting preferred) and have lighting available 24 hours a day.
- Provision of bin washing facilities, including taps for hot and cold water provided through a centralised mixing valve. The taps must be protected from bins and be located where they can be easily accessed even when the area is at bin capacity.
- Floor constructed of concrete at least 75mm thick.
- Floor graded so that any water is directed to a sewer authority approved drainage connection to ensure washing bins and/or waste storage areas do not discharge flow into the stormwater drain.
- Provision of smooth, cleanable and durable floor and wall surfaces that extend up the wall to a height equivalent to any bins held in the area.
- Ensuring ceilings are finished with a smooth-faced non-absorbent material capable of being cleaned.
- All surfaces (walls, ceiling and floors) finished in a light colour.

11.1 ADDITIONAL CONSIDERATIONS

- Waste room floor to be sealed with a two-pack epoxy;
- All corners coved and sealed 100mm up, this is to eliminate build-up of dirt;
- Tap height and light switch height of 1.6m;
- Storm water access preventatives (grate);
- All walls painted with light colour and washable paint;
- Equipment electric outlets to be installed 1700mm above finished floor level;
- Optional automatic odour and pest control system installed
- If 660L or 1100L bins are utilised, 2 x 820mm (minimum) double-doors must be used;
- All personnel doors are hinged, lockable and self-closing;
- Conform to the Building Code of Australia, Australian standards and local laws; and
- Childproofing and public/operator safety shall be assessed and ensured
- Waste and recycling rooms must have their own exhaust ventilation system either;
  - Mechanically - exhausting at a rate of 5L/m² floor area, with a minimum rate of 100L/s minimum; Mechanical exhaust systems shall comply with AS1668.4.2012 and not cause any inconvenience, noise or odour problem or
  - Naturally - permanent, unobstructed, and opening direct to the external air, not less than one-twentieth (1/20) of the floor area.

12 USEFUL CONTACTS

EFC does not warrant or make representation for goods or services provided by suppliers.

LOCAL COUNCIL

Sutherland Shire Council	Ph: (02) 9710 0333	E: ssc@nsw.gov.au

PRIVATE WASTE COLLECTION PROVIDER

Capital City Waste Services	Ph: 02 9599 9999	E: service@ccws.net.au
Remondis	Ph: 02 9032 7100	
Suez Environmental	Ph: 13 13 35	
Wastewise NSW	Ph: 1300 550 408	E: admin@wastewise.com.au

BIN MOVING DEVICE SUPPLIERS

Electrodrive	Ph: 1800 333 002	E: sales@electrodrive.com.au
Sitecraft	Ph: 1300 363 152	E: sales@sitecraft.com.au
Spacepac	Ph: 1300 763 444	

ORGANIC DIGESTERS AND DEHYDRATORS

Closed Loop	Ph: 1300 762 166	
Orca		E: contact.australia@feedtheorca.com
Soil Food	Ph: 1300 556 628	
Waste Master	Ph: 1800 614 272	E: hello@wastemasterpacific.com.au

COOKING OIL CONTAINERS AND DISPOSAL

Auscol	Ph: 1800 629 476	E: sales@auscol.com

ODOUR CONTROL

EF Neutralizer	Ph: 1300 435 374	E: info@elephantsfoot.com.au

SOURCE SPERATION BINS

Source Separation Systems	Ph: 1300 739 913	E: info@sourceseparationsystems.com.au

MOBILE GARBAGE BINS, BULK BINS AND BIN EQUIPMENT

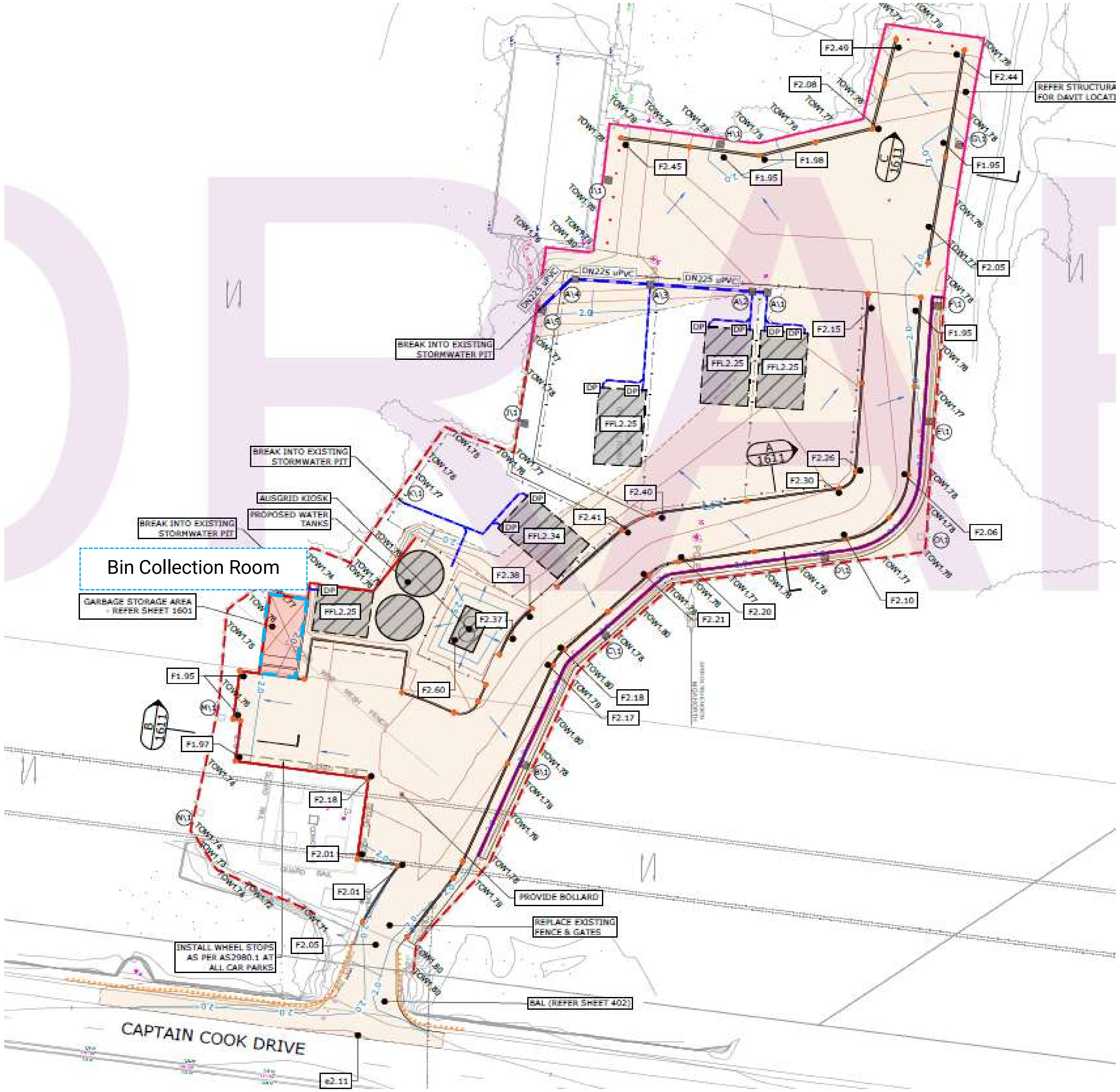
SULO	Ph: 1300 364 388	E: sales@sulo.com.au
OTTO Australia	Ph: 02 9153 6999	

CHUTES, COMPACTORS AND EDIVERTER SYSTEMS

Elephants Foot	Ph: 1800 025 073	E: info@elephantsfoot.com.au

APPENDIX A: ARCHITECTURAL PLANS

APPENDIX: A.1 GROUND FLOOR PLAN



Key

-Bin Collection Room

Source: Tonkin, Drawing no. 1401, Rev A, 29th April 2022, Siteworks Plan.

APPENDIX B: PRIMARY WASTE MANAGEMENT PROVISIONS

APPENDIX: B.1 TYPICAL BIN SPECIFICATIONS

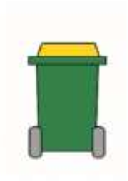
Mobile bins

Mobile bins come in a variety of sizes and are designed for lifting and emptying by purpose-built equipment.

Mobile bins with capacities of up to 1700L must comply with *AS4123.6-2006 Mobile waste containers* which specifies standard sizes and sets out the colour designations for the bodies and lids of mobile waste containers indicating the type of materials they are used to collect.

The most common bin sizes are provided below, although not all sizes are shown. The dimensions are a guide only and differ slightly between manufacturers. Some bins have flat or domed lids and are used with different lifting devices. Refer to *AS4123.6-2006* for further details.

Table G1.1: Average dimension ranges for two-wheel mobile bins



Wheelie bin

Bin capacity	80L	120L		140L		240L	360L
Height (mm)	870	940	1065	1080	1100		
Depth (mm)	530	530		540		735	820
Width (mm)	450	485		500		580	600
Approximate footprint (m^2)	0.24	0.26–0.33		0.27-0.33		0.41–0.43	0.49
Approximate weight (kg)	8.5	9.5		10.4		15.5	23
Approximate maximum load (kg)	32	48		56		96	Not known

Sources include Sulo, Single Waste, Cleanaway, SUEZ, just wheelie bins and Perth Waste for two-wheel mobile bins

Table G1.2: Average dimension ranges for four-wheel bulk bins

Dome or flat lid container

Bin capacity	660L	770L	1100L	1300L	1700L
Height (mm)	1250	1425	1470	1480	1470
Depth (mm)	850	1100	1245	1250	1250
Width (mm)	1370	1370	1370	1770	1770
Approx footprint (m^2)	0.86–1.16	1.51	1.33–1.74	2.21	2.21
Approx weight (kg)	45	Not known	65	Not known	Not known
Approx maximum load (kg)	310	Not known	440	Not known	Not known

Sources include Sulo, Signal Waste, Cleanaway, SUEZ, Just Wheelie Bins and Perth Waste

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

APPENDIX: B.2 SIGNAGE FOR WASTE AND RECYCLING BINS

Waste signs

Signs and educational materials perform several functions including:

- informing residents why it is important to recover resources and protect the environment
- providing clear instructions on how to use the bins and services provided
- alerting people to any dangers or hazards within the bin storage areas.

All waste, recycling and organic bins should be Australian Standard colours and clearly and correctly labelled, such as by a sticker on the lid and/or the body of the bin.

Communal bin storage areas should be clearly signposted with signs outlining how to correctly separate waste into the bins provided. The local council responsible for waste services may be a good source of signs and posters and can advise on what signs are suitable.

Information on who to contact to find out more about the recycling and/or other resource recovery services in the building should also be displayed in communal areas, such as on a noticeboard.

The Planet Ark website also has resources available free of charge for use by businesses and councils. These signs can be found at businessrecycling.com.au/research/signage.cfm

Figure I1.1: **Examples of waste wall posters (EPA supplied)**

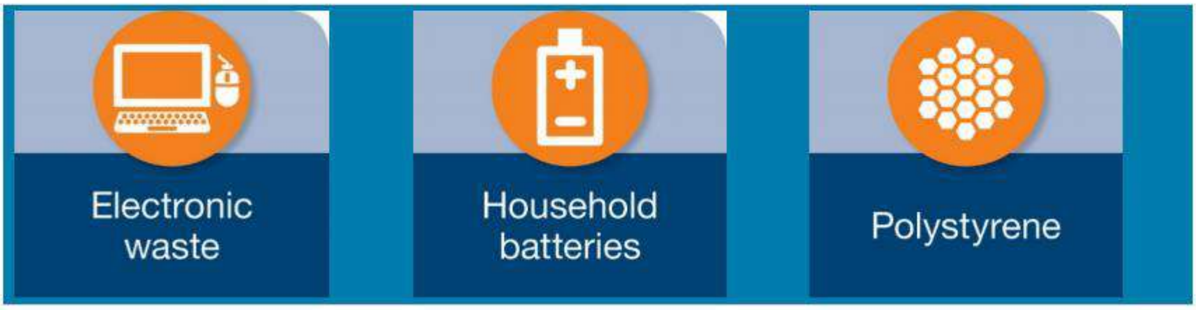
Figure I1.2: **Examples of bin lid stickers (EPA supplied)**

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

Problem waste signs

The EPA has also produced a range of images and signs that can be used for problem wastes, such as fluoro globes and tubes, household and car batteries, e-waste and smoke detectors. To access these resources, contact the NSW EPA. Some examples are shown below.

Figure I2.1: **Problem waste signs**



Safety signs

The use of safety signs for waste resource recovery rooms must comply with *AS1319 Safety signs for occupational environments*. Safety signs must be used to regulate and control safety related to behaviour, warn of hazards and provide emergency information, including fire protection information. Suitable signs should be decided for each development as required.

Figure I3.1: **Example safety signs**

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

APPENDIX: B.3 TYPICAL COLLECTION VEHICLE INFORMATION

General

Appropriate heavy rigid vehicle standards should be incorporated into the road and street designs in new developments where onsite collections are proposed. Road and street designs must comply with relevant Acts, regulations, guidelines, and codes administered by Austroads, Standards Australia, NSW Roads and Maritime Services, WorkSafe NSW and any local council traffic requirements.

Applicants and building designers should consult with councils and other relevant authorities before designing new roads or streets and access points for waste collection vehicles to establish specific design requirements.

Table H4.1: Australian Standards for turning circles for medium and heavy rigid class vehicles

Vehicle class	Overall length (m)	Design width (m)	Design turning radius (m)	Swept circle (m)	Clearance (travel) height (m)
Medium rigid vehicle	8.80	2.5	10.0	21.6	4.5
Heavy rigid vehicle	12.5	2.5	12.5	27.8	4.5

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

Large collection vehicles

Waste collection vehicles may be side-loading, rear-loading, front-lift-loading, hook or crane lift trucks. Vehicle dimensions vary by collection service, manufacturer, make and model. It is not possible to provide definitive dimensions, so architects and developers should consult with the local council and/or contractors.

The following characteristics represent typical collection vehicles and are provided for guidance only. Reference to *AS2890.2 Parking facilities: off-street commercial vehicle facilities* for detailed requirements, including vehicle dimensions, is recommended.

Table B2.1: Collection vehicle dimensions

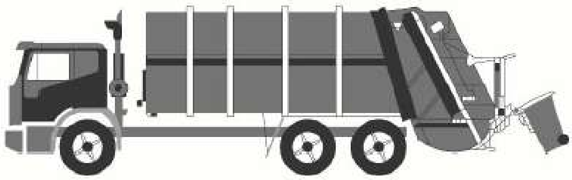
Vehicle type	Rear-loading	Side-loading*	Front-lift-loading	Hook truck	Crane truck
Length overall (m)	10.5	9.6	11.8	10.0	10.0
Width overall (m)	2.5	2.5	2.5	3.0	2.5
Travel height (m)	3.9	3.6	4.8	4.7	3.8
Operational height for loading (m)	3.9	4.2	6.5	3.0	8.75
Vehicle tare weight (t)	13.1	11.8	16.7	13.0	13.0
Maximum payload (t)	10.0	10.8	11.0	14.5	9.5
Turning circle (m)	25.0	21.4	25.0	25.0	18

* The maximum reach of a side arm is 3 m.

Sources: JJ Richards, SUEZ, MacDonald Johnson, Cleanaway, Garwood, Ros Roca, Bingo and Edbro. Figures shown represent the maximum dimensions for each vehicle type.

Rear-loading collection vehicles

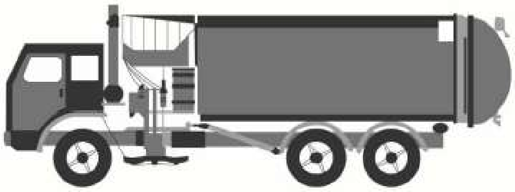
These vehicles are commonly used for domestic waste collections from MUDs and RFBs and sometimes for recycling. They can be used to collect waste stored in mobile bins or bulk bins, particularly where bins are not presented at the kerbside. They are also used for collecting bulky waste.



Rear-loading waste collection vehicle

Side-loading collection vehicles

This is the most commonly used vehicle for domestic waste, recycling and organics collections. It is only suitable for collecting mobile bins up to 360L in capacity.



Side-loading waste collection vehicle

Front-lift-loading collection vehicles

These vehicles are commonly used for collecting commercial and industrial waste. They can only collect specially designed front-lift bulk bins and not mobile bins.

Front-lift-loading waste collection vehicle

Small collection vehicles

Typically, councils and their contractors operate with large collection vehicles (heavy rigid class vehicles) because they carry greater payloads and allow for more cost-effective collection services. Some councils, or their contractors, may have smaller collection vehicles in their fleet. Early discussion with the council is important to confirm this, but it should not be assumed that the council will have access to small collection vehicles.

The waste management systems and the location of the collection point should always be designed so that the council can provide the standard domestic waste service.

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

APPENDIX: B.4 TYPICAL BIN MOVERS

Battery powered tug with a 1 or 2 tonne tow capacity

Features at a glance
One tonne (Evo 1T) or two tonne (Evo 2T) tow capacity
Auto latching hitch
Three speed motor with emergency stop

Typical applications

The Tug Evo is suitable for airports, factories, warehouses, apartment buildings or large facilities. This powered tug is also suitable for transporting medical carts around hospitals or moving heavy specialist equipment.

Features:

- 1 or 2 tonne tow capacity of inclines up to 6 degrees
- 500kg tow capacity if inclines up to 14 degrees
- CE Compliant
- 5 km/h max speed
- 2 x 12V 42Ah MK-gel batteries with 24V smart charger.
- Powerful transaxle

Safety Features:

- Intuitive control with standard automatic safety brake, forward and reverse drive.
- Emergency stop button.
- Emergency back-off button

Source: http://www.electrodrive.com.au/products/tugs/tug-evo.aspx

APPENDIX C: SECONDARY WASTE MANAGEMENT PROVISIONS

APPENDIX: C.1 TYPICAL WORM FARM SPECIFICATIONS

Worm farms

Worm farms or vermiculture systems transform food and other organic material into vermicast (worm compost) and vermi-liquid (liquid extraction from a worm farm). Seafood, seafood shells, meat or bones, and dairy products are not an acceptable part of the worms' diet and should not be appled to these systems. Worm farms can occupy a small footprint and be located on balconies or in gardens. The worm farm should be placed in a sheltered position to avoid getting too hot in summer.

Worm farms come in different sizes and designs and are sold through hardware stores and often at local government offices. Medium and large-scale worm farms can service many households and commercial acticities. These larger systems need a management process to ensure they are properly maintained.

Onsite composting

Compost tumblers and bins and compost bays transform food and other organic material into useful soil enhancer (compost). They are more versatile than worm farms as they can generally process a wider range of materials, including woody garden organics and can be placed in the sun. A variety of compost bins and tumblers are available from hardware stores or some local councils. There are also various online resources on how to construct them using recycling materials such as timber pallets. The footprint area requirement for a typical single household compost bin is about 1m x 1m x 1m.

Before setting up an onsite composter or worm-farm system, check with council for any local requirements such as setback distances from property boundaries.

Source: Better Practice Guide For Resource Recovery In Residential Developments 2019, NSW Environmental Protection Authority

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