



Jounama Creek culvert scour repairs

Review of environmental factors

May 2019



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Roads and Maritime Services

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April 2019

Prepared by GHD Pty Ltd and Roads and Maritime Services
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Approval and authorisation

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Dated:	21/06/2019.

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Executive summary

The proposal

Roads and Maritime Services is proposing to carry out culvert repairs on the Snowy Mountains Highway over Jounama Creek/Jounama Pondage to ensure the long-term stability of the Snowy Mountains Highway road embankment (the proposal) (see location in Figure 1.1).

Key features of the proposal (Figure 1.2) may include:

- building a 240 metre temporary access track off the Snowy Mountains Highway on the southern side of Jounama Pondage
- building a pad for crane access and stockpiling materials on the northern side of Jounama Pondage
- building an access ramp from the northern crane pad and stockpile site
- removing the damaged concrete slab between the culvert and Jounama Pondage (apron slab) and loose material
- extending the existing external side walls (wingwalls)
- building a new apron slab
- reinstating road batters
- establishing a site compound and stockpile sites (including existing stockpile sites 4.3 kilometres and 8.6 kilometres north-west of the proposal site along the Snowy Mountains Highway).

Need for the proposal

The existing culvert over Jounama Creek/Jounama Pondage on the Snowy Mountains Highway has significant scouring at the downstream apron on the Jounama Pondage side. The concrete apron at the culvert outlet has failed, causing the apron to separate from the culvert outlet. The adjoining road embankment also has extensive damage.

Due to the deteriorated condition, there is an increased risk that future flood events could wear away the culvert and damage the Snowy Mountains Highway's subsurface.

Proposal objectives and development criteria

The objectives of the proposal include:

- providing a safe and available bridge connection for all users
- ensuring the long-term serviceability of the Snowy Mountains Highway road embankment and culvert structure
- maintaining the culvert and embankment's structural integrity
- providing timely repairs to minimise asset deterioration
- improving scour protection within the downstream area
- being sensitive to the area's natural environment, heritage and local communities.

The development criteria for the proposal include:

- minimising environmental impact
- cost analysis
- ease of build
- site safety
- project program and amount of work required.

Options considered

Three options were initially considered to address the continued use of the highway, including:

- repairing the culvert apron and embankment
- replacing the culvert with a bridge
- building a bridge at the location of the original creek.

Subsequently, a number of identified culvert repair options were assessed against the proposal objectives and development criteria, including the 'do nothing' option. These included four initial options and four variations.

Option 2 was evaluated as the preferred option after a workshop in June 2017. This option was chosen due to the design being of a similar grade to the existing structure. After detailed survey, options a, b, c and d, based on option 2, were developed.

Option 2d was identified as the preferred option to best achieve the proposal objectives.

Option 2d is preferred because it:

- requires the least amount of cement
- requires the shortest duration of work and number of workers
- limits the amount of access required by foot
- is able to be built underwater during high pondage level
- is the most cost-effective option.

Statutory and planning framework

The NSW *State Environmental Planning Policy (Infrastructure) 2007* permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for the purpose of road infrastructure facilities and is to be carried out by Transport for NSW, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This review of environmental factors (REF) has been prepared to assess the proposal.

The description of the proposal and associated environmental impact has been carried out in the context of clause 228 of the NSW *Environmental Planning and Assessment Regulation 2000*, the *Biodiversity Conservation Act 2016* (BC Act) and the *Fisheries Management Act 1994*. In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act; that Roads and Maritime Services examines and takes into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The REF assesses the impact of the proposal on matters of national environmental significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Community and stakeholder consultation

Roads and Maritime Services has consulted with potentially affected property owners, stakeholders and government agencies during the selection of the preferred option and development of the proposal designs.

Government agencies and stakeholders consulted have included:

- Office of Environment and Heritage (OEH) / National Parks and Wildlife Service
- Environment Protection Authority (EPA)
- Snowy Hydro
- Snowy Valleys Council

- Department of Primary Industries (DPI) – Fishing and Aquaculture
- Aboriginal community (conducted for the Snowy Mountains Highway constraints assessment).

The purpose of consultation has been to:

- inform the community of the proposal
- advise government agencies and stakeholders of the proposal and its possible impact.

If the proposal is determined to proceed, Roads and Maritime Services would continue to consult with community stakeholders and utility providers.

Environmental impact

Soils, water quality and groundwater

The proposal would remove about 0.32 hectares of vegetation during work and expose soils to weathering processes, increasing the risk of erosion and sedimentation. Reinstatement of the access track below AHD 384 would occur. The proposal would involve earthworks in an area of about 0.28 hectares. After completion of the work, the gravel access road within Jounama Pondage's creek channel would be removed. The remainder of the access track will be retained for future maintenance use.

Loose soil may be eroded during rainfall events by run-off. Erosion of earthworks could cause sedimentation of Jounama Pondage. Sedimentation may also influence the vegetation and habitat of nearby areas by smothering groundcover vegetation and changing soil surface characteristics.

To repair the culvert's batter stability, particularly on its southern side, reinstatement work would be required on the batter slope. This would include placing precast elements and rockfill within the scoured section, with the potential for loose soil to be eroded, increasing sedimentation potential.

The remaining portion of the apron slab would be demolished and removed by an excavator. There is the potential for disturbance to the underlying alluvial material, particularly if a rock hammer is required to break up the slab. This may cause sedimentation of Jounama Pondage.

Introduction of pollutants from work into the surrounding environment, if uncontrolled, could potentially increase sediment load and organic matter, affecting water quality. Water quality impact may also result from wet concrete curing when submerged in the pondage, which has the potential to cause an increase in the pH of the surrounding water and negatively impact on the pondage's aquatic conditions. The proposal would include close watch of weather conditions and the potential for high stream flows from Jounama Creek, in which case work would cease.

Hydrology and flooding

The proposal would require blocking off culvert cells to divert water around the immediate work area. Up to three cells would be blocked off at a time, with at least one remaining open. The proposal site is located on bedrock so it is unlikely to generate sediment, however it would impact on flow rates through the open culverts and subsequent water levels. Increased flow rates have the potential to impact on wet concrete.

During a flood event, Snowy Hydro has the potential to release flows from Jounama Pondage. It is unlikely water levels would exceed the known maximum water level in the pondage and at the culvert. Given the maximum water level is known, all stockpiles, plant and other structures associated with the work would be located above the high water level. Therefore, they would not be impacted by flooding due to fluctuations in the water levels in the Jounama Pondage.

Roads and Maritime Services would communicate with Snowy Hydro throughout the work and should a flood event or high water level of the pondage be identified, Roads and Maritime Services would implement the measures in place for relocating equipment and materials at short notice.

Biodiversity

The proposal would remove about 0.32 hectares of vegetation, of which 0.20 hectares is native vegetation. An additional 0.09 hectares of derived native grassland would be temporarily disturbed for the southern compound site.

The vegetation proposed for removal is mainly native shrub species, which have regrown in the road reserve since previous clearing, and introduced grassland. A small derived grassland area dominated by native species would also be removed to build the southern access track, with native grassland around the compound site to be temporarily disturbed during the work via slashing.

The woodland in the study area forms part of a vegetation corridor along the Snowy Mountains Highway, directly connecting Kosciuszko National Park and helping a range of fauna species movement through the study area and across the landscape. It is unlikely the proposal would fragment woodland habitat in the study area.

There is no emergent or in-stream vegetation located in the pondage near the proposal site. Potential aquatic impact of the proposal includes water quality impact, such as sedimentation and a localised increase in pH. The proposal would require blocking off individual culvert cells at varying stages of the work to divert water around the immediate work area. This has the potential to increase flows through the open culverts, with flowing water having the highest potential to result in water quality impact during the proposal. However, work would preferably be conducted during the low streamflow period when the increased flow rate would not be expected to be significant. The majority of the work would occur during periods when the proposal site would also be dry and is unlikely to impact on aquatic habitat.

Assessments of significance, pursuant to section 1.7 of the EP&A Act and EPBC Act 'Significant Impact Guidelines 1.1 Matters of National Environmental Significance' were completed for threatened species which were recorded in the study area during surveys and/or are considered to potentially be impacted by the proposal. The proposal is not likely to have a significant impact on threatened species, populations or ecological communities listed under the BC Act, FM Act or EPBC Act.

Traffic and transport

During work, changed traffic conditions on the Snowy Mountains Highway near work activities could potentially lead to reduced safety for motorists. The proposal would generate heavy vehicle movements through transporting materials, structures, machinery, fuel and general provisions.

The proposed increase in vehicle movements on the Snowy Mountains Highway during work represents an increase of up to 11.2 per cent of the existing traffic volumes. Construction vehicle impact on the local road network is generally expected to be low.

The proposal would benefit road users by ensuring the long-term stability of the Snowy Mountains Highway road embankment.

Noise and vibration

During the work, noise impact is expected to be highly intrusive within all time periods and within 125 to 150 metres of the proposal site. There are two rural residences to the north-west of the proposal site, which are the only residential sensitive receivers in the study area.

Construction noise and vibration impact can be minimised by implementing a range of safeguards and management measures.

Aboriginal heritage

Archaeological site assessment for the constraints analysis did not identify any Aboriginal items or sites within or around the proposal site. Three archaeological sites were previously recorded within

about one kilometre of the proposal site, all of which are artefact scatters. The closest of these is located about 500 metres east of the proposal site, along Jounama Creek.

The proposal would not impact on any of the registered AHIMS sites due to their distance from the proposal site (at least 500 metres).

Non-Aboriginal heritage

There is a stone drain located about 90 metres south of the Jounama Creek culvert. It has been assessed as not having local heritage significance, however there is the potential for impact during work through the establishment of the site compound and access track.

Establishment of the site compound and access track is likely to avoid impacting the stone drain by limiting work on the embankment slope where it is located.

There is no identified potential impact to any aspect of the assessed significance of the Kosciuszko National Park from the proposal.

The specific boundary of the Snowy Mountains Scheme is currently unknown, however the proposal is in keeping with the role and significance of the highway and its purpose within the Snowy Mountains Scheme. There is no identified potential impact from the proposal based on the description of the listed area.

Landscape character and visual impact

Visual impact during work would generally be associated with plant and equipment within the proposal site, vegetation removal and the establishment of the site compound and stockpile sites. These have the potential to temporarily affect views for the resident with a line of sight to the proposal site, local road users and recreational fishermen. Work-related visual impact would be temporary and only for the proposal's duration.

Property and land use

Due to the inherent dangers for pedestrians, the walking track crossing through the proposal site will be closed for the duration of the work. The closure period is expected to be about three to four months in total, however may be up to a period of 12 months. This decision has been made in consultation with Snowy Valleys Council.

An overhead Telstra cable may need to be relocated for the proposal, and the underground section to be located to avoid damage during work. Relocation of the overhead cable is likely to result in service disruptions to the private property it services. Service disruption impacts would be temporary and would be managed to minimise customer disruption. This would include providing notification before disruptions occur.

Potential short-term amenity and access impacts may occur during the proposal. These may include increased noise and vibration, increased truck movements on Snowy Mountains Highway and Murray Jackson Drive due to materials delivery, and temporary visual impact associated with work activities.

The northern stockpile site would be maintained as a permanent stockpile site and access area for culvert inspection and maintenance, however the area in which it would be located is within the existing road reserve and would not affect land use practices.

Air quality

Potential air quality impact during work would mainly be from machinery and other vehicles emitting exhaust fumes. Gaseous emissions are associated with diesel fuel and petrol combustion from vehicle movements and operation of on-site plant and machinery. The impact of these emissions would be temporary (limited to the duration of work) and are considered to be minor.

Potential air quality impact may also occur from dust generation. Dust settlement may impact properties near the proposal site. Air quality impact as a result of dust generation is considered to be minor.

Socio-economic

There may be some minor access changes during the work period which could potentially inconvenience motorists. These changes would likely be for short periods and would have only limited impact.

Potential short-term amenity and access impact may occur during work, including the partial closure of the Talbingo walking track.

The local area would experience a short-term increase in employment opportunities and procurement of local goods and services.

Justification and conclusion

The proposal is required to repair the culvert over Jounama Creek and improve the stability of the Snowy Mountains Highway road embankment, ensuring its long-term stability. This would benefit road users in the long-term and minimise potential disruptions to the road network should the proposal not be carried out.

This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. The REF found the proposal would not result in significant environmental impact or be of such a nature or extent as to be regarded as unacceptable. The safeguards and management measures detailed in this REF would avoid or minimise the expected impact. Overall, the REF finds any negative impact is outweighed by the proposal's longer term positive impact.

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Appendix B	Statutory consultation checklists
Appendix C	Construction drawings for culvert upgrade
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1 Introduction

1.1 Proposal identification

Roads and Maritime Services NSW (Roads and Maritime) proposes to conduct culvert scour repairs on the Snowy Mountains Highway over the Jounama Creek/Jounama Pondage to ensure the long term stability of the Snowy Mountains Highway road embankment ('the proposal') (see location in Figure 1.1).

The proposal is located about 2.3 kilometres north-east of Talbingo in Roads and Maritime's South West Region. The proposal site is located in the Snowy Valleys Council local government area (LGA) (see Figure 1.2). The culverts are located on the western side of the rock fill road embankment. The proposal is entirely located in the road reserve.

Key features of the proposal are shown in Figure 1.2 and include:

- Construction of a temporary access track off the Snowy Mountains Highway for a length of about 240 metres on the southern side of Jounama Pondage
- A construction pad for crane access and stockpiling materials on the northern side of Jounama Pondage
- Construction of an access ramp from the northern crane pad and stockpile site for a length of about 50 metres on the northern side of Jounama Pondage
- Removal of existing apron slab and loose material
- Extension of existing wingwalls
- Constructing a new apron slab
- Reinstating road batters
- A site compound and stockpile sites (including existing stockpile sites 4.3 kilometres and 8.6 kilometres north-west of the proposal site along the Snowy Mountains Highway).

In recent times, the concrete apron on the downstream side of the culvert has been severely undermined and has failed. The proposal is required to restore the downstream apron to ensure that future flood events in Jounama Creek do not further undermine the culvert and eliminate the risk of structural failure of the culverts and embankments.

Utility relocation may be required for an overhead Telstra cable servicing a private property to the north of the proposal site. A section of this Telstra cable is located underground near the proposed access track, which would need to be located to avoid damage during construction.

Construction activities are expected to start in August/September 2019 subject to pondage water levels. The expected construction duration is between three to four months. However due to fluctuating water levels in Jounama Pondage, the construction period may extend over about 18 months.

Jounama Creek flows from east to west through the study area and joins Jounama Pondage at the proposal site. The proposal site is located within Roads and Maritime owned land. Kosciuszko National Park is located to the east of the Snowy Mountains Highway, with a small parcel also located to the north-west of the highway, adjacent to the proposal site on the northern side of Jounama Pondage.

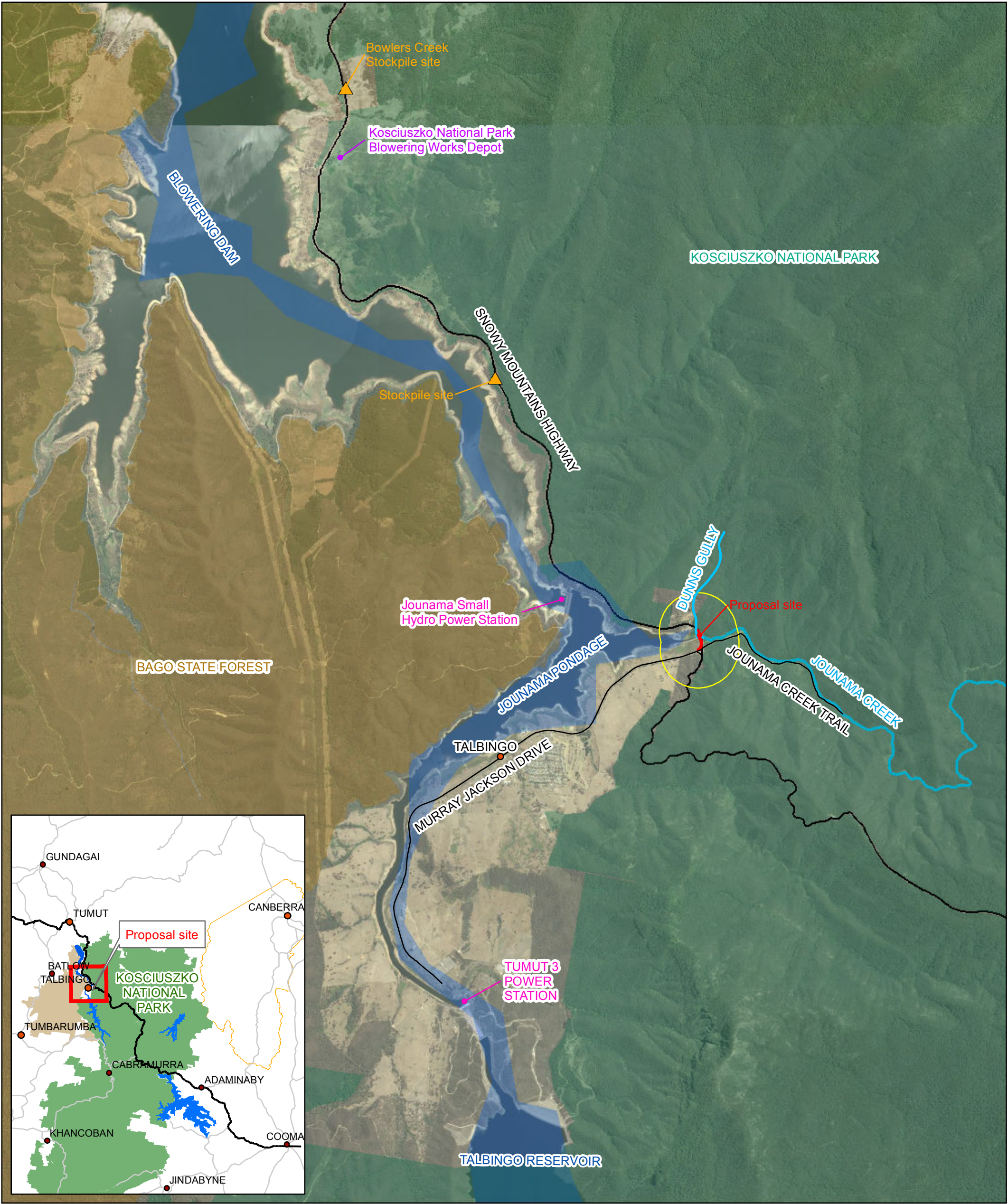
Native woodland is present in Kosciuszko National Park and the road reserve of the Snowy Mountains Highway. Native vegetation in the proposal site is mostly shrubs and regrowth vegetation of both native and introduced species. Native woodland in the study area is known to provide habitat for a number of threatened woodland birds and microchiropteran bats.

A population of endangered Booroolong Frog (*Litoria booroolongensis*) occurs upstream of the proposal in Jounama Creek. The vulnerable Murray Crayfish (*Euastacus armatus*) is also known to occur in Jounama Creek and Jounama Pondage.

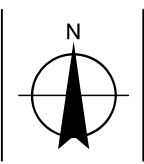
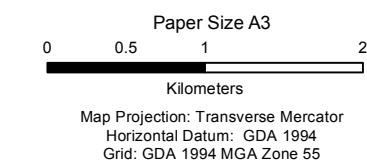
Chapter 6 provides a more detailed location description.

For the purposes of this REF, the following definitions are used:

- The 'proposal site' – refers to the area required for the construction of the proposal, including construction activities and construction vehicle access. It includes the construction footprint, site compound, stockpile sites and any areas that would be disturbed
- The 'study area' – the area likely to be affected by the proposal, either directly or indirectly. The 'study area' is defined as the area within 500 metres of the proposal site
- The 'investigation area' – the area likely to be affected by the proposal, either directly or indirectly. The 'investigation area' is defined by the extent of the potential impacts of the proposal relating to each specific discipline
- The 'locality' – the area within a 10 kilometre radius of the proposal site.



- LEGEND
- Stockpile site
 - Road
 - Waterway
 - Proposal site
 - Study area
 - Kosciuszko National Park
 - Bago State Forest
 - Waterbody

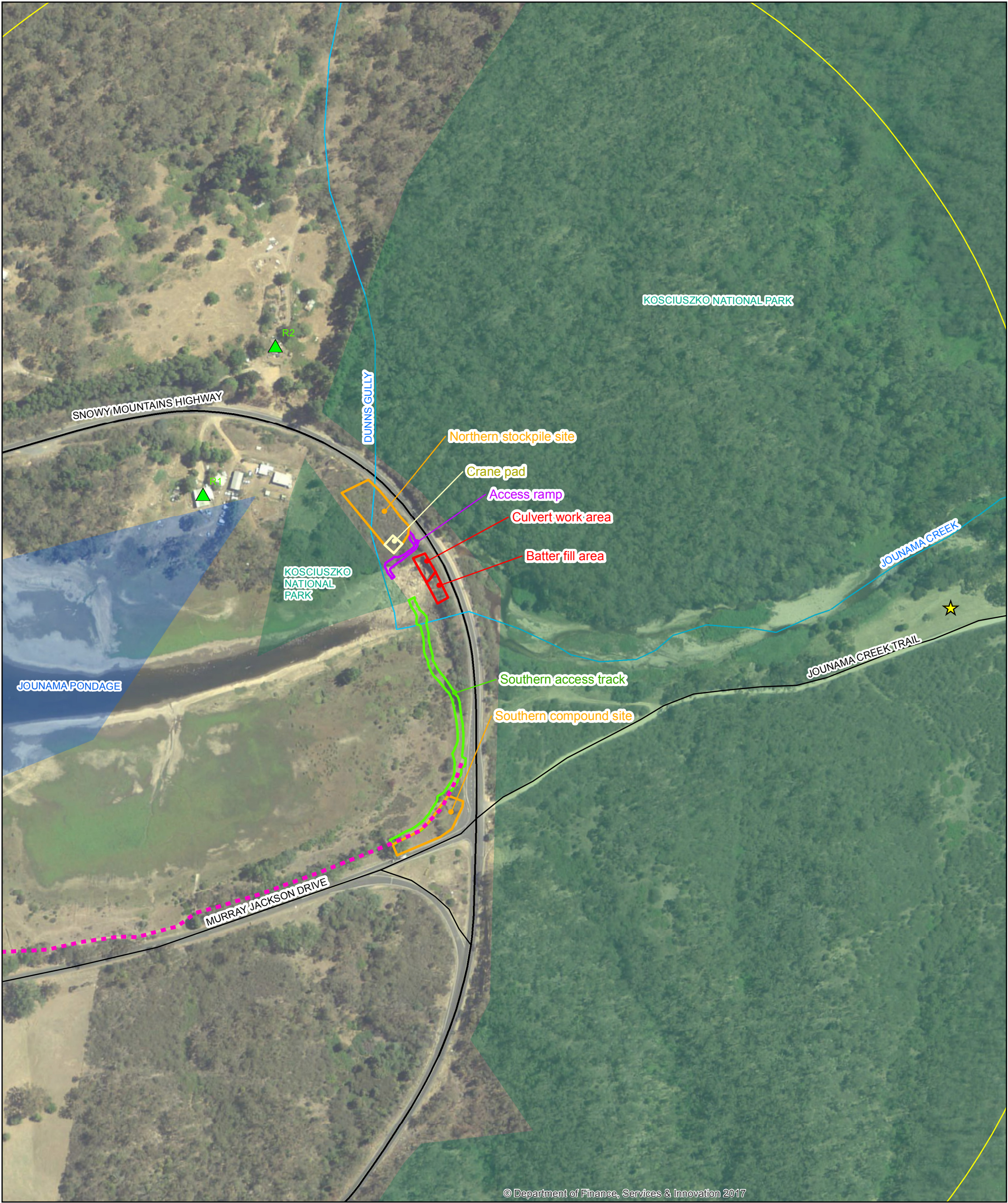


Roads and Maritime Services
Jounama Creek culvert scour repairs REF

Job Number 23-1573100
Revision A
Date 28 Sep 2018

Location of the proposal

Figure 1.1



LEGEND

★ Jounama Creek camping ground

▲ Residence

— Talbingo walking track

— Road

— Waterway

Culvert/batter work area

Crane pad

Compound/stockpile site

Access ramp

Southern access track

Study area

Kosciuszko National Park

Waterbody

037.575150

Paper Size A3

Meters

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 55

Roads and Maritime Services
Jounama Creek culvert scour repairs REF

Job Number	23-1573100
Revision	A
Date	28 Sep 2018

The proposal

Figure 1.2

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Data source: NSW Government (LPI): Aerial photograph - 2017, roads, waterways, National Park - 2012. Created by:bturmer

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by GHD on behalf of Roads and Maritime. For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposed work and associated environmental impacts have been undertaken in the context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, 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), 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 that Roads and Maritime 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 strategic assessment approval granted by the Australian Government under the EPBC Act in September 2015, with respect to the impacts of Roads and Maritime's road activities on nationally listed threatened species, populations, ecological communities and migratory species.

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 Part 5.1 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
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of the Environment and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

2.1 Strategic need for the proposal

2.1.1 Existing culvert condition

The existing four cell box culvert over Jounama Creek/Jounama Pondage on the Snowy Mountains Highway has significant scouring at the downstream apron on the Jounama Pondage side. The concrete apron at the culvert outlet has been severely undermined and has failed, causing the apron to separate from the culvert outlet. Apron damage appears to be a result of gradual undermining of the loose rock support over a period of time. The adjoining road embankment also has extensive scouring.

Due to the current deteriorated condition of the culvert and the adjoining road embankments, there is an increased risk of structural failure of the culverts and embankments. Future flood events in Jounama Creek have the potential to further undermine the culvert structure and in the long-term has the potential to result in failure of the Snowy Mountains Highway.

2.2 Existing infrastructure

2.2.1 Roads

Local road network

The Snowy Mountains Highway is 333 kilometres in length and is the main road connecting the South Coast to the Monaro region and the Monaro region to the South West Slopes, via the Snowy Mountains, from the Princes Highway to the Hume Highway. For most of its length it is a two-way sealed road with a speed limit of 100 kilometres per hour. In most of the study area the speed limit is 60 kilometres per hour. The existing road is typically 6.8 metres wide, with two 3.4 metre travel lanes. There is a 3.6 metre wide gravel shoulder on the eastern side of the road and a 1.2 metre gravel shoulder on the western side of the road. An acceleration lane is located on the Snowy Mountains Highway at the intersection of Murray Jackson Drive.

About 200 metres south of the culvert over Jounama Creek, Murray Jackson Drive, a two-way sealed road, intersects with the Snowy Mountains Highway to the west, which is the main access road to the Talbingo township and the Snowy Hydro Tumut 3 Power Station. The Jounama Creek Trail is a gravel road and intersects with the highway to the east. There are two property accesses located about 230 metres north-west of the culvert over Jounama Creek.

In the study area, the Snowy Mountains Highway is an important route for residents of Talbingo travelling to and from the township, and for Snowy Hydro to access to their infrastructure.

Culvert infrastructure

The culvert in the proposal site is a large four cell culvert, with each cell consisting of a 3.65 metre by 3.65 metre cast insitu reinforced concrete box culvert. The roof slab and base slab of the culverts are continually reinforced and about 483 millimetres thick. The end walls and three interior walls are 470 millimetres and 254 millimetres thick, respectively. There are two wingwalls on the downstream and upstream end, with the end of the wingwall adjacent to the toe of the batter on the downstream side, vertical and about 1067 millimetres high. This creates an exposed wrap-around batter toe where it meets the wingwall, which is highly susceptible to erosion.

The upstream end of the culvert does not have an apron slab. The downstream end has a mass concrete and rock apron slab, which has been damaged and mostly removed. It appears to have been constructed from loose river rock of various sizes. The cut-off wall concrete would likely have

been poured first and the space between the headwall filled with loose rock. The apron would then have been poured directly on to the rock, to a thickness of between 50 to 150 millimetres.

The culvert was constructed in 1965 and discharges water from Jounama Creek into Jounama Pondage.

Traffic volumes

Daily traffic volumes sourced from the Roads and Maritime Traffic Volume Viewer were recorded most recently in 2010, along the Snowy Mountains Highway about 1.34 kilometres north-west of its intersection with Murray Jackson Drive. The total number of vehicles per day was 535, with 70 (13 per cent) being heavy vehicles.

2.2.2 Snowy Hydro

Jounama Pondage, located on the downstream (western) side of the proposal site, is a Snowy Hydro asset and is part of the Snowy Mountains Scheme. The primary function of Snowy Hydro and its assets is to generate and sell electricity. Snowy Hydro operate the Jounama Pondage as required so that they can generate and sell electricity on demand.

Snowy Hydro operate 33 hydro and eight gas fired units to generate power, for electricity retailers and end-use customers in the National Electricity Market (NEM).

The Australian Energy Market Operator (AEMO) operates a wholesale spot market for trading electricity between generators and electricity retailers in the NEM. This means that all the electricity output from generators is pooled and then scheduled to meet electricity demand.

Snowy Hydro operation of the pondage levels is dictated by electricity trading requirements and electricity market value. It is operated similar to a stock market with traders bidding in five minute windows on electricity prices. As required, Snowy Hydro operates different pondage levels to produce electricity. As per the operational strategy, Snowy Hydro tends to keep the Jounama Pondage water levels high.

Snowy Hydro is also described as an insurance provider, where, if production is down elsewhere, such as a coal station, Snowy Hydro will operate to close the energy gaps. Jounama Pondage provides an important link between Talbingo Dam and Blowering Dam and cannot be taken offline.

Tumut 3 Power Station is at the upstream end of the pondage. Whenever the power station generates power, the water makes its way downstream into Jounama Pondage.

The water level of Jounama Pondage can rise and fall very quickly, from minimum operating level to full storage in about 6.5 hours, which can occur daily during peak demands for power. Water levels can fluctuate within about an eight metre range. The maximum level of the pondage is 392.6 metres Snowy Height Datum (SHD). There is no annual or seasonal pattern or trend regarding water levels, however a greater flow rate pattern is observed between June and October, which could be described as a typical wet winter.

The pondage is now generally kept at higher levels than historically, due to the construction of the Jounama Small Hydro Power Station. This is a relatively new power generator, constructed in 2010, where power is generated from water released into Blowering Dam from Jounama Pondage. Water levels are maintained in the pondage until demands for power require water to be released. Water will not be released into Blowering Dam if technical problems downstream prevent the production of power upon release.

2.2.3 Snowy Valleys Council

Snowy Valleys Council (Council) maintains an existing walking track between the Talbingo town and the Jounama Creek Trail on the eastern side of the Snowy Mountains Highway, that services

the Jounama Creek camping grounds. The track primarily provides access from the Jounama Creek camping grounds to Talbingo via the Jounama Creek Trail, crossing the Snowy Mountains Highway. The walking track crosses through the proposal site in the area of the proposed compound site to its crossing at the Snowy Mountains Highway. This section of the walking track would be closed for the duration of construction.

Council also maintains a water pipeline from Jounama Creek, upstream of the camping ground, which is accessed via the Jounama Creek Trail. The pipeline supplies drinking water for Talbingo town.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include:

- Provide a safe and available bridge connection for all users
- Ensure the long term serviceability of the Snowy Mountains Highway road embankment and culvert structure
- Maintain structural integrity of the culvert and embankment
- Provide timely repairs to minimise asset deterioration
- Improve scour protection within the downstream area
- Being sensitive to the area's natural environment, heritage and local communities.

2.3.2 Development criteria

The development criteria for the proposal include:

- Minimising environmental impacts
- Cost analysis
- Ease of constructability
- Safety of the site
- Project program and amount of work required.

The methodology used to assess the proposal and other culvert scour repair options against these criteria is discussed in more detail in section 2.4.1 below.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

Three options were initially considered to address the continued serviceability of the highway, including:

- Repair the culvert apron and embankment slip
- Replace the culvert with a bridge
- Construct a bridge at the location of the original creek.

These options are described in section 2.4.2, below.

Subsequently, a number of identified culvert repair options were assessed against the proposal objectives and development criteria. These included four initial options and a following four options based on variations of one of the initial options (see section 2.4.2).

Each option was assessed against the development criteria listed in section 2.3.2 using an equal weighting scoring approach. Scores were assigned from a scale of 1 to 3 based on the following:

1. Worst option
2. Intermediate option/neutral
3. Best option.

Weighting for each development criteria was assigned from a scale of 0 to 3 based on the following:

0. Irrelevant
1. Not significant
2. Significant
3. Critical/fundamental.

Scores for each option were added to give total scores, which were used to identify the preferred option.

Three options were also identified as potential access routes to the proposal site (see section 2.4.2).

2.4.2 Identified options

Alternative scope options

Repair apron and embankment slip

This option was further developed into the culvert scour repair options, and is discussed below.

Replace the culvert with a bridge

This option would include demolition of the existing culvert structure and installation of a concrete bridge. The bridge would be a single span about 18 metres in length and 12 metres wide with socketed piers into the bedrock.

Construct a bridge at the location of the original creek

This option would include leaving the existing culvert structure as is and installing a concrete bridge over the natural alignment of the creek. The bridge would be of similar construction to the bridge proposed to replace the culvert, which would no longer be used for this option.

Culvert scour repair options

The initial culvert scour repair options for the proposal are described below in Table 2.1.

Table 2.1: Description of initial culvert scour repair options

Option	Description
Option 0	Do nothing – no scour repair work on the culvert.
Option 1	Constructing a new apron slab level to the majority of the plan area.
Option 2	Constructing a new apron slab level to about the western half of the plan area and graded up to the base slab invert for the remainder.
Option 3	Constructing a tapered perimeter edge beam.

The subsequent options, based on Option 2 are described in Table 2.2 below and are shown in Figure 2.1 to Figure 2.4.

Table 2.2: Description of culvert scour repair variation options

Option	Description
Option 2a	Provide a structurally reinforced single-plane apron slab, pitched towards the downstream side to match the existing culvert floor grade.
Option 2b	Provide a structurally reinforced multi-plane apron slab, pitched towards the downstream side to match the existing culvert floor grade at the northern side and graded lengthwise and crosswise to better fit existing bedrock levels.
Option 2c	Alternate design of the apron slab to Option 2b, based on the same concept.
Option 2d	Provide a mass concrete 'rolling-plane' apron slab with large infill rocks, pitched towards the downstream side to match the existing culvert floor grade at the northern side and graded at similar slope to existing bedrock lengthwise and crosswise.

Access route options

Three options were identified as potential access routes to the proposal site, described below in Table 2.3.

Table 2.3: Description of culvert scour repair variation options

Option	Description
Option 1	Access from the Snowy Mountains Highway, to the south of the proposal site.
Option 2	Access from private property, to the north of the proposal site.
Option 3	Access via Murray Jackson Drive, to the south-west of the proposal site.

2.4.3 Analysis of options

Alternative scope option

The construction of a bridge to replace the existing culvert was determined not to be feasible for the following reasons:

- The increased costs associated with bridge construction
- The requirement to keep the highway open or closed for the shortest possible period of time due to political, social, functional and safety reasons
- Constructability issues including flood control measures and damming of the creek during construction.

The 'do nothing' option for the proposal was discounted as this option would not meet the project objectives. It would not ensure the long-term stability of the Snowy Mountains Highway road embankment.

Option 2 was chosen as the preferred option from the initial culvert scour repair options following an options meeting/workshop in June 2017. This option was chosen as the preferred option due to the design being of a similar grade to the existing structure. Following detailed survey, options a, b, c and d, based on option 2, were developed.

Average scores against the development criteria areas for each of the subsequent options, based on Option 2 are detailed in Table 2.4. The higher scores represent the better option.

Table 2.4: Comparison of scores against development criteria for each culvert repair option

Area	Average weighting	Average option score			
		a	b	c	d
Safety	2	1	2	2	3
Constructability	3	1.5	2	2	2.5
Cost	2	1	2	2	3
Project program	2.5	1	2	2	3
Environment	2	2	2	2	2
Total overall score		25	38	39	49
Rank		4	3	2	1

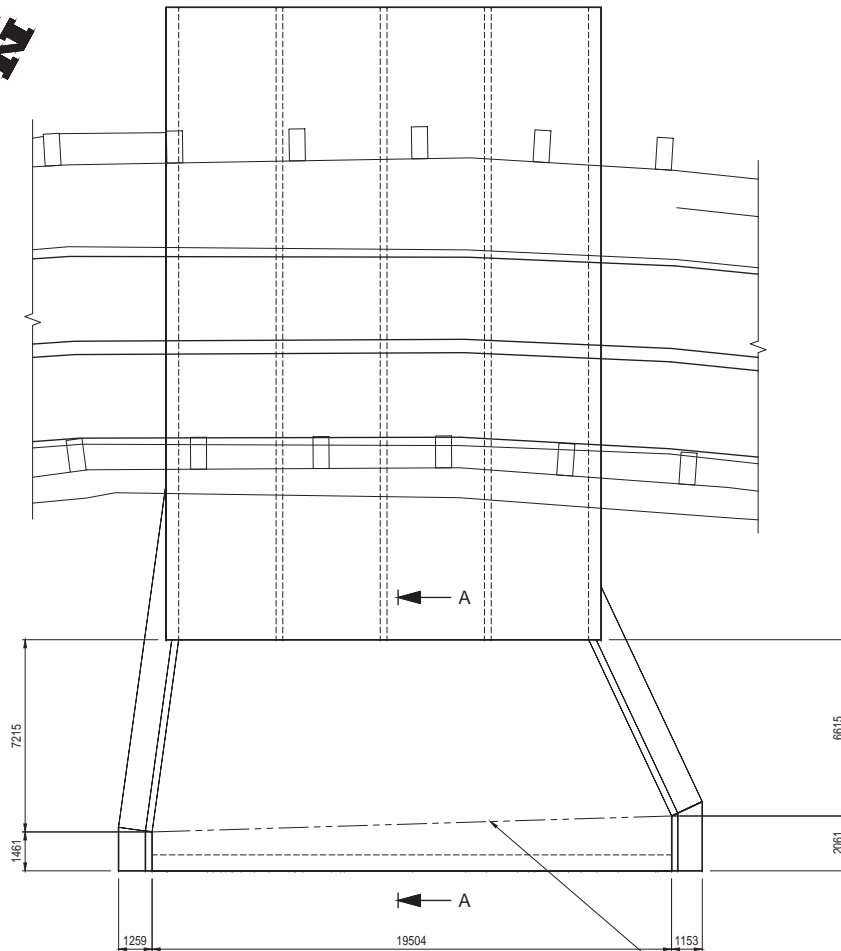
The options were assessed as follows:

- Option a was discounted due to having the lowest scores for safety, constructability, cost and project program
- Options b and c were discounted due to having less favourable scores than option d for safety, constructability, cost and project program
- Option d achieved the highest overall score.

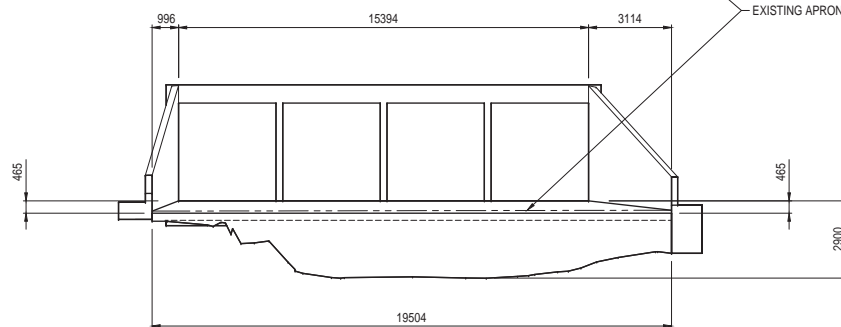
Access route options

The options for the access route were assessed as follows:

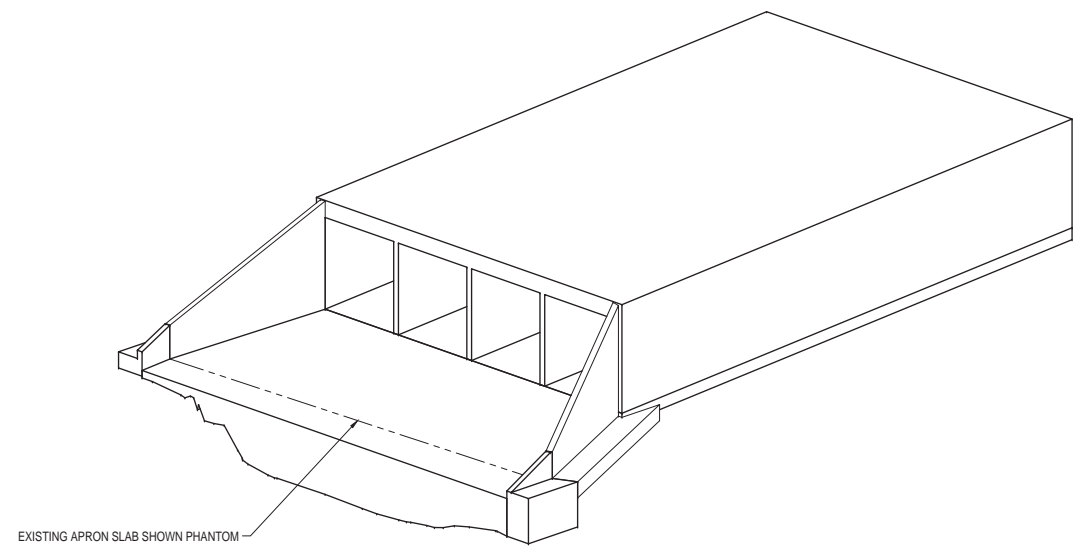
- Option 1 appears the most likely access option due to the majority of the track being clear of the high water level and being the shortest route option
- Option 2 is not preferred due to the potential lease agreements required for access, the long length of the route and a greater length of track is located below the high water level
- Option 3 is not preferred due to it being the longest access route, lease agreements required for access and a greater length of track is located below the high water level.



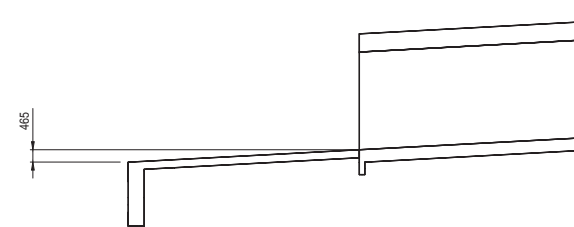
PLAN



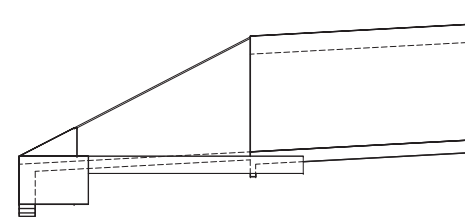
DOWN STREAM ELEVATION



3D VIEW



SECTION A-A



END ELEVATION

Figure 2.1: Culvert option 2a

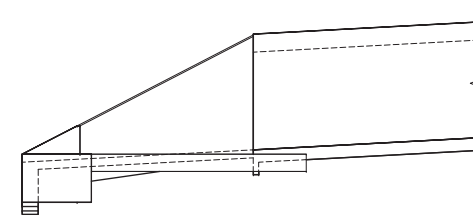
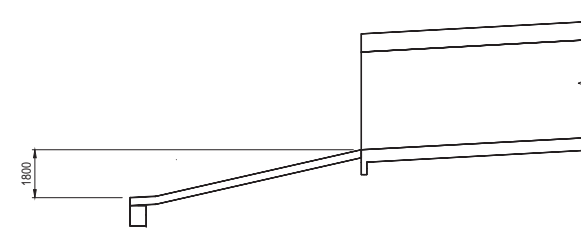
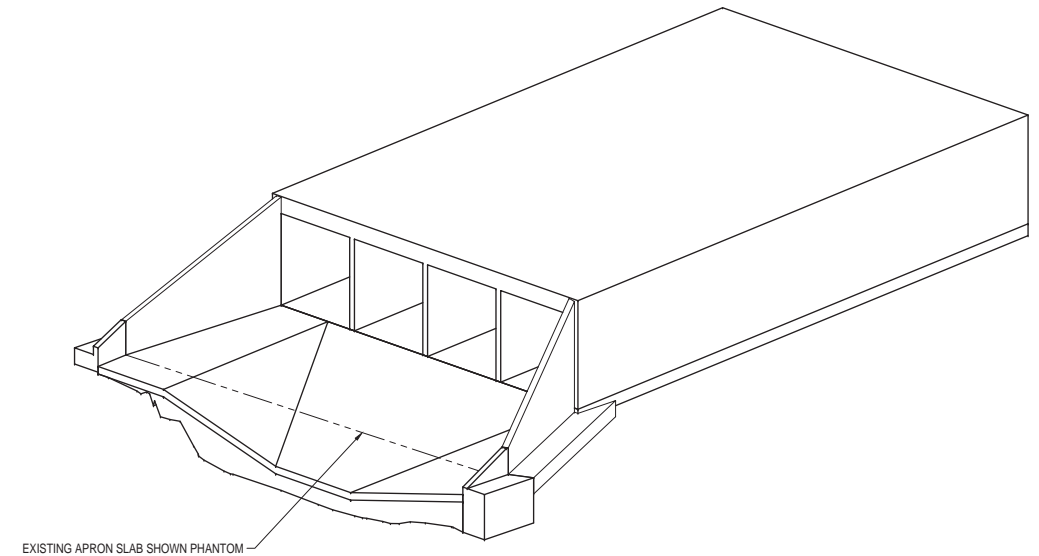
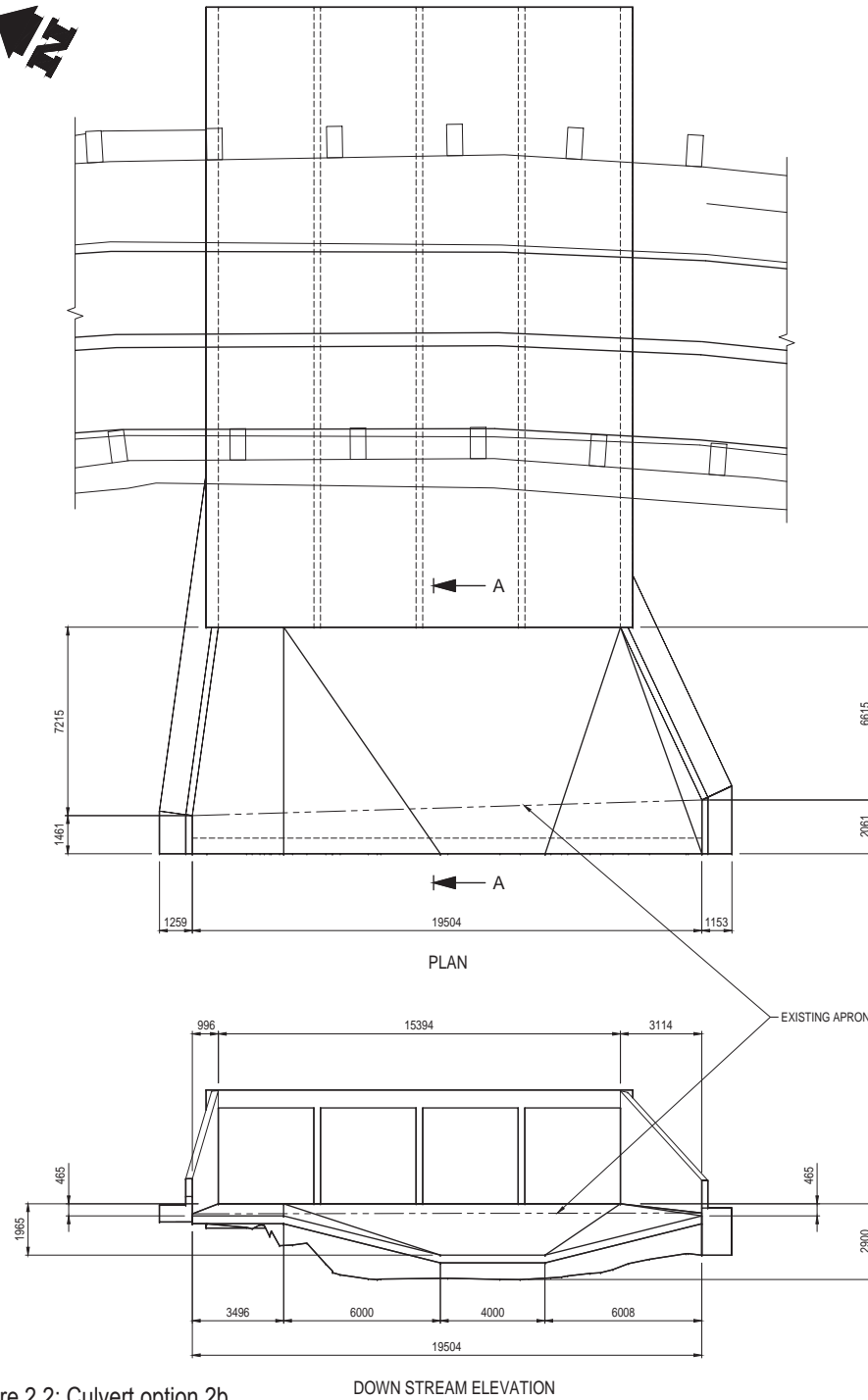
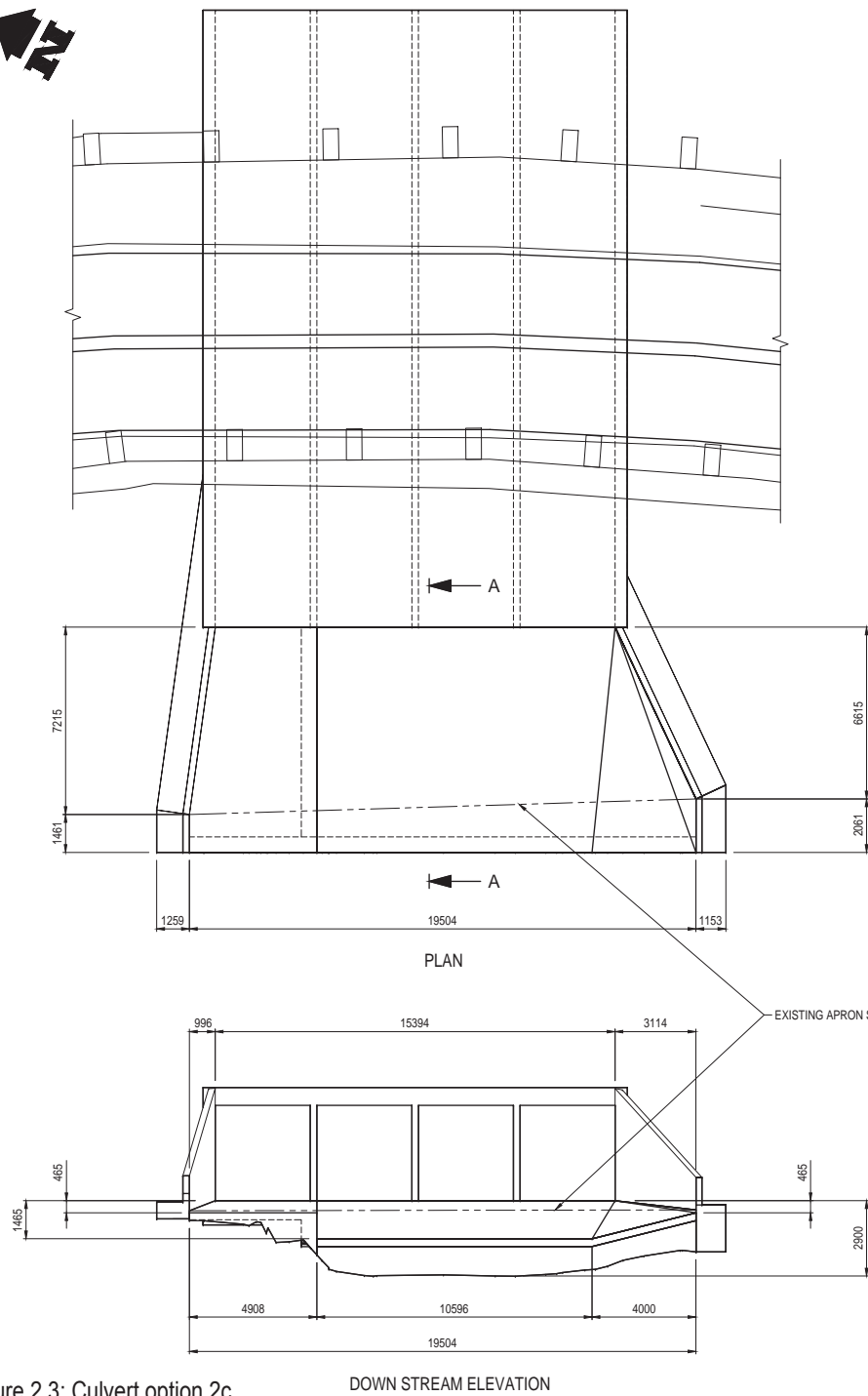


Figure 2.2: Culvert option 2b

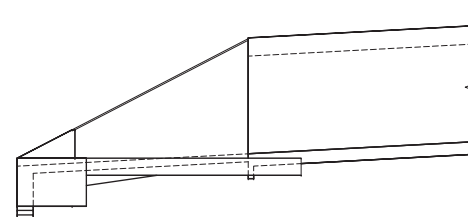
DOWN STREAM ELEVATION



3D VIEW



SECTION A-A



END ELEVATION

Figure 2.3: Culvert option 2c

DOWN STREAM ELEVATION

2.5 Preferred option

Culvert scour repair

The preferred option is option 2d. This option is considered to best achieve the proposal objectives.

Option 2d is preferred for the following reasons:

- It requires the least amount of cement material to fill the area
- It requires the shortest duration of work and number of workers
- It limits the amount of access required by foot
- It is able to be constructed underwater for parts during high pondage level
- It is the most cost effective option.

Option 2d achieves adequate outcomes in relation to ecologically sustainable development in the following ways:

- The precautionary principle – Measures to prevent environmental degradation would not be postponed due to a lack of full scientific certainty about threats of serious or irreversible environmental damage
- Intergenerational equity – The present generation would ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. The proposed culvert scour repair would ensure the long-term stability and safety of the Snowy Mountains Highway road embankment. The preferred option achieves favourable outcomes in relation to these factors
- Conservation of biological diversity and ecological integrity – This is a fundamental consideration and the ecological impacts of the preferred option are unlikely to be significant (see section 6.3)
- Improved valuation, pricing and incentive mechanisms – Environmental factors have been included in the valuation of assets and services. The development criteria for selection of the preferred option included environmental considerations, as described in this REF

The preferred option is considered to be ecologically sustainable. Further assessment against ecologically sustainable development principles is provided in section 8.2.

Access route

The preferred access route option is option 1. This option is the shortest access route of the three options considered and most of the access track is clear of the high water level. A graded access track was previously installed along the route for construction of the original culvert and embankment, but this is no longer in use and requires upgrading for the proposal.

3 Description of the proposal

3.1 The proposal

Roads and Maritime proposes to carry out culvert scour repairs on the Snowy Mountains Highway over the Jounama Creek/Jounama Pondage.

Key features of the proposal are shown in Figure 1.2 and would include:

- Construction of a temporary access track off the Snowy Mountains Highway for a length of about 240 metres on the southern side of Jounama Pondage
- A construction pad for crane access and stockpiling materials on the northern side of Jounama Pondage
- Construction of an access ramp from the northern crane pad and stockpile site for a length of about 50 metres on the northern side of Jounama Pondage
- Storage of plant and equipment on properties adjoining Murray Jackson Drive
- Construction of access foot ramps to upstream and downstream culvert faces
- Removal of existing apron slab and loose material
- Extension of existing wingwalls
- Construction of new apron slab and associated energy dissipaters
- Reinstatement of road batters
- Site compound and stockpile sites (including existing stockpile sites 4.3 kilometres and 8.6 kilometres north-west of the proposal site along Snowy Mountains Highway).

Utility relocation would be required for a Telstra cable servicing a private property to the north of the proposal site. A section of this Telstra cable is located underground near the proposed access track, which would need to be relocated to avoid damage during construction.

The proposed site compound and stockpile sites are described in section 3.4.

The proposal would have an expected construction period of between three to four months. However the construction period may extend over 18 months due to fluctuating water levels in Jounama Pondage and adverse weather conditions such as snow, high rainfall and flooding in Jounama Creek.

The Snowy Mountains Highway would remain operational during the construction period. However, there may be some short term closures for heavy vehicle access.

3.2 Design

3.2.1 Design criteria

Specific design criteria have been developed for the proposal. Key criteria for the proposal include:

- Management of semi-permanent water flows in Jounama Creek and periodic flooding of the culvert by Jounama Pondage
- Constructability given the site access constraints, including rapid fluctuations of water levels
- Integration and upgrading as required of existing road drainage including pipe culverts and flume drains
- Provide scour protection to the existing downstream area between the wingwalls to protect the base slab and wingwall footings
- Extension of both of the wingwalls to prevent recurring batter scour and loss of road embankment support
- Manage the impacts of high water flow velocities

3.2.2 Engineering constraints

Engineering constraints identified for the proposal include:

- Rapid water level rises from rainfall and Snowy Hydro power generation activities
- Steep embankments
- Construction required below water level
- Adverse environmental conditions with wide seasonal variations in temperature and rainfall
- The removal of the partially remaining apron slab
- Undulating mass bedrock level and presence of loose material across the proposal site
- Likelihood of damage to temporary work, including wet concrete, given water level fluctuations
- Likelihood of extended periods where work cannot be performed due to water level fluctuations and adverse weather
- Staged construction required due to the above constraints
- Trickle flow under road south of the proposal site, from the natural Jounama Creek alignment, to be maintained during and following the proposal.

3.2.3 Major design features

Culvert scour repair

The proposed scour repair of the culvert over Jounama Creek is shown in Figure 1.2.

The proposal involves providing a mass concrete ‘rolling-plane’ apron slab with large concrete blocks acting as energy dissipaters. These are pitched towards the downstream side to match the existing culvert floor grade at the northern side due to the higher bedrock. Lengthwise and crosswise the apron slab would be graded at a similar slope to the existing bedrock. The concept design of the proposal is shown in Figure 2.4 with construction drawings shown in Appendix C.

3.3 Construction activities

3.3.1 Work methodology

Staging of work

Construction would be carried out in three stages (see below) and it is primarily Stage B activities that would be impacted by fluctuating pondage water levels. The stage numbering in the following has been structured to reflect staging depicted on the detailed design drawings (see Appendix C). The timeframes below, assume that work would occur continuously without impact to the program from water pondage levels and adverse weather conditions

Stage A - Pre-construction activities

Pre-construction activities would include:

- Establishing the site (fencing, site compound, work area and stockpile sites)
- Establishing plant and vehicle parking areas on properties off Murray Jackson Drive
- Installing environmental control measures and erosion and sediment controls
- Access road, access ramp and hardstand construction activities as detailed in the section below
- Hardstand areas for stockpile/ work areas / compound areas and the crane pad
- Setting up temporary stockpile sites
- Establishing the site compound including site office and toilet facilities
- Establishing a turning area for vehicles, plant and equipment (this would occur within the northern stockpile / work area and either at Talbingo or the National Parks Blowering Works Depot for larger vehicles, if necessary)
- Setting up temporary traffic controls and adjustments to the existing road guard fence to allow for site access.

Southern access road, northern access ramp and hardstand construction activities

Access road, access ramp, crane pad and hardstand construction activities would include:

- Removing trees and vegetation clearing (0.32 hectares of native and introduced vegetation)
- Access road, access ramp, crane pad and hardstand work, including:
 - Stripping, stockpiling and management of topsoil, for site rehabilitation upon completion
 - Excavating material and placing fill for new sections of road, ramp, pad or hardstand
 - Constructing access road / ramp / pad / hardstand including placing and compacting gravel
 - Adjusting safety barriers.
- Drainage work, including:
 - Installing one new culvert along the edge of the Snowy Mountains Highway to allow access to the northern work area and one new culvert in the original Jounama Creek channel (within Jounama Pondage) to allow construction plant to cross the channel. The culvert in the original Jounama Creek channel would be temporary
 - Excavating material around culvert locations, placing bedding material, installing pre-cast reinforced concrete pipe culverts, placing and compacting gravel backfill material and installing concrete headwalls
 - Placement of rock in the batter drain where the northern access ramp traverses (next to the crane pad), to allow batter drain water to percolate through the rock while providing access for the excavator to cross the drain to the ramp.

Suitable excavated material would be re-used as fill. Unsuitable materials that cannot be re-used would be transported to licensed facilities for disposal.

The expected duration for this stage of work is about three months.

Stage B – Culvert repair activities

Culvert repair activities have been separated into seven stages, as follows:

- Stage 1 – Construct southern wingwall extension, demolish remaining apron slab section, remove all loose rock and alluvial material within two metres of the southern wingwall, cast no-fines concrete in this area to reinstate support to the southern wing wall, remove any remaining loose material within the new apron footprint
- Stage 2 – Construct no-fines concrete working pad in three stages as per drawings (see Appendix C)
- Stage 3 – Construct northern wingwall extension, place mass concrete precast blocks on top of no-fines concrete
- Stage 4 – Southern section of apron slab – Install reinforcement and pour new apron slab
- Stage 5 – Central section of apron slab – Install reinforcement and pour new apron slab
- Stage 6 – Northern section of apron slab – Install reinforcement and pour new apron slab
- Stage 7 – Reinstatement batter fill with well graded rock material over one layer of geotextile.

Stage B is subject to suitable construction windows and is dependent on pondage levels.

Stage C – Post-construction activities

Post-construction activities would include:

- Site clean-up and rehabilitation, including:
 - Removing and revegetating southern compound area and Murray Jackson Drive plant parking areas
 - Removing the submerged section of southern access road in the bedrock channel area
 - Removing safety access foot ramps and handrails
 - Removing temporary erosion and sedimentation controls
 - Removing temporary traffic controls
 - Removal of the temporary concrete culvert structure across the original Jounama Creek channel within Jounama Pondage

- Removal of a portion of the temporary access roads. It is intended to retain the northern access ramp, the northern stockpile area and the southern access road above the pondage high water mark
- Revegetating disturbed areas
- Reinstatement of all other disturbed areas.

3.3.2 Construction hours and duration

Construction is expected to start in August/September 2019. The expected duration is between three to four months, however due to fluctuating water levels in Jounama Pondage, the construction period may extend over 18 months.

It is anticipated most of the work for the proposal would be completed in line with OEH's recommended standard hours for construction work (DECC 2009):

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

It is not anticipated that night work would be required, however out of hours work may be required to manage construction around changing water levels in Jounama Pondage. This may include weekend work (all day Saturday and Sunday), and longer days from 6am to about 8pm should light conditions permit. Out of hours work would be subject to approval by Roads and Maritime and would be in line with the Roads and Maritime 'Construction Noise and Vibration Guideline (Roads and Maritime 2016b). This would include notifying nearby residents before out of hours work commences.

3.3.3 Plant and equipment

Plant and equipment required for the proposal would be determined by the contractor(s) during the construction planning phase. Plant and equipment likely to be used for the proposal may include:

General

- | | |
|---|--|
| • Crane | • Concrete Pump Truck |
| • Excavators | • Welding Equipment |
| • Rollers | • Haulage Trucks |
| • Graders | • Backhoe |
| • Water carts | • Front-end loader |
| • Semi-trailers and large delivery trucks | • Tree clearing and mulching equipment |
| • Air compressors | • Bobcats/skid steer loaders |
| • Light vehicles | • Generators |
| • Elevated work platform | • Chainsaws |
| • Demolition and rock saws | • Air track drilling machines |
| | • Jackhammers |
| | • Boats |
| | • Divers. |

Traffic management

- Safety barriers
- Traffic cones and bollards
- Variable message boards and signage
- Temporary traffic lights
- Traffic controllers.

3.3.4 Earthworks

Earthworks would be required for the construction of the access track and installation of the crane pad, stockpile site and access ramp on the northern side of the culvert. This would involve

removing about 150 millimetres of topsoil from the access track route, over an area of about 0.16 hectares. An additional 0.16 hectares of earthworks would also occur for the construction of the northern crane pad, stockpile site and access ramp, although these areas have minimal topsoil present. The crane pad, stockpile site, access ramp and access track are shown in Figure 1.2.

Rock and gravel material required for backfill, hardstand areas and access would be imported for the proposal.

All excavated topsoil would be stockpiled and re-used to rehabilitate the compound areas following completion of construction.

Earthworks for culvert and drainage diversions associated with site access.

3.3.5 Source and quantity of materials

The approximate quantities of materials required for the proposal are estimated to be:

- Apron repairs – concrete – 202 cubic metres
- Apron repairs – reinforcing steel – 24 tonnes
- Precast blocks – concrete – 30 cubic metres
- Reinforced concrete pipe, including headwalls:
 - 450 millimetre diameter – 5 metres
 - 600 millimetre diameter – 8 metres
- Culvert backfill rock – 10 cubic metres
- Batter reinstatement rock – 120 cubic metres
- Gravel – 660 cubic metres.

Materials would be sourced from a local supplier where feasible.

3.3.6 Traffic management and access

Construction access management

Construction vehicles and machinery would access the proposal site using the Snowy Mountains Highway from Tumut and enter the proposal site at designated access points.

A designated access track from the Snowy Mountains Highway to the proposal site would be used. This access track would be included in the traffic management plan.

Construction plant would be restricted as much as possible to the access track, compound site and stockpile areas within the proposal site. However, construction vehicles would need to use the Snowy Mountains Highway to transport construction materials from stockpile sites to the construction site, and to transport waste materials from the proposal site (see Figure 1.1).

For large heavy vehicles, the nearest location for making a U-turn would be in Talbingo or at the National Parks Blowering Works Depot, about eight kilometres north-west of the proposal site.

Two accesses to the Snowy Mountains Highway are proposed to be retained for future inspections. One is located adjacent to the access track on the southern side and the other to the northern stockpile. These two accesses would be behind the guardrail and locked gates (see Figure 1.2).

Vehicle movements

During construction, the proposal would generate heavy vehicle movements through transporting materials, machinery, fuel and general provisions.

Heavy vehicle movements may vary depending on construction methodology and weather conditions. It is estimated that one to 20 heavy vehicles would access the site per day (two to 40

movements per day) over the construction period. The most intensive truck movements will be during large concrete pours, and when reinstating the batter with rock.

Light vehicles would be required to transport staff to and from the proposal site and in various other roles on site. Light vehicles would generally be parked at the site compound and northern stockpile site.

It is estimated that in the order of five to 10 light vehicles would access the site per day for transporting staff (up to 20 movements per day). These movements would typically be expected to occur during early morning and late afternoon periods.

The proposed increase in vehicle movements on the Snowy Mountains Highway during construction represents an increase of up to 11.2 per cent of the existing traffic volumes.

Traffic management

A Traffic Management Plan would be prepared in line with the 'Traffic Control at Work Sites Manual' (RMS 2018) and Roads and Maritime 'Specification G10M – Traffic Management (Maintenance Works) 'before start of construction'. The traffic management plan would provide details of traffic management to be implemented during construction, and to manage traffic flow and driving conditions during construction. All traffic management would be in line with current Roads and Maritime standards.

For short periods of time during construction of the proposal, traffic may be restricted to one lane on the Snowy Mountains Highway. This would occur when machinery is turning from the highway onto the proposed access track, if machinery is required to access the proposal site from the Snowy Mountains Highway and crane movements.

It is likely that traffic barriers would be installed where necessary to separate the construction site from passing traffic. Temporary speed restrictions of 40 km/h would also be implemented.

No major disruptions to traffic are expected. Access to properties along the Snowy Mountains Highway, Murray Jackson Drive, Talbingo township and the Jounama Creek camping ground would be maintained throughout construction.

3.4 Ancillary facilities

3.4.1 Site compounds

A site compound would be established in the road reserve on the northern side of Murray Jackson Drive at its intersection with the Snowy Mountains Highway, south of the proposal site (see Figure 1.2). An alternative site south of Murray Jackson Drive has been noted but this site would only be used subject to assessment by a Roads and Maritime Environmental Officer.

The site compound would be used to store plant and equipment, to provide a site office, limited parking and amenities for construction staff. Chemicals and fuels for construction would be stored in appropriate storage areas within the site compound.

A layer of gravel would be put down over a small area of the site compound and the site office installed on stilts to minimise disturbance to the existing native grassland present, which would be slashed rather than removed. This would allow the site to naturally regrow to its existing condition following decommissioning of the site compound.

3.4.2 Stockpile sites

Four potential stockpile sites have been identified for the proposal, including two existing stockpile sites located along the Snowy Mountains Highway, north-west of the proposal site (see Figure 1.1). These are located about 4.3 kilometres and 8.6 kilometres north-west of the proposal site, near the

Yolde camping ground and the Kosciuszko National Parks Blowering Works Depot, respectively. The existing stockpile site located near the Kosciuszko National Parks Blowering Works Depot is known as the Bowlers Creek stockpile site and is owned by Roads and Maritime.

A stockpile site would also be located on the northern side of the proposal site (Figure 1.2) and within the existing Snowy Valleys Council depot in Tumut. The proposed stockpile site on the northern side of the proposal site would also include a 10 metre by 10 metre crane pad. Following completion of the proposal this site would be maintained as a permanent stockpile site with barrier rail and locked access. The site would provide a permanent access area for culvert inspection and maintenance.

Stockpiles would primarily be used for storing construction materials, however, it is likely that most materials would be delivered to the site and installed directly without requiring stockpiling.

The stockpile sites would be subject to the criteria set out in Roads and Maritime's 'Stockpile Site Management Guideline' (Roads and Maritime 2015c), Stockpile sites would be managed in line with the following guidelines where practicable:

- Located in areas not prone to flash flooding and more than 50 metres from a watercourse
- Have ready access to the road network or direct access to the construction corridor
- Located in previously disturbed areas that do not require the clearing of native woodland vegetation
- Located in areas of low ecological and heritage conservation significance
- Located outside the drip line of trees
- Located on relatively level land.

3.4.3 Drainage

The proposal site would require a temporary drainage crossing to be installed in the original Jounama Creek channel (within Jounama Pondage) to the south of the culvert, to allow construction plant to cross the channel. This would involve installation of a concrete pipe culvert with concrete headwall and would be removed following completion of the proposal.

It would be necessary to block off culvert cells during construction to divert water around the immediate work area. Not all culverts would be blocked off at the same time. Up to three culverts would be blocked off at a time to allow flow through the remaining culvert(s). This would impact on flow rates through the open culverts, however as the proposal site is located on bedrock it is unlikely to create additional sediment due to concentration of water flows. All culvert cells would be reopened when creek streamflow is above 2 cubic metres per second.

3.4.4 Other ancillary facilities

The proposal may require the need for rock breaking to be able to dispose of the existing base slab in pieces suitable for transportation. This would involve breaking up segments of the base slab that have come loose from the bedrock and are unable to be retained on site due to interference with construction activities.

3.5 Public utility adjustment

Public utility adjustment may be required for a Telstra cable servicing a private property to the north of the proposal site. A section of this Telstra cable is located underground near the proposed access track, which would need to be located to avoid damage during construction.

The Telstra pole located about 14.7 metres from the edge line of the Snowy Mountains Highway, within the proposed stockpile site on the northern side of the proposal site would need to be relocated clear of the work area. There is a second Telstra pole on the southern side of the proposal site that may also need to be relocated.

A Dial Before You Dig search did not reveal an additional utilises within the proposal site.

3.6 Property acquisition

The proposal would be located within the road reserve of the Snowy Mountains Highway, which is administered by Roads and Maritime. No property acquisition would be required.

4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

The NSW *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for the purpose of road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Part 5 of the EP&A Act. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by *State Environmental Planning Policy (Coastal Management) 2018*, *State Environmental Planning Policy (State and Regional Development) 2011* or *State Environmental Planning Policy (Major Development) 2005*.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF.

State Environmental Planning Policy No 44 – Koala Habitat

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*). SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat
- Encouraging the identification of core Koala habitat areas
- Encouraging the inclusion of core Koala habitat areas in environment protection zones.

While SEPP 44 does not apply under Part 5 of the EP&A Act, this REF considers the intent of the SEPP.

SEPP 44 applies to each LGA listed in Schedule 1, which includes the Tumut LGA. The Tumut LGA has amalgamated with the Tumbarumba LGA to form the Snowy Valleys LGA. The proposal site occurs within the Snowy Valleys LGA. Schedule 2 of SEPP 44 lists preferred feed tree species of the Koala.

Ribbon Gum (*Eucalyptus viminalis*) trees occur in the study area, along Jounama Creek (described in section 6.3) and are a preferred feed tree species. Therefore, potential Koala habitat is present. However, field survey results and habitat assessment for the Koala indicate that the study area does not contain habitat for this species (see biodiversity assessment in Appendix D). The first record of a Koala in the locality and within Kosciuszko National Park in over 70 years was in 2016, along the shores of Blowering Dam, with no subsequent records.

The study area is therefore unlikely to contain core Koala habitat, defined by SEPP 44 as ‘an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.’

4.1.2 Local Environmental Plans

Local government areas

The proposal site is located within the Snowy Valleys Council LGA, which was created with the amalgamation of the Tumut and Tumbarumba Shire Councils. Currently, the *Tumut Local Environmental Plan 2012* (Tumut LEP) is still relevant to the proposal. Under the Tumut LEP, the proposal site is located in the SP2 – Infrastructure land use zone with the Snowy Mountains Highway a ‘Classified Road’.

The provisions of the Tumut LEP do not apply to the proposal due to the application of the ISEPP. Nevertheless, consideration is given to the provisions of the LEP.

SP2 – Infrastructure land use

The objectives of the SP2 – Infrastructure land use zone in the Tumut LEP are:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or may detract from the provision of infrastructure.

The Snowy Mountains Highway and its road reserve occur within this zone. Any impacts to road users during construction, including traffic delays, would be minor.

The proposal involves scour repairs on the culvert over Jounama Creek, along the Snowy Mountains Highway to ensure the long term stability of the Snowy Mountains Highway road embankment. The proposal is therefore compatible with the objectives of this land use zone.

4.2 Other relevant NSW legislation

4.2.1 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* came into effect on 25 August 2017, which replaced the *Threatened Species Conservation Act 1995* (TSC Act) and the animal and plant provisions of the *National Parks and Wildlife Act 1974*. The aim of the Act is to conserve biodiversity and deliver ecologically sustainable development through a market-based approach particularly for higher risk projects. Ecological outcomes for lower risk projects would be achieved through self-assessment of risk. The market based approach would have a regional and state focus rather than a local focus on biodiversity.

Section 7.3 of the BC Act includes an assessment of significance (5 part test), which uses five factors to assist in determining if the proposed development or activity ‘is likely to significantly affect threatened species or ecological communities, or their habitats’. These five factors must be taken into account by a consent or determining authority when considering a development proposal or development application. This enables a decision to be made as to whether there is likely to be a significant effect on the species or ecological community, and hence if a species impact statement is required.

The potential for impacts on ecology have been considered in section 6.3. The assessment concludes that the proposal would be unlikely to have a significant impact on any threatened species, populations or ecological communities listed under the BC Act. A species impact statement is therefore not required.

4.2.2 Biosecurity Act 2015

The *Biosecurity Act 2015* reforms the management of pests, diseases, weeds and contaminants in NSW. For local government, the Biosecurity Act repealed the *Noxious Weeds Act 1993* which established local councils (or in some areas, county councils) as Local Control Authorities (LCAs). The *Biosecurity Act 2015* provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

4.2.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations including conserving fish stocks and fish habitat and promoting ecologically sustainable development.

The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the proposal. If a significant impact on a threatened species, population or ecological community is likely, a species impact statement must be completed and consultation with the NSW Department of Primary Industries (Fishing and Aquaculture) is required.

The project would include dredging or reclamation work for the culvert scour repairs and therefore written notice to the Minister under section 199 of the *Fisheries Management Act 1994* (FM Act) would be required for such works where they are located within watercourses identified by DPI mapping as key fish habitat. Matters raised by the Minister within 21 days must be considered.

The proposal site is located within watercourses mapped as key fish habitat, which includes Jounama Creek and Jounama Pondage.

The project is not considered likely to result in impacts to marine vegetation or block fish passage to any greater extent than that which already exists and therefore permits would not be required under sections 205 and 219 respectively of the FM Act. See consultation from Fisheries NSW in Appendix E.

4.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides the basis for legal protection and management of Aboriginal sites within NSW, and for the management of National Parks estate.

Section 90 of the Act specifies that the Director-General may issue an Aboriginal heritage impact permit in relation to a specified Aboriginal object, place, land, activity or person, or specified types or classes of these. An Aboriginal heritage impact permit may be issued subject to conditions, or unconditionally.

Aboriginal heritage impact permits must be obtained before the commencement of any project that would, or would be likely to, impact on Aboriginal objects or places.

This REF concludes that the proposal would be unlikely to have a significant effect on an Aboriginal object or Aboriginal place (see section 6.6). An Aboriginal heritage impact permit would therefore not be required for the proposal.

4.2.5 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is concerned with all aspects of heritage conservation ranging from basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement.

Heritage places and items of particular importance to the people of NSW are listed on the State Heritage Register. Only those heritage items that are of State significance are listed on the State Heritage Register. Approval under Section 60 of the Heritage Act may be required for impacts to a listed heritage item.

The Heritage Act also protects 'relics', which can include archaeological material, features and deposits. Section 4(1) of the Heritage Act defines a 'relic' as follows:

relic means any deposit, artefact, object or material evidence that:

(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and

(b) is of State or local heritage significance.

Under Section 139 of the Heritage Act, NSW Heritage Council approval is required before the disturbance or excavation of land if a project will, or is likely to result in, disturbance to a relic.

4.2.6 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes the procedures for issuing of licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an environment protection licence and comply with the conditions of that licence.

The proposal would not involve any scheduled activities listed under Schedule 1 of the POEO Act, therefore an application for an environment protection licence is not required.

With appropriate erosion and sediment controls implemented, the proposal is unlikely to cause water pollution. Therefore, an environment protection licence under the POEO Act is not required.

The POEO Act creates a number of pollution offences. If a 'pollution incident' were to occur during the proposal causing or threatening 'material harm' to the environment, Council would be obliged to notify the NSW Environment Protection Authority (EPA) immediately.

4.2.7 Water Management Act 2000

The *Water Management Act 2000* controls the carrying out of activities in or near water sources in NSW, the extraction and use of water and the construction of works such as dams and weirs. 'Water sources' are defined as a river, lake, estuary, place where water occurs naturally on or below the surface of the ground or NSW coastal waters.

The proposal is exempt from the requirement to obtain a 'controlled activity' approval under section 41 of the *Water Management (General) Regulation 2018* for work on waterfront land as it is being conducted by a public authority.

Under clause 61 of the *Water Management Act 2000*, a person may apply to the Minister for Water for an access licence (section 56) if the application is for a specific purpose access licence and a management plan provides that an application for the licence may be made. Under clause 21 of the *Water Management (General) Regulation 2018*, Roads and Maritime is exempt from obtaining an access licence for road construction and road maintenance according to Schedule 4 Part 1.

Under section 91B of the *Water Management Act 2000*, a water supply work approval authorises its holder to construct and use a specified water supply work at a specified location (eg for pumping water from a river). Extraction of water from Jounama Pondage or Jounama Creek is not required for the proposal, therefore a water supply work approval would not be required.

4.3 Commonwealth legislation

4.3.1 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 have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and chapter 6 of the REF.

A referral is not required for proposed road activities that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF and Appendix D.

The assessment of the proposal's impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Part 5 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 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 the activity.

5 Consultation

5.1 Consultation strategy

Roads and Maritime has consulted with potentially affected property owners, stakeholders and government agencies during the selection of the preferred option and development of the proposal designs. The purpose of consultation has been to:

- Inform the community of the proposal
- Advise government agencies and stakeholders of the proposal and its possible impacts.

If the proposal is determined to proceed, Roads and Maritime would continue to consult with community stakeholders and utility providers.

The REF would not be placed on public display.

5.2 Community involvement

5.2.1 Property owner consultation

Roads and Maritime have consulted with the two property owners, located on the northern side of Jounama Pondage. This consultation has included contacting the property owners by telephone to inform them of the proposed work and the potential to use the adjacent property as an access area. The property owners did not have any concerns regarding the proposal.

Roads and Maritime would continue to consult with both property owners near the proposal site during the final stages of design and throughout construction.

5.3 Aboriginal community involvement

Site investigation and consultation with the Aboriginal community was completed for the Snowy Mountains Highway constraints assessment (Umwelt 2017a), in line with the Roads and Maritime 'Procedure for Cultural Heritage Consultation and Investigation' (PACHCI) and in consultation with the Roads and Maritime Aboriginal Cultural Heritage Officer as summarised in Table 5.1. The constraints assessment included the proposal site.

Table 5.1: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Roads and Maritime assessment – discussions with relevant Local Aboriginal Land Councils were conducted in December 2015, with follow up emails sent requesting any additional information to assist with the cultural constraints mapping.
Stage 2	Site survey and further assessment – a site assessment was carried out by Umwelt (2017a) and representatives from Roads and Maritime, including the Aboriginal Cultural Heritage Officer, in consultation with Aboriginal stakeholders.
Stage 3	Formal consultation and preparation of a cultural heritage assessment report was carried out by Umwelt (2017a). Consultation was undertaken with Wagonga Local Aboriginal Land Council, Brungle/Tumut Local Aboriginal Land Council and Wagga Wagga Local Aboriginal Land Council. Consultation included phone calls to outline the survey and request information on any unrecorded cultural sensitivities for the survey area with follow up emails.

Stage	Description
Stage 4	Implement environmental impact assessment recommendations – relevant to the proposal, standard recommendations would be implemented in relation to unexpected archaeological finds.

A more detailed description of the Aboriginal community consultation process is provided in the Aboriginal heritage assessment for the Snowy Mountains Highway constraints analysis (Umwelt 2017a). Further Aboriginal heritage database assessment has been conducted for the proposal and is discussed in section 6.6.

5.4 ISEPP consultation

Clauses 13 to 16 of the ISEPP require that public authorities consult with councils and other public authorities for certain activities when proposing to carry out development without consent. Appendix B assesses the relevance of these clauses to the proposal.

Formal ISEPP consultation with Council is required due to the partial closure of the Talbingo walking track, which is operated by Council (see section 5.5 below).

5.5 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, listed in [Table 5.2](#). Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

Table 5.2: Government agencies and stakeholders consulted about the proposal

Agency	Methods of consultation
Office of Environment and Heritage (OEH) / National Parks and Wildlife Service	<ul style="list-style-type: none"> Letter sent to Biodiversity Conservation Officer outlining proposal (Feb 2018) Site meeting between Roads and Maritime Project Manager, GHD staff, OEH staff and other stakeholders (March 2018).
Environment Protection Authority (EPA)	<ul style="list-style-type: none"> Letter sent to EPA, Feb 2018 outlining proposal In the absence of attendance of the site meeting, a written response was received from the EPA, dated 27 March 2018.
Snowy Hydro	<ul style="list-style-type: none"> Site meeting between Roads and Maritime Project Manager, GHD staff, Snowy Hydro and other stakeholders (April 2016) Letter sent to Snowy Hydro outlining proposal (Feb 2018) Site meeting between Roads and Maritime Project Manager, GHD staff, Snowy Hydro staff and other stakeholders (March 2018).
Snowy Valleys Council	<ul style="list-style-type: none"> Letter sent to Council outlining proposal (Feb 2018) Site meeting between Roads and Maritime Project Manager, GHD staff, Council and other stakeholders (March 2018).
Department of Primary Industries – Fishing and Aquaculture (Fisheries)	<ul style="list-style-type: none"> Letter sent to Fisheries outlining proposal (Feb 2018). In the absence of attendance of the site meeting, a written response was received from the Fisheries, dated 16 March 2018.

Issues that have been raised as a result of consultation with these agencies and stakeholders are summarised below in Table 5.3. The responses are included in full in Appendix E.

Table 5.3: Issues raised through ISEPP consultation

Agency	Issue raised	Response / where addressed in REF
OEH	<ul style="list-style-type: none"> No immediate concerns as the proposal is located outside the National Park boundaries Booroolong Frog habitat upstream in Jounama Creek should be considered. 	<ul style="list-style-type: none"> Section 6.3
Snowy Hydro	<ul style="list-style-type: none"> Operation of Jounama Pondage levels is dictated by electricity trading requirements and electricity market value and as such it different pondage levels are required to produce electricity Snowy Hydro will not guarantee water levels or durations of low water levels during the construction phase Snowy Hydro is happy to communicate and advise when water level rises are imminent. Constant communication with Snowy Hydro will be essential Jounama Pondage can go from low water level to maximum water level within a window of about six hours It will be vital that any persons or machinery in the area can be evacuated as necessary at any point in time. Extreme water discharge from Talbingo Dam to Jounama Pondage can result in a surge wave Jounama Pondage will be required to remain operational during construction. 	<ul style="list-style-type: none"> Section 5.5
	<ul style="list-style-type: none"> Inflows from Jounama Creek will need to be considered during times of rain and will have an effect on the Pondage levels. The creek catchment is very large When there is rain in the area, the creek can tend to take two to three days for the time of concentration to peak at the culvert Turbidity affects the infrastructure used to produce electricity, therefore sediment and erosion control will be very important. 	<ul style="list-style-type: none"> Section 6.1, 6.2
	<ul style="list-style-type: none"> Designs should consider fish passage. 	<ul style="list-style-type: none"> Section 6.3
Snowy Valleys Council	<ul style="list-style-type: none"> Discussed a solution to the closure/diversion of the Talbingo walking track being in place. 	<ul style="list-style-type: none"> Section 6.11

Agency	Issue raised	Response / where addressed in REF
Fisheries	<ul style="list-style-type: none"> • The REF document should be forwarded to DPI Fisheries for review and comment before the works commence • Should the culvert works involve any dredging and reclamation works, as per Section 199 of the FM Act, written notice of the work must be provided and consideration of matters concerning the proposed works that are raised within 28 days • If the proposed works will inhibit, obstruct or block the movement of fish than a permit under Part 7 of the FM Act is required • The REF should assess whether there is likely to be any significant impacts on listed aquatic threatened species, populations or communities \The REF should outline any Key Threatening Processes that are going to be undertaken as part of or as a result of the works • Mitigation measures undertaken as part of the proposal should be outlined. 	<ul style="list-style-type: none"> • Section 6.3
EPA	<ul style="list-style-type: none"> • The REF should consider the potential impacts of the proposal on the surrounding environment as well as the disposal of waste from the project • The issues considered in need to be assessed in the REF include water and waste water management, construction noise, dust and waste management • The REF must detail the potential water quality impact of the proposed works and clearly detail the best practice measure that will be adopted to mitigate the potential impacts from this activity • Where appropriate measures must be designed and implemented to minimise and control the emission of dust and noise that have the potential to impact on neighbouring properties. 	<ul style="list-style-type: none"> • Section 6.1, 6.2,

5.6 Ongoing or future consultation

Ongoing consultation would be carried out in line with the Roads and Maritime 'Community Engagement Policy Statement 2012' and the Roads and Maritime 'Community Engagement and Communication Manual 2012'.

The following ongoing consultation would be carried out by Roads and Maritime:

- Consult with community stakeholders and property owners in the study area to assist in managing impacts during construction
- Ongoing meetings with community stakeholders and utility providers as required
- Ongoing updates throughout the planning phase and construction period to the immediately affected community
- The Roads and Maritime website would include updates, contact details for further information or complaints, and notices of upcoming work

- A contact number would be provided for the community to register any comments or complaints during construction of the proposal
- Information would be published in local newspapers and possibly Facebook, including notices of traffic control
- Information would also be included in Live Traffic NSW website and 132701 traffic information line.

6 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:

- Potential impacts on matters of national environmental significance under the EPBC Act
- 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 2000* and the *Roads and Related Facilities EIS Guideline* (DUAP 1996). The factors specified in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Soils, water quality and groundwater

6.1.1 Methodology

A preliminary geotechnical site assessment was conducted on 28 September 2017 to assess the suitability of the culvert site for the proposed culvert upgrade (GHD 2017). Due to the presence of good exposures of bedrock below the apron, it was determined that the drilling of geotechnical boreholes at the culvert site was not warranted and would provide little value to the geotechnical ground model.

The need for a detailed geotechnical investigation to be required prior to construction commencing would be reassessed following site clearing.

6.1.2 Existing environment

Topography

The terrain of the study area is hilly to undulating, grading into mountainous to the east of the study area. The proposal site at the culvert itself is not located within a classified Mitchell Landscape, due to its location in a classified water area. The northern section and part of the southern section of the study area covering part of the compound site, is located in the Minjary Hills and Ranges Mitchell Landscape, which has a general elevation of 300 to 930 metres above sea level, with local relief 400 metres (Mitchell 2002).

The southernmost section of the proposal occurs within the Pinbeyan – Ravine Ranges, which has a general elevation of 500 to 1400 metres above sea level, with local relief 700 metres.

Geology

The Minjary Hills and Ranges Mitchell Landscape comprises steep hills and ranges on lower Silurian sandstone, greywacke, quartzite, dacite, tuff and phyllite, and Devonian ignimbrite and sandstone. The Pinbeyan – Ravine Ranges Mitchell Landscape comprises prominent bluffs to 120 metres and plateau top on a synclinal fold in Upper Devonian rhyolite, andesitic basalt, tuff, sandstone, conglomerate and siltstone. Extensive rock outcrops with steep debris slope below cliffs (Mitchell 2002).

Site investigation

The preliminary geotechnical site assessment identified good exposures of bedrock adjacent to the existing culvert apron. The rock level dips down to the south immediately in front of the apron, however the rock surface is very irregular and rises back up again at the south side of the apron. The rock is estimated to be comprised of high to very high strength granite, which is typically

moderately to slightly weathered. Weakly cemented alluvium and loose fill materials overlie the bedrock in the area beneath the apron. The alluvium and fill materials are not durable.

Downstream of the culvert there is a large area of exposed bedrock which extends about 50 metres west of the culvert (GHD 2017).

Soils

The Minjary Hills and Ranges Mitchell Landscape contains rubbly scree with sandy loam matrix on steep slopes and thin red to yellow texture-contrast soils on lower slopes. The Pinbeyan - Ravine Ranges consists of rubbly brown sandy loam grading to red-brown texture-contrast soils on lower slopes (Mitchell 2002).

Site investigation

A section of the embankment of the southern side of the downstream headwall has slumped following a loss of batter toe in the vicinity. The toe loss is likely to be due to erosion and/or rapid drawdown of pore water pressures following dam level drops. At the time of the geotechnical site assessment, the crest of batter slump had regressed to about five metres downslope of the embankment crest. This has undermined the stability of the culvert wingwall (GHD 2017).

Contamination

A search of the EPA 'Contaminated Land: Record of Notices' (EPA 2018a) and 'List of NSW contaminated sites notified to EPA' (EPA 2018b) did not find any sites issued with regulatory notices, or any sites notified to the EPA, located in or near the study area.

Water quality

The water quality of creeks and drainage lines in the study area is affected by agricultural runoff. Agricultural runoff may contain farm chemicals and fertilisers that degrade water quality. Agricultural runoff may also contain manure from stock, which can increase:

- Biochemical oxygen demand
- Levels of nutrients such as nitrogen
- Levels of bacteria such as faecal coliforms.

The water quality of Jounama Pondage is affected by agricultural runoff from the adjoining land of Jounama Pondage and water releases from Talbingo Reservoir via the Tumut 3 Power Station. Treated effluent from Talbingo is also discharged into Jounama Pondage.

As part of their Environmental Protection Licence (EPL) for scheme wide operations (#10515), Snowy Hydro is obligated to conduct monthly surface water monitoring. Near Jounama Pondage, this is conducted at the Tumut 3 Power Station Drainage Pit and the Jounama Small Hydro Power Station Drainage Pit. Samples are taken to test for total petroleum hydrocarbons (TPH), the concentration limits of which have not been exceeded in the last four years of reporting (Snowy Hydro 2018).

Council also conducts three-monthly monitoring of the effluent quality control released from the Talbingo Sewage Treatment Plant as part of its EPL (#5119), which is located on the northern side of the township, on the shoreline of Jounama Pondage. The most recent monitoring report from May 2018, indicates that the licencing limit for suspended solids in the September 2017 sample was exceeded, in addition to the faecal coliform count in three sampling periods (Snowy Valleys Council 2018).

Groundwater

There are no registered groundwater bores in the vicinity of the proposal site or study area. The nearest bore to the proposal is located about 7.8 kilometres north-west of the proposal site

adjacent to the National Parks Blowering Works Depot on the shores of Blowering Dam and has a recorded groundwater level of 6.8 metres.

Generally, the level of the water table in the study area is likely to fluctuate with a range of factors including proximity to creeks and drainage lines, soil type, location of aquifers, elevation, season and rainfall.

6.1.3 Potential impacts

Construction

Soil erosion

There are no major geotechnical or soil constraints to the construction and long term maintenance of the proposal. The proposal would be unlikely to cause any substantial impacts to the geomorphic stability of the areas adjacent to the culvert due to the base of bedrock present at the site. Overall, soil impacts are expected to be low due to the limited amounts of excavation needed for the proposal.

Vegetation removal

The proposal would remove about 0.32 hectares of vegetation for the construction of the access tracks and northern stockpile site, including the crane pad. An additional 0.09 hectares of grassland would be temporarily disturbed for the southern compound site. Vegetation removal would expose soils to weathering processes, increasing the risk of erosion and sedimentation.

Earthworks

The proposal would involve earthworks over an area of about 0.28 hectares. The proposal would require the removal of about 150 millimetres of topsoil from the proposed access track, which would be stored for rehabilitation of the compound areas following completion of the proposal. Following completion of the work the gravel access road within Jounama Pondage, in the creek channel, would be removed with reinstatement below AHD 384. No additional fill would be required.

Loose soil may be eroded during rainfall events by runoff. Erosion of earthworks could cause sedimentation of Jounama Pondage. Sedimentation may also influence the vegetation and habitat of nearby areas by smothering groundcover vegetation and changing soil surface characteristics.

Construction of the culvert upgrade and batter repair

To repair the batter stability surrounding the culvert, particularly on the southern side of the culvert, reinstatement work would be required on the batter slope. This would include placing precast elements and rockfill within the scoured section, with the potential for loose soil to be eroded, increasing the potential for sedimentation.

The culvert is partially founded on weak alluvial material with construction around the base of the culvert and toe of the batter creating the potential to cause erosion and sedimentation of Jounama Pondage.

Demolition of remaining apron slab

The remaining portion of the apron slab would be demolished and removed by an excavator. There is the potential for disturbance to the underlying alluvial material, particularly if a rock hammer is required to break up the slab. This may cause sedimentation of Jounama Pondage. Due to the slab not being connected to the existing wingwalls and base slab, removal is likely to cause minimal disturbance of underlying material, therefore impacts are considered to be minimal.

Vehicle movements, including machinery and support vehicles

Machinery and vehicles used for construction would be driven off road and would have the potential to transport excess material onto sealed roads near the construction site. This is unlikely to be substantial due to the placement of thick gravel onto the surfaces once they are prepared.

Stockpiling

Topsoil from the access track would be stockpiled during construction. Inadequately stabilised stockpiled material could erode in high rainfall or windy conditions.

Soil contamination

Fuel and chemical spills

There is potential for fuel or chemical spills during construction, which may result in localised contamination of soils. Spills could occur during refuelling or through leaking of hydraulic and lubricating oil from plant and equipment. The potential for contamination from fuel and chemical spills is considered to be low provided the safeguards and management measures outlined in section 6.1.4 are implemented.

Exposure of contaminated soil

No known contaminated sites are located in or near the study area. Given the water storage and agricultural land use of the study area, it is unlikely that any soil contamination would be exposed during construction.

Water quality

The introduction of pollutants from construction into the surrounding environment and sedimentation of Jounama Pondage, if uncontrolled, could potentially have the following impacts on the water quality of Jounama Pondage:

- Increased sediment load and organic matter causing adverse impacts to water quality, such as increased turbidity. This could also occur during cement pouring for the culvert apron construction, which may involve underwater construction. Provided safeguards and management measures are implemented, in addition to the development of specific construction methods for high water scenarios, this is unlikely to be substantial
- Gross pollutants (large waste items such as rubbish and construction materials) entering the water, particularly during high rainfall events
- Reduced water quality in Jounama Pondage due to an influx of contaminants such as fuel or chemicals from accidental spills.

Water quality impacts could also occur through uncontrolled release of rinse water from plant washing and concrete slurries.

The potential for wet concrete to cure when submerged in the pondage has the potential to cause an increase in the pH of the surrounding water and negatively impact on aquatic conditions of the pondage. The potential increase in pH of the water decreases as the concrete cures, with spikes in pH levels highest within the first few hours and highly localised (CTC & Associates 2016).

It is noted that concrete pours under water are a regular occurrence and there are many examples, such as boat ramp installations, where underwater concrete is placed. It is noted Road and Maritime bridge specification B80 – Concrete Work for Bridges allows for placement of concrete in water.

Ideally, concrete will be poured in non-submerged conditions, when the pondage level is below the area in which the concrete will be poured. However, pondage levels may rise shortly after a concrete pour and inundate fresh poured concrete. Alternatively, it may be necessary to carry out a concrete pour in shallow water. In either case, the environmental effects will be managed in accordance with the relevant legislation.

The principal potential environmental effect would be the production of calcium hydroxide as a result of lime in the concrete reacting with the water. Lime is a component of cement, however modern cement mixes typically use other cementing agents and contain minimum amounts of lime. Calcium hydroxide production would have an effect of slightly raising the pH of the water locally,

however noting the large volume of water in the pondage and the dilution effect, this effect would be expected to be negligible.

Potential for reaction of concrete with water is related to direct contact between fresh concrete and water. Leaving the formwork in place for a minimum of 24 hours will help to mitigate the potential for calcium hydroxide production.

Any rises in water are generally as a result of rises in the pondage level from dam operation and not increases in stream flow from Jounama Creek. Flowing water has the highest potential for uncured concrete to result in water quality impacts. Construction of the proposal would include close monitoring of weather conditions and the potential for high stream flows from Jounama Creek to occur, in which case construction would cease.

The access road and ramp would be constructed of road base material that is in accordance with Roads and Maritime specifications, containing no dispersive materials and compacted to be stable to reduce the potential for sediment to disperse through the pondage. In addition, larger rocks, to a minimum size of 100 millimetres, would be used for batter construction and as culvert backfill material.

The potential for construction water quality impacts to Jounama Pondage is considered to be moderate, given the proposal sites location below the high water level of the pondage and the likelihood of inundation during the construction period. However, the majority of the construction of the proposal would occur during periods of low pondage levels.

Groundwater

There would be minimal excavation required for the proposal with excavation restricted to earthworks for the access track and stockpile site preparation. No piling would be required at the culvert site. The proposal would therefore be unlikely to intercept groundwater.

Operation

Topography and soils

There would be minor impacts to landscape, geology and soil through the operation of the proposal, due to alterations to the topographic environment by maintaining the northern stockpile site as a permanent stockpile site. This would involve leaving the site with a gravel surface, which could result in increased water runoff at the site.

Maintenance activities during operation that could disturb soils and landforms include cleaning and inspection of the culvert. This is likely to be minimised with access to the site being made permanent and therefore providing a stabilised surface for access.

Water quality

Stormwater runoff from the formalised stockpile site may impact on the water quality of Jounama Pondage. Operation of the stockpile site may lead to the build-up of contaminants on the surface. During rain events these contaminants can be transported by run-off into surrounding waterbodies and lands. Stockpiles would be managed in accordance with Stockpile Site Management Guidelines (Roads and Maritime 2015b). These potential impacts are unlikely to have any greater risk than that which is already present from the existing highway.

Maintenance during operation may result in a spill of chemicals or fuels near Jounama Pondage, however the risk of this occurring is low.

6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction. All activities including placement of underwater concrete will be managed in accordance with relevant legislation with specific management methods identified in the CEMP.	Contractor / Roads and Maritime project manager	Detailed design / pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 <i>Soil and Water Management</i>
	The southern access road and northern access ramp will be constructed of road material, containing no dispersive material and compacted to be stable and reduce the potential for sediment to disperse through the pondage.	Contractor / Roads and Maritime project manager	Detailed design / construction	Additional safeguard RMS Specification R44 Earthworks
	Larger rocks, to a minimum size of 100 millimetres, will be used for batter construction and as culvert backfill material to reduce the potential for sediment to disperse through the pondage.	Contractor / Roads and Maritime project manager	Detailed design / construction	Additional safeguard RMS Specification R11 Stormwater Drainage
	Concrete formwork will be left in place for a minimum of 24 hours to minimise the potential for concrete to react with the surrounding water.	Contractor / Roads and Maritime project manager	Detailed design / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor / Roads and Maritime project manager	Detailed design / Pre-construction	Core standard safeguard C2 Section 4.2 of QA G36 <i>Environment Protection</i>
Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor / Roads and Maritime project manager	Detailed design / Pre-construction	Core standard safeguard C3 Section 4.3 of QA G36 <i>Environment Protection</i>
Soil erosion and sedimentation	Erosion and sediment control measures are to be implemented and maintained to: <ul style="list-style-type: none"> • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drainage inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing <i>Managing Urban Stormwater, Soils and Construction Guidelines</i> (the Blue Book)). 	Project manager and contractor	Construction	Standard safeguard E1

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Erosion and sediment controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard E2
	Erosion and sediment control measures are not to be removed until the works are complete and areas are stabilised.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard E3
	The maintenance of established stockpile sites during is to be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Project manager and contractor	Construction	Standard safeguard E6
Water contamination	There is to be no release of dirty water into drainage lines and/or waterways.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W1
	Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient erosion and sediment controls.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W2
	Water quality control measures are to be used to prevent any materials (eg. concrete, grout, sediment etc) entering drain inlets or waterways.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W3
	During high flow rates of the creek, construction will cease and all culvert cells will remain open to avoid impacting on any fresh concrete resulting in sedimentation of the pondage and potential pH rises of the water.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	All machinery and vehicles working below the high water level of the pondage would be cleaned and in good working order prior to access to the site, which includes conducting visual inspections for fluid leaks etc.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	Potable water is used for wash down.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W5
	Excess debris from cleaning and washing is removed using hand tools.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W6
	All fuels, chemicals, and liquids will be stored at least 50 metres away from any drainage lines and waterways and will be stored in an impervious bunded area within the compound site.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R1
	Refuelling of plant and planned maintenance of machinery and plant will be carried out 50 metres away from waterways and drainage lines.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R2
	Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R5
	Emergency spill kits will be kept on site at all times. All staff will be inducted about incident and emergency procedures and made aware of the locations of emergency spill kits.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R6

6.2 Hydrology and flooding

6.2.1 Methodology

A preliminary hydrological assessment for the culvert upgrade was conducted by GHD and included in the concept design report (GHD 2017). The assessment findings are included below.

6.2.2 Existing environment

Hydrology

Jounama Creek is a perennial water course flowing from east to west through the study area, draining into Jounama Pondage via the culvert under the Snowy Mountains Highway (the proposal site). Dunns Gully, an ephemeral drainage line, flows north to south and drains into Jounama Pondage to the west of the proposal site.

The original creek alignment continues to flow through the road embankment about 30 to 40 metres south of the culvert. This doesn't appear to be causing any instability of the embankment.

Runoff from the study area drains into Jounama Creek and Dunns Gully, which drains into Jounama Pondage. Water from Jounama Pondage can be released downstream into Blowering Dam if allowed, or pumped back up to Talbingo Dam for re-release through the T3 Power Station. Downstream of Blowering Dam, water enters the Tumut River, the largest tributary of the Murrumbidgee River.

The Jounama Creek streamflow gauge is located 500 metres upstream of the Snowy Mountains Highway (station 410094). The catchment at the gauge is 127 square kilometres. Streamflow data provided by Snowy Hydro for the period between 1983 to 2016 indicated the highest flow as 103 cubic metres per second, which occurred in September 2010. The highest stream flows are generally recorded during the six month period from May to November (i.e. winter/spring).

Stream water levels commence to rise immediately once catchment runoff is occurring. If uniform rainfall across the catchment is assumed, the peak flow level at the Snowy Mountains Highway would be expected within three to six hours from the commencement of stream rises.

The capacity of Jounama Pondage is relatively small compared to the incoming flows it receives. For this reason water levels can rise and fall rapidly depending on in-flows and the amount of water being released by Snowy Hydro. An eight metre fluctuating range in water level is possible.

The size of the rocks that had previously been placed for scour protection, now present downstream of the culvert suggest there has been quite high velocities exiting from the culvert and flowing downstream.

Flooding

Three large flood events occurred between 2010 and 2012 in the catchment of the Snowy Scheme, due to heavy rainfall. Stream flows for all of these events stayed at about 10 cubic metres per second at the Jounama Creek gauge for eight or more days. Minor floods, which are usually outside of the high runoff period, generally remain above this level for no more than two days.

The variation in flood level and flow at the highway culvert will be more pronounced compared to the gauge located 500 metres upstream due to the contraction of flow through the culvert structure.

Since January 2013, the highest peak flow recorded was 21 cubic metres per second. The culvert headwater level coinciding with this flow is 0.9 metres above the culvert invert level. During the summer/autumn low flow period, the Jounama Creek flow is generally less than 2 cubic metres per

second, with the exception of runoff periods. The culvert water level depth coinciding with this flow is 0.2 metres.

The amount of runoff generated from a rainfall event depends on the rainfall across the catchment, the intensity of rainfall and the existing catchment saturation prior to the event. If catchment conditions are wet, it is expected that 10 millimetres of rainfall in a 24 hour period would generate significant stream rises. If catchment conditions are dry, it is expected that 25 millimetres of rainfall in a 24 hour period would generate significant stream rises.

Snowy Scheme infrastructure

The T3 Power Station can generate significant amounts of electricity at short notice if needed, by releasing up to 100,000 mega litres of water per day. Releases of this magnitude would cause significant flooding downstream, with Jounama Pondage and Blowering Dam designed to ensure airspace to buffer these releases if necessary (Office of Water 2011).

Snowy Hydro's operating licence states that water must not be released from Jounama Pondage in excess of its natural in-flow if at any time Blowering Dam is spilling. This could result in flooding downstream of Blowering Dam due to channel capacity exceedance of the Tumut River (Office of Water 2011).

State Water is the responsible authority for management of Blowering Dam and are required to make pre-releases to achieve airspace requirements for flood mitigation. However, they are not required to do so if the rate would exceed the operating channel capacity of the Tumut River at Oddy's Bridge, just below Blowering Dam, or at Tumut; or when flooding is occurring on the Murrumbidgee River (Office of Water 2011).

Leading up to the flood events of 2010, Snowy Hydro voluntarily reduced its releases from Jounama Pondage below natural in-flows. These voluntary reductions in releases delayed inflows into Blowering Dam, giving State Water additional buffer time to delay downstream releases, and therefore mitigate downstream flood events. This was acknowledged by the Ministerial review of water management during the 2010 flood events in the Tumut River and Murrumbidgee River carried out by the Office of Water (Snowy Hydro 2011).

6.2.3 Potential impacts

Construction

The proposal would require the blocking off of culvert cells for construction to divert water around the immediate work area. Up to three cells would be blocked off at a time, with at least one culvert cell remaining open. The proposal site is located on bedrock so it is unlikely to generate sediment, however it would impact on flow rates through the open culverts and subsequent water levels at the culvert. Flow rates through the culvert would be most pronounced when flows through Jounama Creek are high.

If two of the four culvert cells are closed and the highest peak flow recorded is 21 cubic metres per second, the flow would increase from 0.9 metres above the culvert invert level to 1.4 metres. If flow is 2 cubic metres per second, the flow would increase from 0.2 metres above the culvert invert level to 0.3 metres for two open cells and 0.45 metres for one open cell. Higher flows through open culverts would spread laterally and possibly impact on wet concrete if it hasn't gained sufficient strength, therefore blocking off two or three cells is more feasible during low and/or moderate flow rates. Construction would preferably occur during the low streamflow period (i.e. summer/autumn). As only one, two or three cells would be blocked off at a time, flow rate and lateral spread of water through the proposed work site would be managed and not be expected to be significant.

During periods of high creek streamflow, up to the peak of 21 cubic meters per second as described above, material placed within the pondage flood zone for the southern access ramp could become dislodged and would require reinstatement.

Water levels in Jounama Pondage and throughout the Snowy Scheme are highly regulated by Snowy Hydro, with releases and in-flows largely controlled (i.e. in-flows from Talbingo Reservoir). During a flood event, Snowy Hydro has the potential to release flows from Jounama Pondage and it is unlikely water levels would exceed the known maximum water level in the pondage, and therefore at the culvert. Given the maximum water level is known, all stockpiles, plant and other structures associated with construction would be located above the high water level, therefore not impacting on flooding.

Roads and Maritime would communicate with Snowy Hydro throughout the construction period and should a flood event or high water level of the pondage be impending, this would be communicated to Roads and Maritime with measures in place for relocating any construction equipment and materials at short notice. This protocol would be incorporated into part of the Hazard and Risk Management Plan.

The potential for impacts to flooding and hydrology are considered to be low provided the safeguards and management measures outlined in section 6.2.4 are implemented.

Operation

Given that the proposal would not change the culvert cell structure, it is unlikely to impact on streamflow and potential flooding of Jounama Pondage. Water entering the pondage from Jounama Creek would continue to do so similar to existing conditions. However, when there is a low level of water in the pondage, flows would be concentrated and accelerated over the base slab. The increased turbulence and velocity of flows may cause downstream disturbance. This would be partially dissipated using large rock boulders in the slab surface. The proposal is therefore unlikely to result in any substantial hydrology changes.

6.2.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Hydrology and flooding	An emergency evacuation plan will be developed and implemented throughout construction. At a minimum, this emergency evacuation plan will include measures such as procedures for regular communication with Snowy Hydro regarding water levels, monitoring of weather conditions, and procedures for removing plant and equipment from the work site.	Project manager and contractor	Pre-construction and construction	Additional safeguard

6.3 Biodiversity

A specialist biodiversity assessment of the proposal was prepared and is provided in Appendix D. The outcomes of the assessment are summarised in this section.

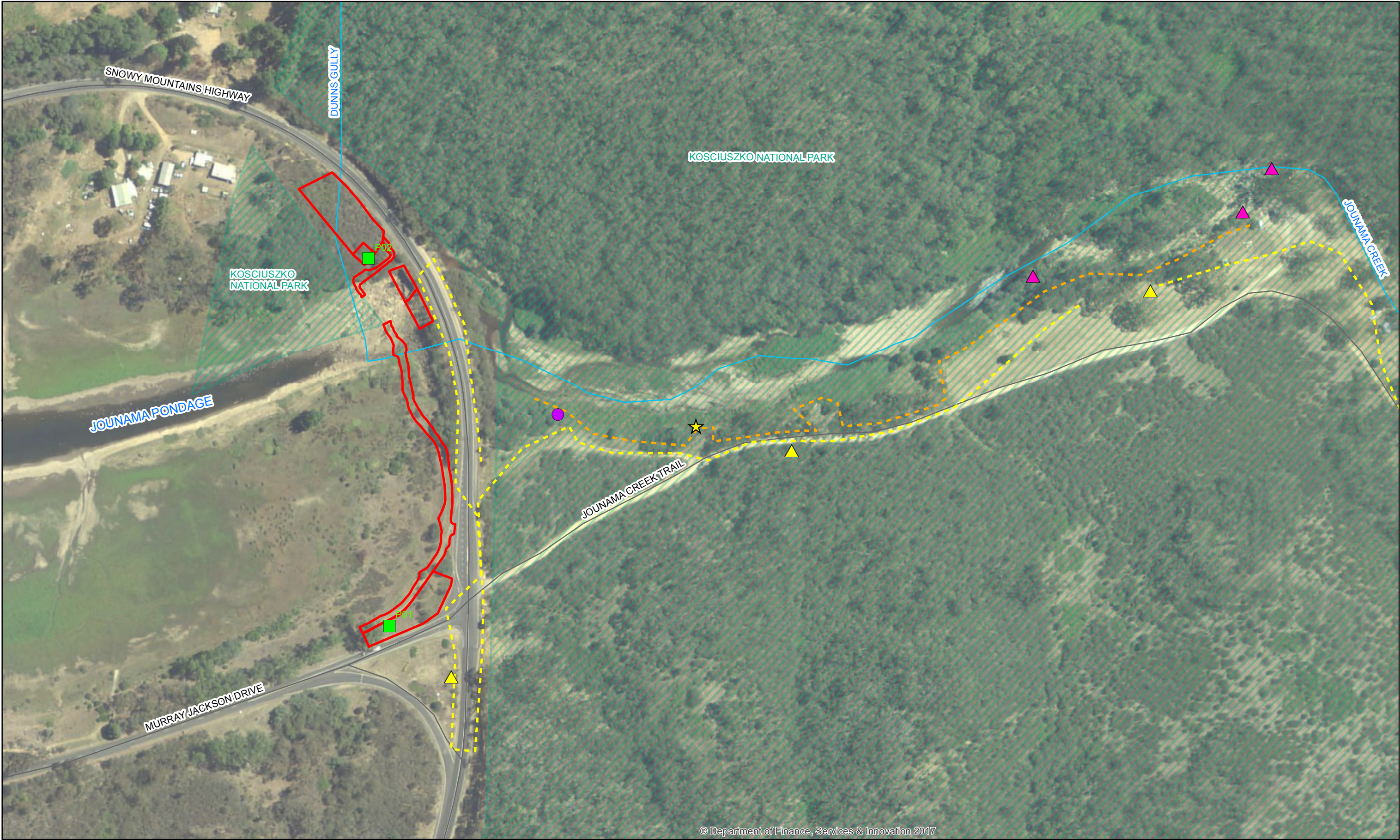
6.3.1 Methodology

The investigation area for the biodiversity assessment is defined as the area within 500 metres of the proposal site.

The assessment involved the following methods:

- Background ecology information was reviewed. This information included:

- BioNet Atlas – threatened species web application, species sightings. Licensed data for Snowy Valleys local government area. Search of all terrestrial threatened flora and fauna species (within a 10 kilometre radius of the proposal site) (searched January 2018) (OEH 2018a)
- BioNet Atlas – threatened species web application, threatened biodiversity profiles (2018b) NSW, online profiles
- BioNet Atlas – vegetation classification for plant community types in the study area
- DotEE (2018a) EPBC Act Protected Matters Search Tool – for a 10 kilometre radius around the proposal site (searched January 2018)
- DotEE (2018b) Species profile and threats database, online profiles
- NSW Department of Primary Industries (DPI) priority weed declarations – Riverina region (DPI 2018) (searched January 2018)
- Previous reports prepared for Roads and Maritime for the Jounama Creek culvert upgrade project were reviewed for background information, including:
 - ‘Jounama Creek culvert repair: Concept design report’ (GHD 2017)
 - ‘Snowy Mountains Highway (HW04) constraints report: Biodiversity assessment’ (Umwelt 2017b).
- Flora and fauna surveys were conducted by two ecologists between 5 February to 7 February 2018 (see Figure 6.1). Surveys included:
 - Flora surveys (in accordance with the Biodiversity Assessment Method)
 - Targeted Booroolong Frog surveys
 - Nocturnal fauna surveys
 - Fauna habitat assessment
 - Diurnal bird surveys
 - Anabat detection and analysis
 - Bat harp trapping
 - Opportunistic fauna observations.
- An assessment of the likelihood of occurrence was completed for threatened species, populations and ecological communities, and migratory species, with the potential to occur in the study area. The possibility of an impact on each species, population or ecological community was also assessed
- Potential impacts on species listed under the BC Act and FM Act were assessed in line with the Assessment of Significance included in section 1.7 of the EP&A Act (see biodiversity assessment in Appendix D)
- Potential impacts on species listed under the EPBC Act were assessed in line with the EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DotE 2013) (see biodiversity assessment in Appendix D)
- Safeguards and management measures for the proposal were developed based on site conditions and the potential impacts of the proposal.



6.3.2 Existing environment

Flora

Plant community types

The following plant community types (PCTs) are present in the study area:

- Apple Box – Eurabbie grassy open forest on sheltered slopes and gullies in the Burrinjuck area, South Eastern Highlands Bioregion (PCTID 652)
- Red Stringybark – Red Box – Long-Leaved Box – Inland Scribbly Gum tussock grass – shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion (PCTID 290).

As PCTID 652 would not be impacted by the proposal, no further assessment of the community is required. In the proposal area PCTID 290 occurs as a derived form and exists as regrowth shrubs and midstorey species due to disturbance from previous road construction (see Photo 1 and Figure 6.2).

These plant community types do not classify for listing as a threatened ecological community under the BC Act or EPBC Act.



Photo 1: PCTID 290 (derived shrubby regrowth) in the study area



LEGEND

— Road

— Waterway

▭ Culvert work/batter fill area

■ Kosciuszko National Park

Vegetation type

■ Derived native grassland

■ Introduced grassland

■ PCTID 290 (derived shrubby regrowth)

Flora survey results and priority weeds

Field surveys identified 63 flora species, of which 38 are native species and 25 are introduced species.

Native tree species in the study area are dominated by Blue Gum (*Eucalyptus bicostata*) and Ribbon Gum (*E. viminalis*) along Jounama Creek and Blakely's Red Gum (*E. blakelyi*) and Red Stringybark (*E. macrorhyncha*) along the adjacent treed slopes.

Native shrubs that occur in the study area include Slender Tea-tree (*Leptospermum brevipes*), Burgan (*Kunzea ericoides*) and Blackthorn (*Bursaria spinosa*).

The groundcover vegetation in the study area is generally dominated by introduced flora species, such as Paspalum (*Paspalum dilatatum*), Purpletop (*Verbena bonariensis*) and Cocksfoot (*Dactylis glomerata*). A higher proportion of native species occurs within the woodland and forest patches of the national park, further away from previous disturbances. Commonly occurring native species include Kangaroo Grass (*Themeda triandra*), and Snowgrass (*Poa sieberiana*).

One priority weed for the Snowy Valleys Council area was recorded during current surveys; Blackberry (*Rubus fruticosus*) (DPI 2018). The control duty for Blackberry is *prohibition on dealings*, which means the plant must not be imported into the state or sold.

Blackberry is also listed as a weed of national significance under the National Weeds Strategy.

Fauna

Fauna habitats

Woodland/forest

Woodland and forest habitat for fauna in the study area is predominantly located within Kosciuszko National Park, which includes a large expanse of dry open eucalypt forest comprised of species including Red Stringybark and Broad-leaved Peppermint (*E. dives*) in the study area. More open woodland is located along Jounama Creek where previous clearing has occurred. These habitats provide foraging, movement and potential breeding habitat for a variety of bird species including threatened species that were recorded during current surveys, such as the Gang-gang Cockatoo (*Callocephalon fimbriatum*)

Mature eucalypt trees occur throughout the study area but do not occur within the proposal site. Regeneration of canopy species is occurring within existing woodland and forest habitat. Mature trees in the study area would be used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats.

Hollow-bearing trees occur throughout the study area and are likely to provide nesting and roosting habitat for microchiropteran bats and arboreal mammals such as the Yellow-bellied Glider (*Petaurus australis*) and Brushtail Possum (*Trichosurus vulpecula*); and a range of woodland birds. Owls such as the threatened Masked Owl (*Tyto novaehollandiae*) and Southern Boobook (*Ninox novaeseelandiae*) may use hollow-bearing trees for nesting.

Woodland and forest areas with coarse woody debris and leaf litter would provide habitat for reptiles such as snakes and skinks, as well as foraging habitat for threatened woodland birds.

Derived native grassland

Native grassy areas in the study area are generally of a relatively small size and scattered distribution due to the high level of disturbance in areas outside of woodland and forest habitat and the dominance of these forested habitat types. Grassy areas provide foraging habitat for common

mammals such as the Eastern Grey Kangaroo (*Macropus giganteus*) and Common Wombat (*Vombatus ursinus*). Grassy areas also provide foraging and nesting habitat for woodland birds, including threatened species such as the Diamond Firetail.

Aquatic habitat

The proposal site is located where Jounama Creek flows into Jounama Pondage. Jounama Creek and Jounama Pondage are both permanent waterways that provide habitat for a variety of aquatic fauna and flora. Both waterways are mapped as key fish habitat by the Department of Primary Industries (Fishing and Aquaculture), with Jounama Pondage providing known habitat for fish species and the Murray Crayfish (*Euastacus armatus*).

Aquatic habitat in Jounama Creek and Jounama Pondage are connected when higher pondage water levels are at or above the culvert base, removing the two to three metre drop from Jounama Creek flow travelling through the culvert to the bedrock of the pondage. During periods of low pondage levels, aquatic habitat in Jounama Creek and Jounama Pondage is not connected and imposes a barrier to aquatic species.

Vegetation lining the fringes of Jounama Creek is generally dominated by the introduced Blackberry (*Rubus fruticosus*), with native shrubs Burgan and Slender Tea-tree occurring along the banks of the creek. The canopy is comprised of native species including Ribbon Gum. Native aquatic groundcover species that occur include Water Primrose (*Ludwigia peploides*) and Slender Knotweed (*Persicaria decipiens*).

Jounama Creek also contains areas of cobble banks and large rocky habitat. Cobble banks with fringing vegetation cover provide habitat for the threatened Booroolong Frog (*Litoria booroolongensis*), which was recorded during current surveys, about 500 metres upstream of the proposals site. This species was known previously from Jounama Creek and current surveys confirm its presence. No potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site.

Large rocky habitat comprised of in-stream boulders and rocks, which also occur on the banks of the creek provide basking and shelter habitat for reptile species including the Australian Water Dragon (*Intellagama lesueurii*), which was recorded during the current survey period. Deep rocky habitat within the creek may also provide shelter habitat for fish species that may occur in the creek.

Vegetation on the fringes of Jounama Pondage is generally dominated by introduced species such as Paspalum (*Paspalum dilatatum*) and Phalaris (*Phalaris aquatica*), with native shrub species including Burgan, Slender Tea-tree and Silver Wattle (*Acacia dealbata*) present generally above the high water line. Jounama Pondage is a rockfill dam containing open water habitat, which provides known habitat for threatened species including the Murray Cod (*Maccullochella peelii*), a translocated population of Macquarie Perch (*Macquaria australasica*), Murray Crayfish and other native species including Golden Perch (*Macquaria ambigua*). Introduced species including Redfin Perch (*Perca fluviatilis*), which is listed as a Class 1 noxious fish under the FM Act, also occur in Jounama Pondage.

Jounama Creek and Jounama Pondage are known to provide habitat for recreational fish species such as Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*).

In addition to the Booroolong Frog, the creek and pondage are also likely to provide potential habitat for commonly occurring frogs such as the Eastern Sign-bearing Froglet (*Crinia parinsignifera*) and Peron's Tree Frog (*Litoria peronii*).

Aquatic habitat also provides foraging and breeding habitat for wetland birds, such as ducks and herons. A number of bird species that depend on wetland habitats were recorded during field surveys, including the Australian Wood Duck (*Chenonetta jubata*), White-faced Heron (*Egretta*

novaehollandiae), Australasian Darter (*Anhinga novaehollandiae*) and White-necked Heron (*Ardea pacifica*).

Fauna survey results

Field surveys recorded 58 fauna species, five of which are introduced and 53 are native species.

The forest and woodland in the study area provides habitat for a number of bird species. Commonly occurring native bird species included the Australian Magpie (*Cracticus tibicen*), Laughing Kookaburra (*Dacelo novaeguineae*) and the Satin Bowerbird (*Ptilonorhynchus violaceus*). Introduced bird species recorded during surveys include the Common Starling (*Sturnus vulgaris*), European Goldfinch (*Carduelis carduelis*) and Common Blackbird (*Turdus merula*). One threatened bird species was recorded during surveys; the Gang-gang Cockatoo, which is listed as vulnerable under the BC Act.

Ten species of mammal were recorded during surveys, including the native Eastern Grey Kangaroo and seven bat species. Introduced mammals included the Feral Pig (*Sus scrofa*) and European Rabbit (*Oryctolagus cuniculus*). Ultrasonic Anabat recordings identified four bat species to a definite call confidence level including Gould's Wattled Bat (*Chalinolobus gouldii*), Large Forest Bat (*Vespadelus darlingtoni*) and White-striped Free-tailed Bat (*Tadarida australis*). Two bat species were recorded to a probable call confidence; Southern Forest Bat (*Vespadelus regulus*) and the threatened Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), which was recorded on one of two recording nights. As many as six other species may also have been recorded, but poor quality data and/or call similarity between species made it difficult to distinguish between certain species.

Two reptile species were recorded during surveys including the Australian Water Dragon and a species of skink (*Egernia* sp.). No threatened species of reptile are likely to occur in the study area.

One amphibian was recorded during current field surveys; the Booroolong Frog, which is listed as endangered under the BC Act and the EPBC Act. Three individuals of the species were observed along Jounama Creek; on cobbles within the creek and within grass on the creek bank, about 500 metres east of the proposal site.

No fish species or other aquatic fauna was observed during surveys, although these are known to occur.

Wildlife connectivity corridors

The proposal site occurs within the road reserve of the Snowy Mountains Highway, with Kosciuszko National Park predominantly occurring to the east, south and north and Jounama Pondage to the west. The road reserve of the Snowy Mountains Highway contains woodland that forms a vegetation corridor, which runs through the study area, and facilitates the movement of a range of fauna species through the study area. Parts of the road reserve have been previously cleared, particularly in the vicinity of the proposal site, however, this has not prevented fauna from traversing the study area. This corridor is directly connected to woodland in Kosciuszko National Park.

Kosciuszko National Park is about 6,900 square kilometres. Kosciuszko National Park shares a border with Maragle and Bago State Forests to the west and Bondo State Forest to the north-east. These three state forests have a total area of over 980 square kilometres. The extent and quality of the remnant vegetation in the study area and locality create high habitat connectivity throughout the study area and wider locality, which provides high quality wildlife connectivity enabling fauna species to traverse the study area and locality without difficulty.

The aquatic habitat in the study area is highly modified due to the Snowy Mountains hydroelectricity scheme. The proposal occurs within Jounama Creek, which drains into Jounama Pondage (formally Tumut River), however between 1949 and 1974 the Tumut River was

impounded by six dams (Snowy Hydro 2011). This has resulted in a modified environment with reduced connectivity for aquatic species. Water entering Jounama Pondage from Jounama Creek has been diverted through the culvert at the proposal site. When the pondage water levels are low, water entering the pondage drops down about two to three metres from the culvert slab before it can enter the pondage. This does not; however, completely inhibit aquatic habitat connectivity between the two areas of Key Fish Habitat. Habitat in Jounama Creek and Jounama Pondage are connected when higher pondage water levels are at or above the culvert base, removing the drop from the culvert to the bedrock of the pondage.

Threatened species and populations

The literature review, database search and field surveys identified four ecological communities, seven flora species, seven bird species, eight mammal species, four amphibian species and three fish species listed under the EPBC Act that are known or likely to occur in the study area.

The literature review, database search and field surveys identified two ecological communities, 10 flora species, 24 bird species, 11 mammal species, one reptile species, four amphibian species, three fish species, and one crustacean listed under the BC Act and/or FM Act that are known or likely to occur in the locality.

Table 6.1 provides a summary of the biota listed under the BC Act, FM Act and EPBC Act that have been recorded or are considered likely to occur in the study area and whether an impact is likely.

Table 6.1: Listed species and their likelihood of occurrence in the study area and possibility of impact

Scientific name	Common Name	Status		Potential occurrence (Low, Moderate, High, Recorded)	Possibility of impact
		BC Act	EPBC Act		
Plants					
Thelymitra atronitida	Black-hooded Sun Orchid	CE	-	Moderate	Low
Birds					
Stagonopleura guttata	Diamond Firetail	V	-	Moderate	Low
Artamus cyanopterus	Dusky Woodswallow	V	-	Moderate	Low
Petroica phoenicea	Flame Robin	V	-	Moderate	Low
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Recorded	Low
Hieraaetus morphnoides	Little Eagle	V	-	Moderate	Low
Tyto novaehollandiae	Masked Owl	V	-	Moderate	Low
Petroica rodinogaster	Pink Robin	V	-	Moderate	Low
Myiagra cyanoleuca	Satin Flycatcher	-	Mi	Moderate	Low
Petroica boodang	Scarlet Robin	V	-	Moderate	Low
Haliaeetus leucogaster	White-bellied Sea-eagle	V	-	Moderate	Low
Mammals					

Scientific name	Common Name	Status		Potential occurrence (Low, Moderate, High, Recorded)	Possibility of impact
		BC Act	EPBC Act		
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Recorded	Low
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	Moderate	Low
<i>Macrotis lagotis</i>	Greater Glider	-	V	Moderate	Low
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Moderate	Low
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	Moderate	Low
Amphibians					
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E	Recorded	Low
Fish					
<i>Macquaria australasica</i>	Macquarie Perch	E	E	High	Low
<i>Maccullochella peelii</i>	Murray Cod	-	V	High	Low
<i>Euastacus armatus</i>	Murray Crayfish	V (FM Act)	-	High	Moderate
<i>Bidyanus bidyanus</i>	Silver Perch	V	CE	High	Low

- V – Vulnerable, E – Endangered, CE – Critically Endangered, Mi – Migratory
- **Bold** – an EP&A Act assessment of significance and/or EPBC Act significance assessment has been completed for these species, which were recorded in the study area or those that have a high or moderate likelihood to occur in the study area and for which an impact is likely

The EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DEWHA 2009) was used to assist in determining the significance of the potential impacts of the proposal on one frog species recorded in the study area during current surveys. Assessments of significance under section 1.7 of the EP&A Act were completed for one bird, one frog, one mammal and one crustacean species listed under the BC Act and/or FM Act identified as being likely to be impacted by the proposal and/or that were recorded in the study area during current surveys. The assessments concluded that the proposal is unlikely to have a significant impact on these species (see *conclusion on significance of impacts* in section 6.3.3 below).

6.3.3 Potential impacts

Construction

Removal of native vegetation

The proposal would remove about 0.32 hectares of vegetation, of which 0.20 hectares is native vegetation (see Table 6.2). An additional 0.09 hectares of derived native grassland would be temporarily disturbed for the southern compound site.

Table 6.2: Impacts on vegetation

Plant community type (PCT)	Status		Proposal area ¹ (hectares/m ²)	Percent cleared in CMA ²
	BC Act	EPBC Act		
PCTID – 290 (derived shrubby regrowth)	-	-	0.16	67
Derived native grassland	-	-	0.04	N/A
Introduced grassland	-	-	0.12	N/A
Total			0.32	

1- Area to be cleared based on ground-truthed vegetation mapping within the study area.

2- Based on the VIS classification database.

The vegetation proposed to be removed is predominantly native shrub species that have regrown in the road reserve since previous clearing has occurred, and introduced grassland. A small area of derived grassland dominated by native species would also be removed for construction of the southern access track, with native grassland in the area of the compound site to be temporarily disturbed during the construction period via slashing. These areas would be allowed to naturally regenerate following completion of the proposal.

Wildlife connectivity and habitat fragmentation

The woodland in the study area forms part of a vegetation corridor along the Snowy Mountains Highway that directly connects to Kosciuszko National Park and facilitates the movement of a range of fauna species through the study area and across the landscape. Kosciuszko National Park contains a vast area of native woodland habitat that also connects to other remnant patches including Bago and Maragle State Forests to the west and Bondo State Forest to the north-east. This woodland is vital habitat in the landscape with connectivity between patches important for maintaining fauna movement across the landscape.

Fragmentation of the vegetation in the locality has previously occurred through construction of the Snowy Mountains Highway and other local roads and access tracks, and for the development of the Snowy Mountains Scheme, which includes Jounama Pondage. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences, however the extent of native vegetation in the locality remains high.

Due to the limited amount of vegetation proposed to be removed in the already modified road reserve of the Snowy Mountains Highway, the removal of vegetation being limited to regrowth, and the extent of remaining native vegetation surrounding the proposal, it is unlikely that the proposal would fragment woodland habitat in the study area. Fauna would remain able to traverse the study area. It is unlikely that species limited in their dispersal abilities would be restrained by the proposed removal of vegetation.

The proposal would not remove any large areas or native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Removal of threatened fauna habitat

The vegetation proposed to be removed is mostly regrowth shrubs, native grassland and introduced grassland. Some of this vegetation is likely to provide habitat for fauna species, including threatened species such as the Gang-gang Cockatoo and Eastern Bentwing-bat, which

were recorded during surveys and may use the regrowth shrubs in the proposal site as marginal foraging habitat.

Table 6.3 includes the threatened fauna that have been recorded or have a high likelihood of occurrence in the study area and the potential for the proposal to impact on these species. Where relevant, the area of potential habitat of the species to be impacted has been included. It is unlikely to the proposal would have a substantial impact on these species due to the low quality of habitat to be removed and the limited area of habitat disturbance.

Table 6.3: Impacts on threatened fauna habitat

Species	Potential occurrence (Moderate, High, Recorded)	Impact by proposal likely?	Impact area of potential habitat (ha)
Booroolong Frog	Recorded	No	0
Eastern Bentwing-bat	Recorded	No	0.16
Gang-gang Cockatoo	Recorded	No	0.16
Murray Crayfish	High	Moderate	0.09

Aquatic impacts

Jounama Creek and Jounama Pondage are known to provide habitat to a number of fish species and the threatened Murray Crayfish. There is potential for the Murray Crayfish to burrow in the banks of the pondage in the vicinity of the proposal site and for fish to shelter under parts of existing apron slab and rock material. Due to the fluctuating water levels of the pondage, larger native fish are not expected to use the proposal site as primary habitat and are likely to be found in deeper water. There is no woody debris located in the area of the culvert, which is located on bedrock, and potential habitat for these species is entirely comprised of artificial concrete from the breakaway of the apron slab.

The existing apron slab would be removed during construction, with rock material also being removed and/or relocated. The banks of the pondage would be disturbed during construction of the new apron slab and modification to the existing culvert wingwalls and road embankment. The potential impacts may be minimised by removing only the necessary rocks and potential fish habitat and refugia during construction. This would be done so with minimal intrusion, particularly to the banks where possible, to allow any sheltering species to move away and re-establish in suitable habitat away from the proposal site. This habitat is likely to only provide marginal habitat and removal is unlikely to impact on any resident species due to the large area of alternative habitat in the pondage available.

Removal of potential artificial habitat for the Murray Crayfish is unlikely to substantially impact on the species due to the placement of similar artificial habitat during construction of the proposal. In addition, this habitat is unlikely to provide preferred or substantial habitat for the species. The fluctuating water levels of the pondage would not be altered during the construction period and so would be unlikely to affect the species to any degree further than existing pondage operating conditions.

The existing drop from the culvert to the bedrock is currently two to three metres, which limits the movement of fish species through the culvert during periods of low flow. Although the proposal would be designed to limit this drop and potential obstruction of fish passage as much as possible in line with DPI policy, there would still be an almost one metre drop from the culvert to the bedrock.

There is no emergent or in-stream vegetation located in the pondage in the vicinity of the proposal site. Vegetation on the banks of the pondage would be disturbed during construction, however this

vegetation is mostly terrestrial vegetation that is inundated by fluctuating pondage levels and is of low quality due to the dominance of introduced groundcover species. Aquatic habitat in the wider study area upstream in Jounama Creek is known to provide habitat for the endangered Booroolong Frog recorded during surveys, however vegetation to be removed by the proposal is unlikely to provide potential habitat for this species (see *Fauna habitat* in section 6.3.2). Habitat in the culvert area is mostly deep water habitat surrounded by introduced terrestrial vegetation and lacks favoured Booroolong Frog habitat including cobble banks with fringing aquatic vegetation. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

Removal of the existing apron slab may cause sedimentation of Jounama Pondage if the underlying alluvial material is disturbed during the removal process. Given that the proposal site is located mostly on bedrock, it is unlikely to generate significant amounts of sediment and safeguards would be implemented to prevent surrounding soil from the construction zone entering the pondage. This is discussed further below in *sedimentation and bank erosion*.

The proposal would require the blocking off of individual culvert cells at varying stages (at a minimum one culvert cell would remain open) of construction to divert water around the immediate work area. This has the potential to increase flows through the open culverts, however works would preferably be conducted during the low streamflow period when the increased flow rate would not be expected to be significant. The majority of the work would occur during periods when the proposal site would also be dry and is therefore unlikely to impact on aquatic habitat. Flowing water has the highest potential to result in water quality impacts during construction, which would mostly occur as a result of significant rainfall in the upstream catchment. Construction of the proposal would include close watch of weather conditions and the potential for high stream flows from Jounama Creek to occur, or rising high pondage levels due to pondage operation, in which case construction would cease and any blocking of culvert cells would be removed until water levels dropped.

The *Fisheries NSW policy and guidelines for fish habitat conservation and management* (DPI 2013) would be used to guide the management of impacts on aquatic biodiversity from the proposal.

Consultation with DPI – Fisheries has been carried out during the preparation of this document to minimise the impact on the aquatic environment (see Appendix E).

Injury and mortality

Death or injury may occur to fauna present during clearing of vegetation during construction. If birds are present but not nesting during construction they will generally move away from the proposal site to escape the disturbance. No hollow-bearing trees would be removed by the proposal, therefore fauna would not be inhibited from moving away from the proposal site.

Injury and mortality of aquatic species is highly unlikely as most of the work would be completed during periods of low pondage levels and water flow through the culvert. In the unlikely event that aquatic species are present they would generally move away from the proposal site to escape the disturbance.

Indirect/operational impacts

Sedimentation and bank erosion

The proposal may cause sedimentation of Jounama Pondage through removal of the existing apron slab, vegetation removal and machinery works adjacent to the pondage. There is the potential that work could cause destabilisation of the pondage banks, leading to erosion of the pondage and deposition of sediment, impacting water quality. Due to the low gradient of the banks it is unlikely this would be to a substantial degree to cause significant impacts, however, work on

the road embankments and the original Jounama Creek alignment to contain water seepage, also has the potential to cause erosion and sedimentation.

Disturbance to the pondage bed during construction for machinery access and removal of the existing apron slab may result in localised increases in turbidity in Jounama Pondage if the underlying alluvial material is disturbed. Turbidity caused by these activities is expected to be low due to the proposal site being located predominantly on bedrock. There is potential for sediment to be generated during high flow conditions of Jounama Creek, however the construction site would be stabilised prior to predicted rises in flow levels to decrease potential for sediment impacts. Rises of pondage levels are unlikely to result in substantial sediment impacts as rises generally occur as a slow increase and are not rapid.

Construction of the access road and ramp would be out of road base material that is in accordance with Roads and Maritime specifications, containing no dispersive materials and compacted to be stable to reduce the potential for sediment to disperse through the pondage. In addition, larger rocks, to a minimum size of 100 millimetres, would be used for batter construction and as culvert backfill material.

Sedimentation has the potential to affect flora and fauna, including fish, frogs, turtles and macroinvertebrates. Fish normally move away from highly turbid water and potential sedimentation is unlikely to block fish passage due to the location of the proposal site on the edge of Jounama Pondage. More extreme impacts on fish species resulting from sedimentation and accompanying turbidity increases in the river can include:

- Smothering of gill surfaces with sediment leading to asphyxiation
- Swallowing of large amounts of sediment leading to illness
- Inhibition of light penetration into the water column which can affect predator-prey interactions
- Impacts on habitat diversity in the immediate area and downstream by smothering and filling of interstitial spaces inhabited by fish.

An erosion and sediment control plan would be prepared as part of the CEMP to manage potential erosion and sedimentation issues during construction. Potential impacts from sedimentation would also be managed by implementing safeguards identified in section 7 of this REF.

Changes to fish passage

Fish passage is important for several reasons, including:

- Access to habitat, food and shelter
- The avoidance of predators
- Seasonal movement associated with breeding cycles.

Fish passage may be blocked by sedimentation within Jounama Pondage, as described above. There is also potential for fish passage to be blocked during construction activities from closing off culvert cells and during intrusive stages of construction such as apron slab removal. This is unlikely to substantially block fish passage to any greater extent than the existing culvert already imposes, due to at least one of the four culvert cells being open at all times, and the existing ability of fish to only navigate the migration from Jounama Creek to Jounama Pondage when pondage levels are higher than the culvert invert, removing the two to three metre drop. The proposal would decrease the drop of the culvert to about one metre, which is likely to still impose a block to fish passage, although to a decreased extent.

Construction activities in the pondage have the potential to encounter and possibly injure or kill aquatic fauna and flora species, possibly by direct contact from machinery. However, this would be minimised by construction being mostly conducted during low pondage levels and low periods of creek flow when aquatic species would be away from the proposal site.

The potential deposition of debris from construction and demolition, including sediment, in the pondage could also impact on fish passage in the area by creating blockages. Construction

activities have been designed to minimise any deposition of debris in the pondage by using larger size rocks for apron and batter construction and road base material for access roads that is in accordance with Roads and Maritime specifications.

Potential water quality impacts would also be managed by implementing safeguards identified in section 7 of this REF.

Disturbance of bats roosting in culvert

Culverts may be used as temporary roosting habitat by bat species such as the Eastern Bentwing-bat. Unmanaged construction works have the potential to result in stress, injury or mortality of microbats within a roosting colony. Disturbance of roosting individuals through noise, light or vibration, which may cause them to leave the roost during daylight hours, would increase energy expenditure and stress levels, and increase the risk of predation by diurnal birds. In addition, the culverts themselves are not being replaced for the proposal, which is limited to repairing the apron slab, existing wingwalls and batter. Surveys of the culverts indicated limited bat roosting habitat with any potential habitat not being removed by the proposal, which is therefore unlikely to impact any potential artificial habitat.

With the implementation of safeguards in section 6.3.4 including culvert inspections, if required, the proposal would be unlikely to substantially affect bats in the study area.

Invasion and spread of weeds

Groundcover vegetation in the study area is dominated by introduced species. The proposal has the potential to further introduce and spread weeds in the study area by movement of machinery and light vehicle traffic during construction of the proposal.

One priority weed species was identified during the surveys; Blackberry, which is present primarily along the banks of Jounama Creek in the study area with scattered occurrences around the edges of Jounama Pondage.

The spread of weeds is of particular concern in areas that are more dominated by native species, which are generally located in the tracts of forest and National Park and away from disturbance including the road and camping ground. It is unlikely the proposal would cause the further spread of weeds into these areas beyond that which already exists. The spread of weeds would be managed by implementing safeguards identified in section 6.3.4.

Water quality

The proposal has the potential to cause impacts to aquatic flora and fauna in Jounama Pondage through spills of contaminants such as fuels or chemicals. This may occur during refuelling operations or during preparation and use of chemicals for weed management. Spills could potentially contaminate habitat for species dependent on aquatic habitat such as frogs and fish.

The potential for wet concrete to cure when submerged in the pondage has the potential to cause an increase in the pH of the surrounding water and negatively impact on aquatic fauna within the pondage. The potential increase in pH of the water decreases as the concrete cures, with spikes in pH levels highest within the first few hours and highly localised (CTC & Associates 2016). Flowing water has the highest potential for uncured concrete to result in water quality impacts. The proposal would mostly be constructed during periods of low flow. In addition, any rises in water are generally as a result of rises in the pondage level from dam operation and not increases in stream flow from Jounama Creek. Construction of the proposal would include close watch of weather conditions and the potential for high stream flows from Jounama Creek to occur in which case construction would cease.

Potential water quality impacts from sedimentation are described above in *sedimentation and bank erosion*.

Potential water quality impacts would be minimised through the implementation of safeguards outlined in sections 6.1.4 and 6.3.4.

Invasion and spread of pathogens and disease

The proposal has the potential to result in the spread of pathogens such as bacteria and fungi. This could occur through the spread of soils on vehicle tyres and operatives' footwear. Impacts of pathogens include spread of known diseases that are detrimental to fauna such as the amphibian chytrid fungus and psittacine circoviral disease. A known population of the endangered Booroolong Frog occurs upstream of the proposal in the unregulated portion of Jounama Creek. While the proposal would be limited to downstream, in deep water habitat unsuitable for the species, it is extremely important not to introduce the amphibian chytrid fungus into this population at the detriment to its continued persistence.

The potential spread of pathogens would be minimised through the implementation of safeguards outlined in section 6.3.4.

Noise and vibration

The proposal is likely to result in an increase of noise and vibration during construction. This would mostly result from construction machinery and vehicles accessing the proposal site. This has the potential to temporarily affect the use of the study area by fauna species, however, most will generally move away from the source to an alternative area of nearby habitat. Increased noise and vibration activity would be likely to be short in duration and only during the construction period.

Groundwater dependent ecosystems

The proposal is located in the catchment of the groundwater dependent ecosystems identified in *groundwater dependent ecosystems* in section 6.3.2. The proposal would require the removal of regrowth shrubs and native grassland, which are not a part of a groundwater dependent ecosystem. The proposal would not involve any major earth works or other activities which are likely to impact the groundwater dependent ecosystems and is unlikely to substantially alter the local groundwater system in the study area.

Avoidance and minimisation

The 'avoid, minimise, mitigate and offset' hierarchy has been followed in relation to impacts on threatened species, ecological communities and migratory species listed under the BC Act, FM Act and the EPBC Act.

To minimise impacts on native vegetation the compound site and access track have been designed to occur within previously disturbed corridors with low quality native vegetation. Areas of vegetation removal have been kept to a minimum to reduce impact. Stockpile sites have been located within existing stockpile site areas to avoid impacts to native vegetation.

Rehabilitation work within Jounama Creek have been designed to minimise impacts on aquatic habitat through sedimentation controls and use of some precast concrete and large infill rocks to reduce use of wet concrete. Most of the construction would be completed during periods of low pondage levels and low flow of Jounama Creek to minimise the potential for sediment impacts on the pondage. In addition, a crane would be used from outside of the pondage to transport materials to the work site to supplement the required construction plant and machinery within the pondage and associated impacts these may cause, including sediment impacts and potential fuel spills.

The proposal has also been designed to avoid the complete blocking of Jounama Creek, with at least one culvert cell of the four cells to be open at all times. This would avoid potential blocking of fish passage. All culvert cells are to be reopened during periods of high streamflow in Jounama Creek.

The potential for impacts to biodiversity are considered to be low provided the safeguards and management measures outlined in section 6.3.4 are implemented.

Biodiversity offsetting is not required for the proposal due to the limited removal of native vegetation.

Conclusion on significance of impacts

The assessment of likelihood of occurrence found that the proposal may potentially impact on one bird, one mammal, one amphibian and one crustacean species listed under the BC Act and/or FM Act that are known or likely to occur in the study area. Assessments of significance under section 1.7 of the EP&A Act were completed for these species to determine if a significant impact is likely to result from the proposal.

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement is not required.

The assessment of likelihood of occurrence found that the proposal may potentially impact upon one amphibian species listed as threatened under the EPBC Act. The EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DotE 2013) was reviewed when determining if a significant impact is likely on a matter of NES.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act and therefore a referral is not required.

6.3.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Removal of native vegetation	<p>Flora and fauna management measures will be prepared as part of the Construction Environmental Management Plan (CEMP) to minimise the ecological impacts of the proposal. It will address terrestrial and aquatic matters and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> Plans for the construction site and adjoining area showing native vegetation, including the boundaries of Kosciuszko National Park (particularly the portion located on the western side of the highway), flora and fauna habitat and threatened species Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features and areas for rehabilitation or re-establishment of native 	Roads and Maritime project manager	Detailed design / pre-construction	<p>Additional safeguard and core standard safeguard F3</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Impacts to fauna	vegetation <ul style="list-style-type: none"> Procedures addressing relevant matters specified in the <i>Biodiversity guidelines – Protecting and Managing biodiversity</i> on Roads and Maritime projects including but not limited to: <ul style="list-style-type: none"> Pre-clearing including establishment of exclusion zones and on-ground identification of specific habitat features to be retained Vegetation clearing and bushrock removal Fauna handling and unexpected threatened species finds Rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions Monitoring during construction and post-construction adaptive management measures to be applied if monitoring indicates unexpected adverse impact. 			
	Clearing of vegetation will be undertaken as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 4: Clearing of vegetation and removal of bushrock</i> .	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	If required, fauna handling during vegetation removal will be undertaken by a licensed fauna ecologist or wildlife carer, as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 9: Fauna handling</i> .	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F7

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	All staff working on site will undertake a site-specific environmental induction. This will include the limits of vegetation clearing and the areas of vegetation to be retained.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	All vehicles and equipment used for construction will adhere to the access tracks, existing roads and exclusion areas outlined in the traffic management plan (TMP).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	Revegetate or replant disturbed areas with native vegetation following construction in accordance with the Roads and Maritime <i>Biodiversity Guidelines</i> (RTA 2011).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
Aquatic impacts	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures</i> of the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI 2013).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	A minimum of one of the culverts will be open at all times during construction, to maintain flow from Jounama Creek to Jounama Pondage.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
Chemical impacts on flora and fauna	Any herbicides used for weed control will be applied to the manufacturers Material Safety Data Sheet.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Broad spectrum non-selective herbicides (residual herbicides) will not be used. Herbicides selected for use will be appropriate for the species being treated.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	Spraying of herbicides will not be undertaken in windy weather or within such distance of a watercourse as would cause any of the herbicide to enter the water.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
	Should increases in flow rates from Jounama Creek be expected (ie due to prediction of significant rainfall event), the work site will be stabilised to reduce any potential sediment impacts.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F6
Invasion and spread of pathogens and disease	Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011) – <i>Biodiversity Guidelines Guide 7: Pathogen management</i> .	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F5

Other safeguards and management measures that would address biodiversity impacts are identified in section 6.1.4.

6.4 Traffic and transport

6.4.1 Existing environment

Existing Roads

The Snowy Mountains Highway is a 333 kilometre main road connecting the South Coast to the Monaro region and the Monaro region to the South West Slopes, via the Snowy Mountains, from

the Princes Highway to the Hume Highway. It is a two-way sealed road with a speed limit of 100 kilometres per hour for the majority of its length. In most of the study area the speed limit is 60 kilometres per hour. The existing road is typically 6.8 metres wide, with two 3.4 metre travel lanes. There is a 3.6 metre wide gravel shoulder on the eastern side of the road and a 1.2 metre gravel shoulder on the western side of the road. An acceleration lane is located on the Snowy Mountains Highway at the left hand turn from Murray Jackson Drive.

About 200 metres south of the culvert over Jounama Creek, Murray Jackson Drive, a two-way sealed road, intersects with the Snowy Mountains Highway to the west, which is the main access road to the Talbingo township and the Snowy Hydro Tumut 3 Power Station. The Jounama Creek Trail is a gravel road and intersects with the highway to the east.

In the study area, the Snowy Mountains Highway is an important route for residents of Talbingo travelling to and from the township, and for Snowy Hydro to access their infrastructure.

Traffic volumes

Existing daily traffic volumes for roads in the study area are described in section 2.2.1.

Property Access

There are two private property accesses located about 230 metres north-west of the proposal site. The Jounama Creek Trail is the only other unsealed access road connecting to the Snowy Mountains Highway in the study area.

Jounama Pondage

The Jounama Pondage is used by anglers for fishing from the banks, however no boat access is available on the water year round. The Jounama Classic fishing competition, held once a year in October, offers the only opportunity to access Jounama Pondage by boat.

6.4.2 Potential impacts

Construction

Changed traffic conditions

The proposal site is located adjacent to the Snowy Mountains Highway. Construction impacts to traffic would occur throughout the construction period, particularly when machinery is turning from the highway and if machinery requires construction access to the proposal site from the highway.

Traffic on Murray Jackson Drive is unlikely to be substantially impacted and road lanes would remain open during the construction period.

Lane closures for short periods would cause minor traffic delays. No temporary detours would be required for the proposal.

Changed traffic conditions during construction may result in short term delays to traffic. A Traffic Management Plan (TMP) would be prepared and implemented throughout construction to manage potential impacts to traffic.

Increased traffic on Snowy Mountains Highway

Construction vehicles and machinery would access the proposal site using the Snowy Mountains Highway from Tumut and enter the proposal site at designated access points. Large vehicles required to make a u-turn to access the proposal site, may enter via Talbingo along Murray Jackson Drive.

During construction, the proposal would generate heavy vehicle movements through transporting materials, structures, machinery, fuel and general provisions.

Light vehicles would be required to transport staff to and from the site.

As described in section 3.3.6, the following vehicle movements are expected during construction:

- One to 20 heavy vehicles would access the site per day (two to 40 movements per day)
- About five to 10 light vehicles would access the site per day for transporting staff (up to 20 movements per day).

The proposed increase in vehicle movements on the Snowy Mountains Highway during construction represents an increase of up to 11.2 per cent of the existing traffic volumes. Construction vehicle impacts on the local road network are generally expected to be low.

Changes to property access

No changes to property access would be required during construction. Access to properties would be maintained throughout construction.

Jounama Pondage access

Temporary exclusion zones in Jounama Pondage would be implemented around the construction site where water vessels require access. As boating is not permitted on the pondage, exclusion zones would primarily be to limit recreational fishing in the area and inform the public of the work extent. As such, construction work in the pondage is not expected to impact the uses on Jounama Pondage.

Operation

The proposal would benefit road users during operation by ensuring the long term stability of the Snowy Mountains Highway road embankment.

The potential for impacts to traffic and transport are considered to be low provided the safeguards and management measures outlined in section 6.4.3 are implemented.

6.4.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Traffic and transport	<p>Traffic will be managed as part of the CEMP. Traffic management measures will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RMS 2018) and QA <i>Specification G10M Traffic Management (Maintenance)</i> (RMS 2018). Traffic measures will include:</p> <ul style="list-style-type: none">• Confirmation of haulage routes• Measures to maintain access to local roads and properties• Site specific traffic control measures (including signage) to manage and regulate traffic movement• Requirements and methods to	Contractor	Detailed design / Pre-construction	<p>Core standard safeguard TT1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	consult and inform the local community of impacts on the local road network <ul style="list-style-type: none"> • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms. 			
	Property access will be maintained at all times.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard C3
	Community consultation is to be undertaken in accordance with the <i>Community Involvement Practice Notes and Resource Manual</i> .	Contractor / Roads and Maritime project manager	Construction	Standard safeguard C1
	Should construction be carried out during the Jounama Classic fishing competition, participants will be notified of construction activities and associated exclusion zones.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard

6.5 Noise and vibration

6.5.1 Methodology

A quantitative assessment of the noise impacts of the project was completed by Roads and Maritime using their Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime 2016a) and the Construction Noise Estimator (Roads and Maritime 2016b). A detailed quantitative noise and vibration assessment was considered unnecessary due to the outcome of this assessment, including the provision of all potential additional mitigation measures required for noise and vibration impacts, and the limiting of highly intrusive noise works to occur within standard working hours.

It is anticipated that the duration of the construction period would be about three to four months, however construction would be staged and intermittent due to the fluctuating water levels of Jounama Pondage, which are mostly unpredictable.

The Construction Noise Estimator was used to identify an appropriate background noise level and Noise Management Level (NML) for each time period based on the location of the proposal site in a rural environment. The noisiest plant expected to be used during construction and the construction scenarios were entered into the calculator with any shielding implemented as part of the standard mitigation measures. It was assumed there would be no line of sight to the sensitive receiver.

The estimator then displays the affected distance where receivers would be impacted to different degrees.

The proposal was categorised as bridge works with the standard affected distances for this scenario, as stated in the CNVG, identified in Table 6.4.

Table 6.4: Affected distances for bridge work construction scenario

Construction scenario	Affected distance, metres								
Mitigation level (dBA)	35	40	45	50	55	60	65	70	75 ²
Rural community									
Bridge works	1165	815	565	390	265	185	125	75	40

² Highly noise affected

The shortest distance to the nearest affected receiver was calculated as 125 metres.

The information entered into the estimator predicts the noise levels and mitigation measure at all receivers to inform the consultation required.

Construction vibration levels

Safe working buffer distances to comply with the human comfort and cosmetic damage criteria were sourced from the CNVG and are presented in Table 6.5.

Table 6.5: Vibration safe working buffer distances

Activity	Human comfort	Cosmetic damage (standard dwellings)
<ul style="list-style-type: none"> Small hydraulic hammer (300 kg – 5 to 12 tonne excavator) 	<ul style="list-style-type: none"> 7 m 	<ul style="list-style-type: none"> 2 m
<ul style="list-style-type: none"> Medium hydraulic hammer (900 kg – 12 to 18 tonne excavator) 	<ul style="list-style-type: none"> 23 m 	<ul style="list-style-type: none"> 7 m
<ul style="list-style-type: none"> Jackhammer 	<ul style="list-style-type: none"> 2 m 	<ul style="list-style-type: none"> 1 m (nominal)

6.5.2 Existing environment

The existing noise environment in the project area is influenced predominantly by road traffic noise from the Snowy Mountains Highway and Murray Jackson Drive. Additional contributions to the noise environment can be attributed to recreational fishing and camping activities along Jounama Creek and Jounama Pondage, and minor agricultural operations from rural land use.

There are two rural residences located in the study area, to the north-west of the proposal site, which are the only residential sensitive receivers in the study area (see Figure 1.2).

The noise management levels for the proposal during and outside standard construction hours at sensitive receivers are summarised in Table 6.6, according to the Construction Noise Estimator and based on the rural location.

Table 6.6: Construction noise management levels, dBA

Receivers	Construction noise management level, L_{Aeq} (15min)					Sleep disturbance noise level L_{Amax}
	During standard hours		Outside standard hours			
	Noise affected	Highly noise affected	Day	Evening	Night	Night
Residence	40 ¹	75	35 ¹	35 ¹	35 ¹	65 dBA (External)

- Note 1: Noise management levels are based on a Recorded Background Level (RBL) of 30 dBA

6.5.3 Potential impacts

Construction

Noise

The results of the distance based assessments indicate that within 125 to 150 metres of the proposal site, work would be highly intrusive when conducted within all time periods. The mitigation level would be 60 dBA within these distances.

According to the noise estimator for the construction scenario, the proposal is predicted to exceed the construction NML of 40 dBA during standard construction hours at the closest sensitive receiver by 15 d BA. The expected exceedance of the NML outside of standard hours for all time periods is predicted to be 20 d BA.

Sensitive receivers are not predicted to exceed the highly noise affected level of 75 d BA.

Vibration

The nearest sensitive receiver to construction activities is 125 metres. As this is well outside the safe working buffer distances the CVNG indicates for construction to comply with the human comfort and cosmetic damage criteria (see Table 6.5), the receiver is not expected to be impacted by vibration from construction work.

Operation

The proposal is expected to operate similar to the existing culvert structure. No additional elements would be constructed that are likely to create additional noise for sensitive receivers in the study area. Therefore, noise mitigation measures would not be required for the proposal.

The potential for impacts caused by noise and vibration are considered to be low provided the safeguards and management measures outlined in section 6.5.4 are implemented.

6.5.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Noise and vibration	Noise and Vibration Management will be considered and appropriate measures and implemented as part of the CEMP. Noise and vibration management will generally follow the approach in the <i>Interim Construction Noise Guideline</i> (ICNG) (DECC 2009).	Contactor	Detailed design / Pre-construction	Core standard safeguard NV1 Section 4.6 of QA G36 <i>Environment Protection</i>
Noise and vibration	All sensitive receivers (eg local residents) likely to be affected will be notified at least five days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: <ul style="list-style-type: none"> • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Contactor	Detailed design / pre-construction	Core standard safeguard NV2

6.6 Aboriginal heritage

An Aboriginal heritage assessment was completed for the Snowy Mountains Highway constraints analysis (Umwelt 2017a). The findings relevant to the proposal are summarised below.

6.6.1 Methodology

The Aboriginal archaeological baseline assessment was conducted for routine maintenance and repair work on bridges and bridge sized culverts, and repair and reinstatement of slips along a section of the Snowy Mountains Highway, which included the Jounama Creek culvert proposal site. Site investigation and consultation with the Aboriginal community was completed in line with the 'Procedure for Cultural Heritage Consultation and Investigation' (PACHCI) Stage 1 and in consultation with the Roads and Maritime Aboriginal Cultural Heritage Officer. A methodology overview for the Aboriginal heritage assessment is summarised in Table 5.1 in section 5.3.

The investigation area for the Aboriginal heritage assessment included the Jounama Creek culvert and also included an assessment of the watercourses associated with the culvert and its banks and slopes, which were evaluated in reference to:

- Reliability of the water source, that is, consideration is given to whether the creekline was likely to have been a source of permanent, semi-permanent or occasional water and associated resources prior to the impacts of historical land use
- Disturbance factors that may have impacted/removed archaeological evidence such as road and bridge construction

- Associated with other landforms likely to be of high archaeological sensitivity such as the slopes.

A search of the OEH Aboriginal Heritage Information Management System (AHIMS) database was also conducted in March 2018 for any sites that had previously been recorded within 200 metres of the survey area.

6.6.2 History

The study area is predominantly situated in Wiradjuri country, which was known as the land of the Three Rivers. The Wiradjuri language group is the largest group in NSW, encompassing the Macquarie, Lachlan and Murrumbidgee Rivers (NPWS 2003).

Localised resources would have centred on the Tumut River and associated tributaries, wetlands and billabongs. From the waterways, crayfish, a variety of fish, mussels, eels, tortoises and numerous water birds were available as well as reeds and vegetable shoots, roots, fruits and leaves across the floodplains of the Tumut River (Sams 1982). Terrestrial mammals, reptiles and birds, including wombats, kangaroos, goannas and bush turkeys, were also recorded as being hunted in the region (Sams 1982).

Seasonal movement of Aboriginal groups along the Tumut River valley in relation to Bogong Moth (*Agrotis infusa*) hunts in the nearby mountains were observed in post contact times. Flood (1980) notes the gathering of people along the Tumut River valley in preparation for moth feasts also functioned as a means of fulfilling social obligations between neighbouring groups such as marriage, ceremonies, trade and initiation.

6.6.3 Existing environment

Artefact scatters and isolated artefacts have generally been found next to creeks or rivers. Water sources would have been focal points for Aboriginal people due to the accessibility of resources at these locations. Culturally modified trees have been documented near creeks and rivers in the region, however the spatial distribution of this site type may be distorted due to European farming practices.

Archaeological site assessment for the constraints analysis did not identify any Aboriginal items or sites within or around the vicinity of the proposal site. Three archaeological sites were previously recorded within about one kilometre of the proposal site, all of which are artefact scatters. The closest of these is located about 500 metres east of the proposal site, along Jounama Creek. The sites include the following registered sites:

- AHIMS # 56-6-0007 – two flakes located about 600 metres south of Jounama Creek
- AHIMS # 56-6-0052 – flakes and cores located adjacent to Jounama Creek
- AHIMS # 56-6-0053 – flakes and cores located adjacent to Jounama Creek.

The AHIMS search from March 2018 did not identify any Aboriginal sites or places within 200 metres of the search area.

6.6.4 Potential impacts

The proposal would not impact on any of the registered AHIMS sites due to their distance from the proposal site (at least 500 metres).

6.6.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Aboriginal	<ul style="list-style-type: none"> • The <i>Standard Management</i> 	Contactor	Detailed	Core

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
heritage	<p><i>Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place</p> <ul style="list-style-type: none"> • Work will only re-commence once the requirements of that Procedure have been satisfied. 		design / pre-construction	<p>standard safeguard AH2</p> <p>Section 4.9 of QA G36 <i>Environment Protection</i></p>

6.7 Non-Aboriginal heritage

A non-Aboriginal heritage assessment was carried out for the Snowy Mountains Highway constraints analysis (Umwelt 2017c). The findings relevant to the proposal are summarised below.

6.7.1 Methodology

The methodology for the heritage assessment for the constraints analysis, which included the proposal site and surrounding area, included:

- Investigating documents, including primary archival sources such as historic maps, plans and photographs, and newspapers
- Secondary sources, including published and unpublished works, which were used to provide the report's historical context
- Contacting the Tumut and District Historical Society and the Tumut Family History Group Inc to request any historical information in collections they maintain of the area in general, the Snowy Mountains Highway and any potential items or places of heritage interest in the study area
- A site inspection involving survey of the study area by vehicle and pedestrian inspection of impact areas to understand the heritage character of existing heritage items and to determine the nature and extent of archaeological resources.

6.7.2 History

The local region was first explored by Hume and Hovell in 1824, who passed through the region now known as Tumut on their expedition from Lake George to Port Phillip (Clouston 1924). The settlement of Tumut soon included an inn, store and blacksmith and in 1847 a private bridge was constructed crossing the Tumut River.

The area was primarily used for grazing but the growing of wheat increased and flour mills were established in the area. The discovery of gold in Adelong to the north-west and Kiandra to the south-east resulted in increased commercial activity throughout the region. The region further developed when copper ore was discovered at Lobbs Hole south of Talbingo (to the south of Tumut) around 1866 and mining began there in 1874. The ore was transported by bullock wagon to Tumut until smelting began on site in 1907.

The Snowy Mountains Highway did not initially follow any planned route; it evolved from the linking of isolated sections of road established to serve areas of settlement. These isolated roads were formed gradually from tracks linking cattle and sheep runs. Settlement extended along the Murrumbidgee River and up the Tumut River to Talbingo with 80 settlers living on the Tumut Plains by 1839.

A route from Kiandra over Talbingo Mountain to Tumut is known to have existed from 1848 when the first dray was driven across by William Bell; the crossing of Talbingo Mountain was known to usually take two days. The route of this early track is considered to be fairly close to the current route of the Snowy Mountains Highway aside from the portion crossing Talbingo Mountain. In the 1860s this route was used as a weekly mail service between Kiandra and Tumut and during the Kiandra Gold Rush a weekly gold escort also ran along the route because of the risk of highwaymen.

6.7.3 Existing environment

The site inspection and investigation of the study area identified one item of potential heritage significance in the vicinity of the proposal site and two statutorily listed items within the study area. These are identified below.

Stone drain

There is a stone drain located about 90 metres south of the Jounama Creek culvert. The stone constructed drain consists of stone blocks secured with mortar, lining a small rectangular cut and creating a drain (see [Figure 6.3](#)). The drain runs east to west down the slope of a culvert embankment crossing Jounama Creek.

The stone constructed drain does not meet any of the criteria for local heritage significance as set out by the Heritage Division of OEH. Beyond its physical presence indicating the need to drain water away from a section of road and prevent slope erosion, the drain is not considered likely to provide any information not already known from the historical record and is not thought to have any archaeological research potential.



Figure 6.3: Stone drain located south of Jounama Creek culvert

Kosciuszko National Park

The Kosciuszko National Park, located in the study area, has heritage significance as the largest National park in New South Wales and is listed on the Register of the National Estate. The wide range of altitudes and topographical features in the park leads to a very high diversity of biological environments, with many historical sites would within the park. The Kosciuszko National Park encompasses a large geographical area and although the listing includes individual historical sites, none are known to exist within the study area.

Snowy Mountains Scheme

The Snowy Mountains Scheme has heritage significance as the largest engineering scheme ever undertaken in Australia, and is internationally important for its engineering success and as a symbol of Australian achievement. It is listed on the Register of the National Estate. The Snowy Mountains Scheme listing encompasses a large geographical area and although the listing includes historical sites, none are known to exist within the study area. Upgrades and diversions of sections of the Snowy Mountains Highway were undertaken during the construction of the Snowy Mountains Scheme with the aim of improving access and safety throughout the area.

Snowy Valleys Council and Snowy Hydro were unable to supply a map showing the specific boundary of the Snowy Mountains Scheme Area.

6.7.4 Potential impacts

Stone drain

The stone constructed drain has been assessed as not having local heritage significance; however there is the potential for impact during construction through the establishment of the site compound

and access track.

Establishment of the site compound and access track is likely able to avoid impacting the stone drain by limiting work on the slope of the embankment where it is located. However, if not feasible to maintain the drain it can be removed as part of the proposal without further assessment due to its lack of heritage significance.

Kosciuszko National Park

There is no identified potential impact to any aspect of the assessed significance of the Kosciuszko National Park from the proposal. No further discussion of the listed item was conducted for the heritage assessment.

Snowy Mountains Scheme

The specific boundary of the Snowy Mountains Scheme is currently unknown; however, the proposal is in keeping with the role and significance of the highway and its purpose within the Snowy Mountains Scheme. There are no identified potential impacts from the proposal based on the description of the listed area.

6.7.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Non-Aboriginal heritage	<ul style="list-style-type: none">The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Core standard safeguard H2 Section 4.10 of QA G36 <i>Environment Protection</i>

6.8 Landscape character and visual impacts

6.8.1 Existing environment

The landscape character of the study area is generally defined by woodland within Kosciuszko National Park and the water storage facility of Jounama Pondage. The township of Talbingo is located about two kilometres to the south-west, comprised of both residential and rural properties used for agriculture (primarily grazing). The terrain of the study area is hilly to undulating.

There is one residential key receiver in the study area with views of the proposal site, located about 200 metres north-west. Other key receivers in the study area include road users on the Snowy Mountains Highway and Murray Jackson Drive and pedestrians using the walking track between Talbingo town and the Jounama Creek camping facilities.

6.8.2 Potential impacts

Construction

Visual impacts during construction would generally be associated with:

- Plant and equipment within the proposal site, including the crane pad and compound site
- Vegetation removal
- Establishing the site compound and stockpile sites.

These have the potential to temporarily affect views for the resident with a line of sight to the proposal site, local road users and recreational fishermen. Construction-related visual impacts would be temporary and only for the duration of the proposal.

Operation

Following completion of the proposal, the culvert repair works would not be directly visible from key receivers, particularly during periods when the water level of Jounama Pondage exceeds the base of the culvert. The northern stockpile site would be maintained as a permanent stockpile site and access area for culvert inspection and maintenance, therefore the establishment of the site would introduce a new, permanent element into the landscape, although a minor feature.

The proposal would not change the landscape character of the study area.

6.8.3 Safeguards and management measures

There are no specific landscape and visual mitigation measures proposed.

6.9 Property and land use

6.9.1 Existing environment

The surrounding landscape is primarily dominated by woodland within Kosciuszko National Park and the water storage facility of Jounama Pondage, which is owned and operated by Snowy Hydro. Two rural property are located within about 200 metres north-west of the proposal site.

There is an existing walking track between the Talbingo township and the Jounama Creek Trail on the eastern side of the Snowy Mountains Highway, that services the Jounama Creek camping grounds on the eastern side of the highway. The walking track crosses through the proposal site in the area of the proposed compound site to its crossing at the Snowy Mountains Highway.

Council also maintains a water pipeline from Jounama Creek, upstream of the camping ground, which is accessed via Jounama Creek Trail. The pipeline supplies drinking water for the Talbingo township and the access point is located upstream of the proposal.

An overhead Telstra cable servicing a private property to the north of the proposal site is located over the proposal site. A section of this Telstra cable is located underground in the vicinity of the proposed access track.

6.9.2 Potential impacts

Construction

Talbingo walking track

Due to the inherent dangers for pedestrians the walking track crossing through the proposal site presents, the decision has been made, in consultation with Council, to close the affected section of the track for the duration of the construction period. The period of closure is expected to be about three to four months in total, however this may be over a period of up to 12 months.

While the closure of the walking track would disrupt the designated access for pedestrians to cross from the Jounama Creek Trail to reach Talbingo, and vice versa, it would not completely close access to the trail. Pedestrians would still be able to utilise the walking track from west of the proposal site.

Utilities

The overhead Telstra cable may require relocation for the proposal, with the underground section to be located to avoid damage during construction. Relocation of the overhead cable is likely to result in service disruptions for the private property it services. Service disruption impacts would be temporary and would be managed to minimise customer disruption. This would include providing notification before disruptions occur.

The water pipeline that supplies drinking water for the Talbingo township would not be impacted by the proposal.

Amenity and access

Potential short term amenity and access impacts may occur during construction. These may include increased noise and vibration, increased truck movements on Snowy Mountains Highway and Murray Jackson Drive associated with materials delivery, and temporary visual impacts associated with construction activities.

Access to private properties and access tracks in the study area would be maintained throughout the construction period.

Operation

In the long term, the proposal would be unlikely to cause any significant negative impacts to land use. The culvert over Jounama Creek would function similar to existing conditions and be construction wholly within the existing road reserve.

The northern stockpile site would be maintained as a permanent stockpile site and access area for culvert inspection and maintenance; however the area in which it would be located is within the existing road reserve and would not affect land use practices. Existing vegetation in the area of the crane pad would not be allowed to regenerate, however vegetation is part of the road reserve and not used for conservation or other purposes.

6.9.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Property and land use	A construction program will be developed to maintain access and amenity for all land uses adjacent to the proposal site as far as is practicable. This will include a plan for maintaining access to the western portion of the walking track.	Contractor / Roads and Maritime project manager	Pre-construction and construction	Additional safeguard
	The walking track will be closed for the shortest time practicable. Should construction work cease for a lengthy period of time the track would be re-opened temporarily if it is safe to do so.	Contractor / Roads and Maritime project manager	Pre-construction and construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	As part of the Communications Plan, campers at the Jounama Creek camping ground and local Talbingo residents will be notified about the closure of the walking track throughout the construction period. This will include public signage.	Project manager	Construction	Standard safeguard SE1
Utilities	<p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be undertaken. 	Contactor	Detailed design / pre-construction	Core standard safeguard U1

6.10 Air quality

6.10.1 Existing environment

The investigation area for the air quality assessment is defined as the area within 500 metres of the proposal site. The area contains two sensitive receivers in the vicinity of the proposal site.

The proposal is located in a rural area north-east of Talbingo, south of Tumut, which is dominated by woodland within Kosciuszko National Park and the water storage facility of Jounama Pondage. Within Talbingo there are residential and rural properties used for agriculture and the Jounama Creek camping ground is located to the east of the proposal site (see Figure 1.1 and Figure 1.2).

Sources of air pollution in the investigation area are likely to mainly include emissions from vehicles on the Snowy Mountains Highway and Murray Jackson Drive. Smoke from campfires during the cooler months may also come from the camping grounds east of the proposal site.

A search of the National Pollutant Inventory (DotEE 2018c) on 22 March 2018 did not identify any air pollutant substances for the 2016 to 2017 reporting period near the investigation area.

6.10.2 Potential impacts

Construction

During construction the following activities would potentially result in air quality impacts:

- Vegetation clearing
- Stripping and stockpiling topsoil
- Windblown dust from exposed surfaces eg stockpiles
- Earthworks
- Transport and handling of soils and materials

- Use of construction vehicles, generating exhaust fumes.

Potential air quality impacts during construction would predominantly be from machinery and other construction vehicles emitting exhaust fumes. Gaseous emissions are associated with diesel fuel and petrol combustion from vehicle movements and operation of on-site plant and construction machinery. These sources would generate emissions of carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide and trace amounts of non-combustible hydrocarbons.

The emissions rate and potential impact would depend on the number and power output of the engines, the quality of fuel used, the condition of the engines and the intensity (engine speed) of use. A number of plant items would be in use at any given time. The volume of gaseous emissions would be influenced by the number and type of items that are running at full power or idling.

The impact of these emissions would be temporary in nature (limited to the duration of construction) and are considered to be minor. Implementation of the safeguards and management measures outlined in section 6.10.3 would minimise these impacts.

Potential air quality impacts may also occur from dust generation. Dust generation could result in health and amenity impacts to nearby receivers. The quantity of dust dispersed would depend on the dust generation rate and the drift of dust particles which is influenced by atmospheric stability as well as wind speed and direction. Larger particles generally settle closer to the source while finer particles disperse over greater distances.

Dust settlement may impact properties near the proposal site. Air quality impacts as a result of dust generation are considered to be minor, as they would be limited to the construction phase and would be minimised by implementing the safeguards and management measures outlined in section 6.10.3.

With the implementation of safeguards and management measures in section 6.10.3, it is expected the potential air quality impacts during construction would be low and short-term.

Operation

Changes in air quality as a result of the proposal would be considered negligible. The proposal would operate similar to existing conditions. There may be minor additional emissions from vehicles accessing the new stockpile site and accessing the culvert for maintenance and inspections. However the proposal is unlikely to cause any substantial adverse air quality impacts at the nearby residence.

6.10.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Air quality	Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.	Contractor	Construction	Core standard safeguard A1
	Works (including the spraying of paint and other materials) 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	Core standard safeguard A2

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Vegetation or other materials are not to be burnt on site.	Contractor	Construction	Core standard safeguard A3
	Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction	Core standard safeguard A4
	Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in accordance with the Roads and Maritime Services <i>Stockpile Site Management Guideline (EMS-TG-10)</i> .	Contractor	Construction	Core standard safeguard A5

6.11 Waste management

6.11.1 Policy setting

Roads and Maritime is committed to ensuring responsible management of unavoidable waste and to promoting the reuse of such waste through appropriate measures. This is done in accordance with the resource management hierarchy principles contained in the *Waste Avoidance and Resource Recovery Act 2001*. The resource management hierarchy principles in order of priority as outlined in the *Waste Avoidance and Resource Recovery Act 2001* are:

- Avoidance of unnecessary resource consumption
- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal.

By adopting the above principles, Roads and Maritime encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development as outlined in Section 8.2 of this REF.

6.11.2 Existing environment

The existing environment is generally free of any waste. Being located adjacent to a restricted access waterway and a National Park, waste is minimal and none was observed during field inspections. Small amounts of litter may occasionally enter the culvert and Jounama Pondage from campers upstream at the Jounama Creek campsite.

6.11.3 Potential impacts

The study area for the waste management assessment is defined as the area within 500 meters of the proposal. The proposal has the potential to generate waste from the following sources, some of which would be recycled or reused:

- Concrete waste from the removal of parts of the existing apron
- Green waste from vegetation clearing (native and introduced vegetation). Noxious weed material would be separated from native green waste

- Excess spoil from the construction of the northern and southern access points
- Roadside materials (fencing, guide posts, guard rail etc)
- Paper and office waste from site management facilities
- General waste from staff (lunch packaging etc).

The largest quantities of waste expected to be produced would be from excavation of rock from the apron of the existing culvert and clearing activities for the northern and southern access points.

The potential to reuse materials would be investigated during detailed design. Mulched vegetation would be used in sediment erosion controls, stabilisation and rehabilitation where appropriate. Any spoil material that cannot be used on site would be classified in accordance with the 'Waste Classification Guidelines' (EPA 2014) and disposed of at an approved materials recycling or waste disposal facility.

Liquid and solid waste would be removed by tanker or truck and disposed of off-site at a facility that is licensed and able to accept those wastes for storage, reuse or disposal. Fuel and chemical storage areas would be bunded and protected in accordance with the specifications set out by OEH and WorkCover.

Materials not reused would be removed to a licensed or approved facility. The impacts of waste generation at the site are considered to be low, and would be minimised. Stockpiles would be managed to avoid causing pollution or contamination in accordance with the *Stockpile Site Management Guideline* (Roads and Maritime 2016b).

The operation of the new culvert is not likely to result in any increased waste or litter.

6.11.4 Safeguards and mitigation

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Waste management – general impacts of waste	Resource management hierarchy principles will be followed: <ul style="list-style-type: none"> • Avoid unnecessary resource consumption as a priority • Recover resources as far as is practicable (including reuse of materials, reprocessing, and recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i>). 	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M2
Waste management – general impacts of waste	Bulk project waste (eg fill) sent to a site not owned by Roads and Maritime (excluding OEH licensed landfills) for land disposal is to have prior formal	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M3

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	written approval from the landowner, in accordance with Roads and Maritime <i>Environmental Direction No. 20 – Legal Off-site disposal of Bulk RTA Project Wastes.</i>			
Waste management – general impacts of waste	Waste will not be burned on site.	Project manager and contractor	Construction	Core standard safeguard M6
Waste management – general impacts of waste	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Project manager and contractor	Construction	Core standard safeguard M8

6.12 Socio-economic

The investigation area for the socio-economic assessment is defined as the region around the towns of Talbingo and Tumut.

6.12.1 Existing environment

The Snowy Mountains Highway connects the South West Slopes to the South Coast, linking Talbingo and Tumut along its length. Demographic data for these towns is provided below.

Talbingo

The 2016 Census (ABS 2018a) provides the following core demographic data about Talbingo:

- At the time of the 2016 Census there were 239 people living in Talbingo
- 54.5 per cent of the people living in Talbingo over the age of 15 and who identified as being in the labour force were employed full time
- 22.7 per cent were working on a part time basis
- The median weekly household income was \$909 per week
- The main method of travel to work was by car, with 38 people driving or travelling as a passenger in a vehicle
- The largest age demographic was 65 and over (36.6 per cent of the population).

The top employment industries for Talbingo (ABS 2018a) are provided in Table 6.7.

Table 6.7: Top employment occupations for Talbingo in 2016

Industry	Percentage of people employed
Professionals	15.4
Community and personal service workers	15.4
Labourers	15.4

Industry	Percentage of people employed
Managers	12.3
Technicians and trade workers	12.3
Clerical and administrative	12.3

Tumut

The 2016 Census (ABS 2018b) provides the following core demographic data about Tumut:

- At the time of the 2016 Census there were 6154 people living in Tumut
- 56.6 per cent of the people living in Tumut over the age of 15 and who identified as being in the labour force were employed full time
- 31.3 per cent were working on a part time basis
- The median weekly household income was \$1066 per week
- The main method of travel to work was by car, with 1905 people driving or travelling as a passenger in a vehicle
- The largest age demographic was 65 and over (22.3 per cent of the population).

The top employment industries for Tumut (ABS 2018b) are provided in Table 6.8.

Table 6.8: Top employment occupations for Tumut in 2016

Industry	Percentage of people employed
Technicians and trade workers	16.6
Labourers	15.2
Professionals	13.8
Machinery operators and drivers	13
Clerical and administrative workers	10.8
Community and personal service workers	10.5

Snowy Mountains Highway

The Snowy Mountains Highway is an important state road connecting the South West Slopes to the South Coast via the Monaro region. It joins the Hume Highway north-west of Tumut, a major highway connecting Sydney and Melbourne. The Snowy Mountains Highway connects Tumut and Talbingo and is an important route for residents of Talbingo travelling to and from the township, and for Snowy Hydro's access to their infrastructure.

6.12.2 Potential impacts

Construction

Road users

There may be some minor access changes during the construction period which could potentially inconvenience motorists. These changes would likely be for short periods and would have only limited impacts. These impacts are assessed in section 6.4.

Amenity and access

Potential short term amenity and access impacts may occur during construction as summarised in section 6.9.

Benefits

The local area would experience a short-term increase in employment opportunities and procurement of local goods and services.

Operation

Benefits

The proposal would improve road safety by ensuring the long-term stability of the Snowy Mountains Highway road embankment.

6.12.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Socio-economic	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none">• Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, including changes in access to the Jounama Creek camping ground and walking tracks• Contact name and number for complaints. <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor / Roads and Maritime project manager	Detailed design / pre-construction	Core standard safeguard SE1

6.13 Other impacts

6.13.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Hazards and risk	The existing hazards and risks in the study area are generally associated with operation of the existing road network.	<ul style="list-style-type: none">• The proposal has the potential to intercept utilities during earthworks. This risk would be managed by further investigation during detailed design, including 'Dial Before You Dig'• Spills or leakage of contaminants such as

Environmental factor	Existing environment	Potential impacts
		<p>fuels, chemicals and hazardous substances entering surface and groundwater or contaminating soils, particularly Jounama Pondage</p> <ul style="list-style-type: none"> Flooding of the proposal site during standard operation of Jounama Pondage by Snowy Hydro Changed traffic conditions leading to incidents.
Climate change impacts on the proposal	<p>The nearest weather station to Talbingo is in Tumbarumba, located about 35 kilometres south-west. The Tumbarumba area receives an average annual rainfall of 977.9 millimetres. Rainfall is highest in the winter months, reaching a maximum in August with an average of 106.7 millimetres (BOM 2018).</p> <p>Average monthly minimum temperature varies from -0.1 degrees celsius in July to 12.2 degrees celsius in January. The average monthly maximum temperature varies from 10.7 degrees celsius in July to 28.9 degrees celsius in January (BOM 2018).</p>	<p><i>Construction</i></p> <ul style="list-style-type: none"> Increases in temperatures may reduce work capacity and increase the risk of heat stress for site workers Impacts to various construction activities from climate change, such as increased temperatures interfering with concreting An increase in extreme weather events, such as intense rainfall interfering with construction timeframes or dry, hot weather conducive to generation of dust Increased summer and autumn rainfall may result in increased flooding and erosion risks at the site, and associated erosion and sediment loss <p><i>Operation</i></p> <ul style="list-style-type: none"> Increases in temperature may affect integrity of the culvert in the long term Increased potential for localised flooding and increased flow velocities from Jounama Creek which may affect the integrity of the proposal Drainage and stormwater impacts Changes to flora and fauna species and distribution, including pest and weed species Erosion impacts, resulting in sediment loss from the site Watercourse impacts, including changes to channel structure and other characteristics resulting from changed hydrological conditions.

6.13.2 Safeguards and management measures for other impacts.

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Hazard and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP is required due to the high risk assisted with working within Jounama Pondage that has rapidly fluctuating water levels that are not under the control of Roads and Maritime. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Details of hazards and risks associated with the activity • Measures to be implemented during construction to minimise these risks • A monitoring program to assess performance in managing the identified risks • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, WorkCover NSW and EPA or Office of Environment and Heritage publications.</p> <p>Consultation with Snowy Hydro will occur during preparation of the HRMP to ensure appropriate safeguards are included regarding timing and establish protocols for advice regarding increases in water levels.</p>	Contactors	Detailed design / pre-construction	Additional safeguard

6.14 Cumulative impacts

6.14.1 Study area

The cumulative impact assessment for the proposal considers the area surrounding the township of Talbingo and the Snowy Mountains Highway in the locality of the proposal. There are no currently known projects being carried out in Talbingo, however, Roads and Maritime are proposing to conduct routine maintenance and repair work on bridges and bridge sized culvers and repair and reinstatement of slips that may occur in mountainous areas. A constraints analysis was conducted for these works along a section of the Snowy Mountains Highway, between the Hume Highway junction to the Yarrangobilly Caves Road south-east of Talbingo. Three of these bridges and/or culverts occur in the locality of the proposal, including the proposal itself.

The proposal would have cumulative impacts with the proposed maintenance work in other locations within the locality, including a minor removal of native vegetation, although of low diversity and condition, and potential erosion and sedimentation impacts during construction. Potential cumulative impacts are considered to be low.

6.14.2 Potential impacts

Environmental factor	Construction	Operation
Traffic	The proposal has the potential to occur at the same time as the proposed maintenance work to be conducted along the length of the Snowy Mountains Highway, which would result in cumulative traffic delays along the Snowy Mountains Highway.	No cumulative operational traffic impacts are expected from the proposal.
Erosion and sedimentation	The proposal has the potential to occur at the same time as the proposed maintenance work to be conducted along the length of the Snowy Mountains Highway, which could result in cumulative erosion and sedimentation impacts of connected waterways in the study area and locality.	No cumulative operational erosion and sedimentation impacts are expected from the proposal.

6.14.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Cumulative construction impacts	<ul style="list-style-type: none">Traffic management measures will consider other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic	Project manager	Construction	Additional safeguard

7 Environmental management

7.1 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 will be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, South West 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 will be developed in accordance with the specifications set out in QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, QA Specification G10 - Traffic Management and QA Specification R44 – Earthworks.

7.2 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 works on the surrounding environment. The safeguards and management measures are summarised in Table 7.1.

Table 7.1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> 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. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN1
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Roads and Maritime project	Pre-construction	Core standard safeguard GEN2

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
			manager		
GEN3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> Threatened species habitat Adjoining residential areas requiring particular noise management measures. 	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN3
SW1	Soils, water quality and groundwater – Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction. All activities including placement of underwater concrete will be managed in accordance with relevant legislation with specific management methods identified in the CEMP.	Contractor / Roads and Maritime project manager	Detailed design / pre-construction	<p>Core standard safeguard SW1.</p> <p>Section 2.1 of QA G38 <i>Soil and Water Management</i></p>
SW2	Soils, water quality and groundwater – Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor / Roads and Maritime project manager	Detailed design / Pre-construction	<p>Core standard safeguard C3</p> <p>Section 4.3 of QA G36 <i>Environment Protection</i></p>
SW3	Soils, water quality and	The southern access road and northern access ramp will be constructed of road material, containing no dispersive material and compacted to be stable	Contractor / Roads and	Detailed design /	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	groundwater – Soil and water	and reduce the potential for sediment to disperse through the pondage.	Maritime project manager	construction	RMS Specification R44 Earthworks
SW4	Soils, water quality and groundwater – Soil and water	Larger rocks, to a minimum size of 100 millimetres, will be used for batter construction and as culvert backfill material to reduce the potential for sediment to disperse through the pondage.	Contractor / Roads and Maritime project manager	Detailed design / construction	Additional safeguard RMS Specification R11 Stormwater Drainage
SW5	Soils, water quality and groundwater – Soil and water	Concrete formwork will be left in place for a minimum of 24 hours to minimise the potential for concrete to react with the surrounding water.	Contractor / Roads and Maritime project manager	Detailed design / construction	Additional safeguard
SW6	Soils, water quality and groundwater – Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor / Roads and Maritime project manager	Detailed design / Pre-construction	Core standard safeguard C2 Section 4.2 of QA G36 <i>Environment Protection</i>
SW7	Soils, water quality and groundwater –	Erosion and sediment control measures are to be implemented and maintained to: <ul style="list-style-type: none"> Prevent sediment moving off-site and sediment laden water entering any 	Contractor / Roads and Maritime project	Construction	Standard safeguard E1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Soil erosion and sedimentation	water course, drainage lines, or drainage inlets <ul style="list-style-type: none"> • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing <i>Managing Urban Stormwater, Soils and Construction Guidelines</i> (the Blue Book)). 	manager		
SW8	Soils, water quality and groundwater – Soil erosion and sedimentation	Erosion and sediment controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard E2
SW9	Soils, water quality and groundwater – Soil erosion and sedimentation	Erosion and sediment control measures are not to be removed until the works are complete and areas are stabilised.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard E3
SW10	Soils, water quality and groundwater – Soil erosion and sedimentation	The maintenance of established stockpile sites during is to be in accordance with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Contractor / Roads and Maritime project manager	Construction	Standard safeguard E6
SW11	Soils, water quality and groundwater – Water contamination	There is to be no release of dirty water into drainage lines and/or waterways.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
SW12	Soils, water quality and groundwater – Water contamination	Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient erosion and sediment controls.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W2
SW13	Soils, water quality and groundwater – Water contamination	Water quality control measures are to be used to prevent any materials (eg. concrete, grout, sediment etc) entering drain inlets or waterways.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W3
SW14	Soils, water quality and groundwater – Water contamination	During high flow rates of the creek, construction will cease and all culvert cells will remain open to avoid impacting on any fresh concrete resulting in sedimentation of the pondage and potential pH rises of the water.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
SW15	Soils, water quality and groundwater – Water contamination	All machinery and vehicles working below the high water level of the pondage would be cleaned and in good working order prior to access to the site, which includes conducting visual inspections for fluid leaks etc.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
SW16	Soils, water quality and groundwater – Water contamination	Potable water will be used for wash down.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard W5
SW17	Soils, water quality and	Excess debris from cleaning and washing is removed using hand tools.	Contractor / Roads and	Construction	Standard safeguard W6

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	groundwater – Water contamination		Maritime project manager		
SW18	Soils, water quality and groundwater – Water contamination	All fuels, chemicals, and liquids will be stored at least 50 metres away from any drainage lines and waterways and will be stored in an impervious bunded area within the compound site.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R1
SW19	Soils, water quality and groundwater – Water contamination	Refuelling of plant and planned maintenance of machinery and plant will be carried out 50 metres away from waterways and drainage lines.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R2
SW20	Soils, water quality and groundwater – Water contamination	Vehicle and plant wash downs and/or concrete truck washouts will be carried out within a designated bunded area with an impervious surface or will be carried out off site.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R5
SW21	Soils, water quality and groundwater – Water contamination	Emergency spill kits will be kept on site at all times. All staff will be inducted about incident and emergency procedures and made aware of the locations of emergency spill kits.	Contractor / Roads and Maritime project manager	Construction	Standard safeguard R6
HF1	Hydrology and flooding	An emergency evacuation plan will be developed and implemented throughout construction. At a minimum, this plan will include measures such as procedures for regular communication with Snowy Hydro regarding water levels, monitoring of weather conditions, and procedures for removing	Contractor / Roads and Maritime project manager	Pre-construction and construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		plant and equipment from the work site.			
B1	Biodiversity – Removal of native vegetation	<p>Flora and fauna management measures will be prepared as part of the Construction Environmental Management Plan (CEMP) to minimise the ecological impacts of the proposal. It will address terrestrial and aquatic matters and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> Plans for the construction site and adjoining area showing native vegetation, including the boundaries of Kosciuszko National Park (particularly the portion located on the western side of the highway), flora and fauna habitat and threatened species Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features and areas for rehabilitation or re-establishment of native vegetation Procedures addressing relevant matters specified in the <i>Biodiversity guidelines – Protecting and Managing biodiversity</i> on Roads and Maritime projects including but not limited to: <ul style="list-style-type: none"> Pre-clearing including establishment of exclusion zones and on-ground identification of specific habitat features to be retained Vegetation clearing and bushrock removal Fauna handling and unexpected threatened species finds Rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions Monitoring during construction and post-construction adaptive management measures to be applied if monitoring indicates unexpected adverse impact. 	Roads and Maritime project manager	Detailed design / pre-construction	<p>Additional safeguard and core standard safeguard F3</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>
B2	Biodiversity – Impacts to fauna	Clearing of vegetation will be undertaken as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 4: Clearing of vegetation and removal of bushrock</i> .	Contractor / Roads and Maritime project manager	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
B3	Biodiversity – Impacts to fauna	If required, fauna handling during vegetation removal will be undertaken by a licensed fauna ecologist or wildlife carer, as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 9: Fauna handling</i> .	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F7
B4	Biodiversity – general	All staff working on site will undertake a site-specific environmental induction. This will include the limits of vegetation clearing and the areas of vegetation to be retained.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
B5	Biodiversity – general	All vehicles and equipment used for construction will adhere to the access tracks, existing roads and exclusion areas outlined in the traffic management plan (TMP).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
B6	Biodiversity – general	Revegetate or replant disturbed areas with native vegetation following construction in accordance with the Roads and Maritime <i>Biodiversity Guidelines</i> (RTA 2011).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
B7	Biodiversity – Aquatic impacts	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures</i> of the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI 2013).	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
B8	Biodiversity – Aquatic impacts	A minimum of one of the culverts will be open at all times during construction, to maintain flow from Jounama Creek to Jounama Pondage.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
B9	Biodiversity – chemical impacts on flora and fauna	Any herbicides used for weed control will be applied to the manufacturers Material Safety Data Sheet.	Contractor / Roads and Maritime project manager	Construction	
B10	Biodiversity – chemical impacts on flora and fauna	Broad spectrum non-selective herbicides (residual herbicides) will not be used. Herbicides selected for use will be appropriate for the species being treated.	Contractor / Roads and Maritime project manager	Construction	
B11	Biodiversity – chemical impacts on flora and fauna	Spraying of herbicides will not be undertaken in windy weather or within such distance of a watercourse as would cause any of the herbicide to enter the water.	Contractor / Roads and Maritime project manager	Construction	
B12	Biodiversity – Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F6
B13	Biodiversity – Invasion and spread of pathogens and disease	Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011) – <i>Biodiversity Guidelines Guide 7: Pathogen management</i> .	Contractor / Roads and Maritime project manager	Construction	Standard safeguard F5
TT1	Traffic and transport	Traffic will be managed as part of the CEMP. Traffic management measures will be prepared in accordance with the <i>Roads and Maritime Traffic Control at Work Sites Manual</i> (RMS 2018) and <i>QA Specification G10M Traffic Management (Maintenance)</i> (RMS 2018). Traffic measures will include: <ul style="list-style-type: none"> Confirmation of haulage routes 	Contractor	Detailed design / Pre-construction	Core standard safeguard TT1 Section 4.8 of QA G36 <i>Environment</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<ul style="list-style-type: none"> Measures to maintain access to local roads and properties Site specific traffic control measures (including signage) to manage and regulate traffic movement Requirements and methods to consult and inform the local community of impacts on the local road network Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads A response plan for any construction traffic incident Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic Monitoring, review and amendment mechanisms. 			<i>Protection</i>
TT2	Traffic and transport	<ul style="list-style-type: none"> Property access will be maintained at all times Community consultation is to be undertaken in accordance with the <i>Community Involvement Practice Notes and Resource Manual</i>. 	Contractor / Roads and Maritime project manager	Construction	Standard safeguard C3 and C1
TT3	Traffic and transport	Should construction be carried out during the Jounama Classic fishing competition, participants will be notified of construction activities and associated exclusion zones.	Contractor / Roads and Maritime project manager	Construction	Additional safeguard
NV1	Noise and vibration	Noise and Vibration Management will be considered and appropriate measures implemented as part of the CEMP. Noise and vibration management will generally follow the approach in the <i>Interim Construction Noise Guideline</i> (ICNG) (DECC 2009).	Contactar	Detailed design / Pre-construction	Core standard safeguard NV1 Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
NV2	Noise and vibration	<p>All sensitive receivers (eg local residents) likely to be affected will be notified at least five days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information. 	Contactor	Detailed design / pre-construction	Core standard safeguard NV2
AH1	Aboriginal heritage	<ul style="list-style-type: none"> • The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place • Work will only re-commence once the requirements of that Procedure have been satisfied. 	Contactor	Detailed design / pre-construction	<p>Core standard safeguard AH2</p> <p>Section 4.9 of QA G36 <i>Environment Protection</i></p>
H1	Non-Aboriginal heritage	<ul style="list-style-type: none"> • The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. • Work will only re-commence once the requirements of that Procedure have been satisfied. 	Contactor	Detailed design / pre-construction	<p>Core standard safeguard H2</p> <p>Section 4.10 of QA G36 <i>Environment Protection</i></p>
PL1	Property and land use - access	<ul style="list-style-type: none"> • A construction program will be developed to maintain access and amenity for all land uses adjacent to the proposal site as far as is practicable. This will include a plan for maintaining access to the western portion of the walking track 	Contractor / Roads and Maritime project manager	Pre-construction / Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<ul style="list-style-type: none"> The walking track will be closed for the shortest time practicable. Should construction work cease for a lengthy period of time the track would be re-opened temporarily if it is safe to do so. 			
PL2	Property and land use - access	As part of the Communications Plan, campers at the Jounama Creek camping ground and local Talbingo residents will be notified about the closure of the walking track throughout the construction period. This will include public signage.	Roads and Maritime project manager	Construction	Standard safeguard SE1
PL3	Property and land use - Utilities	<p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be undertaken. 	Contractor	Detailed design / pre-construction	Core standard safeguard U1
A1	Air quality	Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust.	Contractor	Construction	Core standard safeguard A1
A2	Air quality	Works (including the spraying of paint and other materials) 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	Core standard safeguard A2
A3	Air quality	Vegetation or other materials are not to be burnt on site.	Contractor	Construction	Core standard safeguard A3
A4	Air quality	Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction	Core standard safeguard A4

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
A5	Air quality	Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in accordance with the Roads and Maritime Services <i>Stockpile Site Management Guideline (EMS-TG-10)</i> .	Contractor	Construction	Core standard safeguard A5
WM1	Waste management – general impacts of waste	Resource management hierarchy principles will be followed: <ul style="list-style-type: none"> • Avoid unnecessary resource consumption as a priority • Recover resources as far as is practicable (including reuse of materials, reprocessing, and recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act 2001</i>). 	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M2
WM2	Waste management – general impacts of waste	Bulk project waste (eg fill) sent to a site not owned by Roads and Maritime (excluding OEH licensed landfills) for land disposal is to have prior formal written approval from the landowner, in accordance with Roads and Maritime <i>Environmental Direction No. 20 – Legal Off-site disposal of Bulk RTA Project Wastes</i> .	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M3
WM3	Waste management – general impacts of waste	Waste will not be burned on site.	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M6
WM4	Waste management – general impacts of waste	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor / Roads and Maritime project manager	Construction	Core standard safeguard M8
SE1	Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community	Contractor / Roads and	Detailed design / Pre-	Core standard safeguard SE1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
		<p>during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, including changes in access to the Jounama Creek camping ground and walking tracks • Contact name and number for complaints. <p>The CP will be prepared in accordance with the <i>Community Involvement and Practice Notes Resource Manual</i> (RTA 2008).</p>	Maritime project manager	construction	
HR1	Hazard and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP is required due to the high risk assisted with working within Jounama Pondage that has rapidly fluctuating water levels that are not under the control of Roads and Maritime. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Details of hazards and risks associated with the activity • Measures to be implemented during construction to minimise these risks • A monitoring program to assess performance in managing the identified risks • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, WorkCover NSW and EPA or Office of Environment and Heritage publications.</p> <p>Consultation with Snowy Hydro will occur during preparation of the HRMP to ensure appropriate safeguards are included regarding timing and establish protocols for advice regarding increases in water levels.</p>	Contactor	Detailed design / pre-construction	Additional safeguard

7.3 Licensing and approvals

If a contractor carries out an activity requiring approval from an authority, it is the responsibility of the contractor to obtain the necessary approval. Licences and approvals that may be required for the proposal are summarised in Table 7.2

Table 7.2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Fisheries Management Act 1994 (s199)</i>	Notification to the Minister for Primary Industries prior to any dredging or reclamation works. The draft REF would be provided to Fisheries for comment.	A minimum of 28 days prior to the start of work.

8 Conclusion

This chapter provides the justification for the proposal taking into account 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*.

8.1 Justification

The culvert over Jounama Creek has been identified as requiring repair for several years due to the scouring of the embankment and breaking away of the base slab of the culvert. The Snowy Mountains Highway is an important route providing a link between the South West Slopes and the South Coast via the Monaro region. It is also an important route for residents and property owners commuting to and from Talbingo, and provides access for Snowy Hydro to their infrastructure. The Snowy Mountains Highway provides the only main access to Talbingo.

The proposal would repair the culvert over Jounama Creek and improve the stability of the Snowy Mountains Highway road embankment, ensuring its long term stability. This would benefit road users in the long term and minimise potential disruptions to the road network should the proposal not be carried out.

There would also be a number of adverse environmental impacts as a result of the proposal. Where possible, impacts would be avoided or minimised through the design process and site-specific safeguards.

On balance, it is considered that the adverse environmental impacts of the proposal are outweighed by the beneficial effects and that the proposal is therefore justified.

8.2 Objects of the EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	<p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may also provide potential habitat for listed fauna species. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on these species are unlikely to be significant, as detailed in section 6.3.</p> <p>The proposal would require the closure of the Talbingo walking track that provides access from Talbingo to the camping ground along the Jounama Creek Trail. The walking track would only be temporarily, partially closed in the vicinity of the site compound. The track would be reopened following completion of the construction period.</p> <p>The proposal would have potential impacts on the water quality of Jounama Pondage during</p>

Object	Comment
	<p>construction. These impacts would be minimised with the implementation of safeguards.</p> <p>The proposal would benefit the community by ensuring the long-term stability of the Snowy Mountains Highway road embankment.</p>
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	<p>Roads and Maritime is carrying out consultation and environmental investigations required to properly plan and develop the proposal without undue impacts on the local economy.</p> <p>The proposal would benefit the community by ensuring the long-term stability of the Snowy Mountains Highway road embankment.</p>
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	<p>Roads and Maritime would consult with utility providers about the potential protection and relocation of utilities near the proposal site, and would continue to consult with these providers during the detailed design phase and construction.</p>
5(a)(iv) To encourage the provision of land for public purposes.	<p>The proposal involves work for the purpose of a culvert and road embankment repair, which is for a public purpose.</p>
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	<p>The proposal would require the closure of the Talbingo walking track that provides access from Talbingo to the camping ground along the Jounama Creek Trail. The walking track would only be temporarily, partially closed in the vicinity of the site compound. The track would be reopened following completion of the construction period.</p>
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	<p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may also provide potential habitat for listed fauna species. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on these species are unlikely to be significant, as detailed in section 6.3.</p>
5(a)(vii) To encourage ecologically sustainable development.	<p>Ecologically sustainable development is considered in Sections 8.2.1 to 8.2.4 below.</p>
5(a)(viii) To encourage the provision and maintenance of affordable housing.	<p>Not relevant to the project.</p>
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	<p>Not relevant to the project.</p>

Object	Comment
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Roads and Maritime has consulted with the community and stakeholders for the proposal as described in chapter 5. Issues raised during consultation in relation to the proposal have been addressed during the environmental planning and assessment process.

8.2.1 The precautionary principle

This principle states that “if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

Evaluation and assessment of alternative options have aimed to reduce the risk of serious and irreversible environmental impacts. Consultation considered issues raised by stakeholders and government departments and a comprehensive environmental assessment was carried out to provide accurate and impartial information to avoid and minimise any potential impacts.

The detailed assessment of potential environmental impacts in the preparation of the design has sought to minimise impacts on the amenity of the area, while maintaining engineering feasibility and safety for all road users.

This process has enabled the proposal’s impacts to be predicted within a reasonable degree of certainty. All predictions, however, contain a degree of variability, which reflects the variable nature of the environment. Where there has been any uncertainty in the prediction of impacts throughout the environmental impact assessment process, a conservative approach was adopted to ensure the worst case scenario was predicted in the assessment of impacts. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty.

A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high-level of environmental performance.

8.2.2 Intergenerational equity

The principle states, “the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations”.

The proposal would benefit future generations by ensuring the proposal does not give rise to long-term adverse environmental impacts and by ensuring that potential impacts are minimised by implementing appropriate safeguards. This would ensure the principle of intergenerational equity is not compromised.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a road with a higher chance of embankment and subsequent road failure. The proposal would benefit future generations by ensuring the long term stability of the Snowy Mountains Highway road embankment.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states that the “conservation of biological diversity and ecological integrity should be a fundamental consideration”.

An assessment of the existing local environment has been carried out to identify and manage the potential impacts of the proposal on local biodiversity. The proposal would remove about 0.2

hectares of native vegetation. This vegetation may provide potential habitat for listed fauna. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. A specialist biodiversity assessment is provided in Appendix D. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts. On this basis, the conservation of biological diversity and ecological integrity has been a fundamental consideration in the assessment of the proposal.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires that “environmental factors should be included in the valuation of assets and services, such as:

- (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
- (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
- (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.”

The REF has examined the environmental consequences of the proposal and identified safeguards and management measures for areas that have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these safeguards and management measures would result in an economic cost to Roads and Maritime. The implementation of safeguards and management measures would increase both the capital and operating costs of the proposal. This signifies environmental resources have been given appropriate valuation.

The concept design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This approach would also be applied to the detailed design.

All contractors engaged by Roads and Maritime are to abide by the environmental standards and procedures established by Roads and Maritime, and are to factor environmental management measures (such as waste management) into the cost of their work.

8.3 Conclusion

The proposed culvert scour repairs at Jounama Creek, Talbingo is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to 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, joint management and biodiversity conservation agreements under the BC Act, wilderness areas, critical habitat, 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.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in the following impacts:

- Modification of habitat for listed fauna under the BC Act, FM Act and EPBC Act
- Minor traffic delays during construction

- Potential noise and air quality impacts to residences during construction
- Potential soil and water quality impacts during construction
- Temporary closure of the Talbingo walking track during construction.

Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also benefit road users and the local community by ensuring the long term stability of the Snowy Mountains Highway road embankment. 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 Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 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 the Environment is not required.

9 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.

Leigh Maloney
Environmental Scientist
GHD Pty Ltd
Date: 17 May 2019

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.

NICHOLAS McMULLEN.
BRIDGE WORKS MANAGER


Date: 21/06/2019.

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Terms and acronyms used in this REF

Term / Acronym	Description
AusLink	Mechanism to facilitate cooperative transport planning and funding by Commonwealth and state and territory jurisdictions
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
CEMP	Construction environmental management plan
EIA	Environmental impact assessment
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (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	<i>Fisheries Management Act 1994</i> (NSW)
Heritage Act	<i>Heritage Act 1977</i> (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
NES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
Roads and Maritime	NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.

Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads 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
<p>a. Any environmental impact on a community?</p> <p>The proposal would result in short-term negative impacts to the local community, primarily as a result of traffic disruptions, in addition to construction noise and dust. Safeguards and management measures outlined in section 7.2 would be implemented to minimise these impacts.</p> <p>The proposal would require the closure of the Talbingo walking track that provides access from Talbingo to the camping ground along the Jounama Creek Trail. The walking track would only be temporarily, partially closed in the vicinity of the site compound. The track would be reopened following completion of the construction period.</p> <p>The proposal would have potential impacts on the water quality of Jounama Pondage during construction, which has the potential to impact on Snowy Hydro operations. Safeguards and management measures outlined in section 7.2 would be implemented to minimise these impacts.</p> <p>The proposal would benefit the community by ensuring the long-term stability of the Snowy Mountains Highway road embankment.</p>	<p>Short-term moderate negative</p> <p>Short-term minor negative</p> <p>Short-term moderate negative</p> <p>Long-term positive</p>
<p>b. Any transformation of a locality?</p> <p>The proposal would not change the landscape character of the study area as the proposal would be visually similar to the existing conditions at the site, although the presence of the new permanent public access area or stockpile site would be a minor addition to the area. The proposal would be in keeping with the current road environment and would not have a substantial visual impact on residences or sensitive receivers in the study area.</p>	<p>Long-term minor negative</p>

Factor	Impact
<p>c. Any environmental impact on the ecosystems of the locality?</p> <p>During construction there is an increased risk of impacts such as erosion leading to water quality impacts, chemical and fuel spills, construction noise and spread of pathogens. These risks would be minimised through the implementation of safeguards detailed in sections 6.1.4 and 6.3.4.</p> <p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may also provide potential habitat for listed fauna species. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on these species are unlikely to be significant, as detailed in section 6.3. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts.</p>	<p>Short-term minor negative</p> <p>Long-term minor negative</p>
<p>d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>During construction, the proposal would reduce the aesthetic quality of the locality as a result of visual impacts, dust generation and traffic movements. Noise impacts would occur from construction plant, machinery and vehicles. These impacts would be minimised through implementation of safeguards outlined in section 7.2.</p> <p>The proposal would not change the landscape character of the study area as the proposal would be visually similar to the existing conditions at the site, although the presence of the new permanent public access area or stockpile site would be a minor addition to the area. The proposal would be in keeping with the current road environment and would not have a substantial visual impact on residences or sensitive receivers in the study area.</p>	<p>Short-term minor negative</p> <p>Long-term minor negative</p>
<p>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?</p> <p>The proposal would have potential impacts on a stone drain adjacent to the proposal site, however it is not listed as having archaeological significance. No other impacts on heritage impacts are likely to occur as a result of the proposal.</p>	<p>Nil</p>
<p>f. Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</p> <p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may also provide potential habitat for listed fauna species. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on these species are unlikely to be significant, as detailed in section 6.3. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts.</p>	<p>Long-term minor negative</p>

Factor	Impact
<p>g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</p> <p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may also provide potential habitat for listed fauna species. Impacts on listed biota are unlikely to be significant, as detailed in section 6.3. Jounama Creek and Jounama Pondage also provides known habitat for listed fauna. Impacts on these species are unlikely to be significant, as detailed in section 6.3. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts.</p>	Long-term minor negative
<p>h. Any long-term effects on the environment?</p> <p>The proposal would cause long-term ecological impacts as described in (g) above. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts as described in section 6.3.</p> <p>Long term visual impacts to the surrounding environment would occur as described in (d) above.</p> <p>The proposal would benefit the community by ensuring the long-term stability of the Snowy Mountains Highway road embankment.</p>	<p>Long-term minor negative</p> <p>Long-term minor negative</p> <p>Long-term positive</p>
<p>i. Any degradation of the quality of the environment?</p> <p>The proposal would result in short-term negative impacts to the local community, primarily as a result of traffic disruptions, in addition to construction noise and dust. Safeguards and management measures outlined in section 7.2 would be implemented to minimise these impacts.</p> <p>The proposal would cause long-term minor ecological impacts as described in (g) above. Detailed design and implementation of safeguards and management measures would aim to minimise biodiversity impacts as described in section 6.3.</p> <p>Long term visual impacts to the surrounding environment would occur as described in (d) above.</p>	<p>Short-term moderate negative</p> <p>Long-term minor negative</p> <p>Long-term minor negative</p>
<p>j. Any risk to the safety of the environment?</p> <p>There is potential for road safety to be affected during construction due to changed traffic conditions along the existing roads. Traffic management safeguards described in section 6.4.3, including the preparation of a traffic management plan, would address safety risks.</p> <p>The proposal would improve the safety of the Snowy Mountains Highway by ensuring the long-term stability of the road embankment.</p>	<p>Short-term minor negative</p> <p>Long-term positive</p>

Factor	Impact
<p>k. Any reduction in the range of beneficial uses of the environment?</p> <p>The proposal would result in minor traffic impacts during construction, including an increase in the volume of heavy vehicles, and interruptions to traffic flow and temporary changes in speed limit. These impacts would be mitigated by the measures outlined in section 6.4.3.</p> <p>The proposal would require the closure of the Talbingo walking track that provides access from Talbingo to the camping ground along the Jounama Creek Trail. The walking track would only be temporarily, partially closed in the vicinity of the site compound. The track would be reopened following completion of the construction period.</p>	<p>Short-term minor negative</p> <p>Short-term minor negative</p>
<p>l. Any pollution of the environment?</p> <p>The proposal would result in short-term pollution impacts as a result of construction noise, visual impacts and dust. Safeguards and management measures outlined in section 7.2 would be implemented to minimise these impacts.</p> <p>The proposal would have potential impacts on the water quality of Jounama Pondage during construction. Safeguards and management measures outlined in section 7.2 would be implemented to minimise these impacts.</p> <p>Waste generated during construction could pollute the environment. Waste would be managed in line with the safeguards outlined in section 6.13.2.</p>	<p>Short-term moderate negative</p> <p>Short-term moderate negative</p> <p>Short-term minor negative</p>
<p>m. Any environmental problems associated with the disposal of waste?</p> <p>Waste streams generated during construction are common and would pose no difficulty in their disposal. Waste would be recycled wherever possible. Waste would be managed in line with the safeguards outlined in section 6.13.2.</p>	<p>Nil</p>
<p>n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</p> <p>All resources required for the proposal are readily available and are not in short supply.</p>	<p>Nil</p>
<p>o. Any cumulative environmental effect with other existing or likely future activities?</p> <p>Potential cumulative impacts relate primarily to disruption for road users on Snowy Mountains Highway, in addition to soil erosion, sedimentation and vegetation removal. With the implementation of the safeguards detailed in this REF, these impacts are unlikely to be significant.</p>	<p>Nil</p>
<p>p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</p> <p>The proposal is not located within a coastal area, and would not cause any impact on coastal processes and coastal hazards.</p>	<p>Nil</p>

Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
<p>a. Any impact on a World Heritage property?</p> <p>The proposal would not have any impact on a World Heritage property. There are no World Heritage properties within 10 kilometres of the study area.</p>	Nil
<p>b. Any impact on a National Heritage place?</p> <p>There are two National Heritage places in the locality of the proposal:</p> <ul style="list-style-type: none"> • Australian Alps National Parks and Reserves, which includes Kosciuszko National Park • Snowy Mountains Scheme. <p>The heritage assessment for the Snowy Mountains Highway constraints analysis concluded that the proposal would not have an impact on these places.</p>	Nil
<p>c. Any impact on a wetland of international importance?</p> <p>No wetlands of international importance are located near the study area.</p>	Nil
<p>d. Any impact on a listed threatened species or communities?</p> <p>The proposal would remove about 0.2 hectares of native vegetation. Vegetation to be removed may provide potential habitat for fauna listed under the EPBC Act. The proposed removal of habitat is unlikely to have significant impacts on threatened biota due to the small area of habitat that would be affected by the proposal, the disturbed nature of the habitat proposed to be removed, the mobility of the species assessed, the proposal being unlikely to significantly fragment habitat for these species and the retention of hollow-bearing trees. Jounama Creek also provides known habitat for a frog species listed under the EPBC Act. Impacts on this species are unlikely to be significant due to the proposal being located downstream of known and potential habitat for the species. An assessment of impacts was carried out in section 6.3 and is detailed further in the biodiversity assessment (Appendix D).</p>	Minor

Factor	Impact
<p>e. Any impacts on listed migratory species?</p> <p>The proposed removal of habitat is unlikely to have substantial impacts on migratory species (see biodiversity assessment in section 6.3 and Appendix D).</p>	Minor
<p>f. Any impact on a Commonwealth marine area?</p> <p>The proposal is not located near a marine area.</p>	Nil
<p>g. Does the proposal involve a nuclear action (including uranium mining)?</p> <p>The proposal does not involve a nuclear action (including uranium mining).</p>	Nil
<p>h. Any environmental impact on the Great Barrier Reef Marine Park?</p> <p>The proposal would not result in any impacts to the Great Barrier Reef Marine Park due to its distance from the park.</p>	Nil
<p>i. Any environmental impact on a water resource, in relation to coal seam gas development and large coal mining development?</p> <p>The proposal is not a coal seam gas or large coal mining development.</p>	Nil
<p>j. Any impact (direct or indirect) on Commonwealth land?</p> <p>The proposal would not have an impact (direct or indirect) on Commonwealth land.</p>	Nil
<p>k. Any impact on the environment, where Commonwealth agencies are proposing to take action?</p> <p>Roads and Maritime is not a Commonwealth agency.</p>	Nil

Appendix B

Statutory consultation checklists

Infrastructure SEPP

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No		ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will <i>strain</i> the existing road system in a local government area?	No		ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No		ISEPP cl.13(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a <i>substantial</i> volume of water?	No		ISEPP cl.13(1)(d)
Temporary structures	Will the works 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, will this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	Yes	Talbingo walking track would require partial closure - Snowy Valleys Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Will the works involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No		ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
-------	------------------	----------	-----------------------	--------------

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 works? If yes, does a heritage assessment indicate that the potential impacts to the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	No		ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a <i>minor</i> extent?	Yes	Works are located below the full capacity level of Jounama Pondage that is periodically inundated. Jounama Pondage is a Snowy Hydro asset and have been consulted with and ongoing consultation will occur on a regular basis.	ISEPP cl.15

Public authorities other than councils

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> ?	Yes	Office of Environment and Heritage	ISEPP cl.16(2)(a)
Marine parks	Are the works adjacent to a declared marine park under the <i>Marine Parks Act 1997</i> ?	No	Department of Planning and Environment	ISEPP cl.16(2)(b)
Aquatic reserves	Are the works adjacent to a declared aquatic reserve under the <i>Fisheries Management Act 1994</i> ?	No	Office of Environment and Heritage	ISEPP cl.16(2)(c)

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i> ?	No	Department of Planning and Environment	ISEPP cl.16(2)(d)
Bush fire prone land	Are the works 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	Rural Fire Service	ISEPP cl.16(2)(f)

Appendix C

Construction drawings for culvert upgrade

B72 - SNOWY MOUNTAINS HIGHWAY

SNOWY VALLEYS COUNCIL

JOUNAMA CREEK CULVERT REPAIRS

AT 3.5 km NORTH - EAST OF TALBINGO

SCHEDULE OF DRAWINGS

- 1

COVER SHEET AND SCHEDULE OF DRAWINGS
- 2

CRANE REACH DIAGRAM - 100t LIEBHERR LTM 1100-5.2
- 3

SITE PREPARATION PLAN
- 4

CONSTRUCTION STAGING DIAGRAM - SHEET 1
- 5

CONSTRUCTION STAGING DIAGRAM - SHEET 2
- 6

CONCRETE DETAILS - SHEET 1
- 7

CONCRETE DETAILS - SHEET 2
- 8

ACCESS ROAD PLAN AND LONG SECTION
- 9

EXCAVATOR ACCESS PLAN AND LONG SECTION
- 10

ACCESS ROAD - CROSS SECTIONS - SHEET 1
- 11

ACCESS ROAD - CROSS SECTIONS - SHEET 2
- 12

EXCAVATOR ACCESS - CROSS SECTIONS - SHEET 1
- 13

WORK AREA - CROSS SECTIONS - SHEET 1

THE WORKS SHALL BE COMPLETED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS WHERE RELEVANT:

- B30

-

EXCAVATION AND BACKFILL FOR BRIDGEWORKS
- B80

-

CONCRETE WORK FOR BRIDGES
- B82

-

SHOTCRETE WORK
- B115

-

PRECAST CONCRETE MEMBERS (NOT PRETENSIONED)
- B153

-

ERECTION OF PRECAST CONCRETE MEMBERS (NOT PRETENSIONED)
- B201

-

STEELWORK FOR BRIDGES
- B203

-

WELDING OF REINFORCING STEEL
- B220

-

PROTECTIVE TREATMENT OF BRIDGE STEELWORK
- B240

-

SUPPLY OF BOLTS, NUTS, SCREWS AND WASHERS
- B264

-

ERECTION OF BARRIER RAILINGS AND MINOR COMPONENTS
- B341

-

DEMOLITION OF EXISTING STRUCTURE
- B350

-

UNDERWATER BRIDGE INSPECTIONS
- G1

-

JOB SPECIFICATION REQUIREMENTS
- G7

-

UTILITY ADJUSTMENT
- G10

-

TRAFFIC MANAGEMENT
- G22

-

WORK HEALTH AND SAFETY (CONSTRUCTION WORKS)
- G36

-

ENVIRONMENTAL PROTECTION
- G38

-

SOIL AND WATER MANAGEMENT (SOIL AND WATER MANAGEMENT PLAN)
- G40

-

CLEARING AND GRUBBING
- G71

-

CONSTRUCTION SURVEYS
- G73

-

DETAIL SURVEY
- 3051

-

GRANULAR BASE AND SUB-BASE MATERIALS FOR SURFACED ROADPAVEMENTS
- 3071

-

SELECTED MATERIAL IN FORMATION LAYERS
- 3222

-

NO-FINES CONCRETE (FOR SUBSURFACE DRAINAGE)
- 3552

-

SUBSURFACE DRAINAGE PIPE (CORRUGATED PERFORATED AND NON-PERFORATED PLASTIC)
- 3556

-

RIGID STRIP FILTER DRAINS
- 3557

-

FLEXIBLE STRIP FILTER DRAINS
- 3580

-

AGGREGATE FILTER MATERIALS FOR SUBSURFACE DRAINAGE
- R44

-

EARTHWORKS
- R63

-

GEOTEXTILES (SEPARATION AND FILTRATION)
- R81

-

NO FINES CONCRETE SUBBASE
- R178

-

VEGETATION
- R179

-

LANDSCAPE PLANTING
- R201

-

FENCING



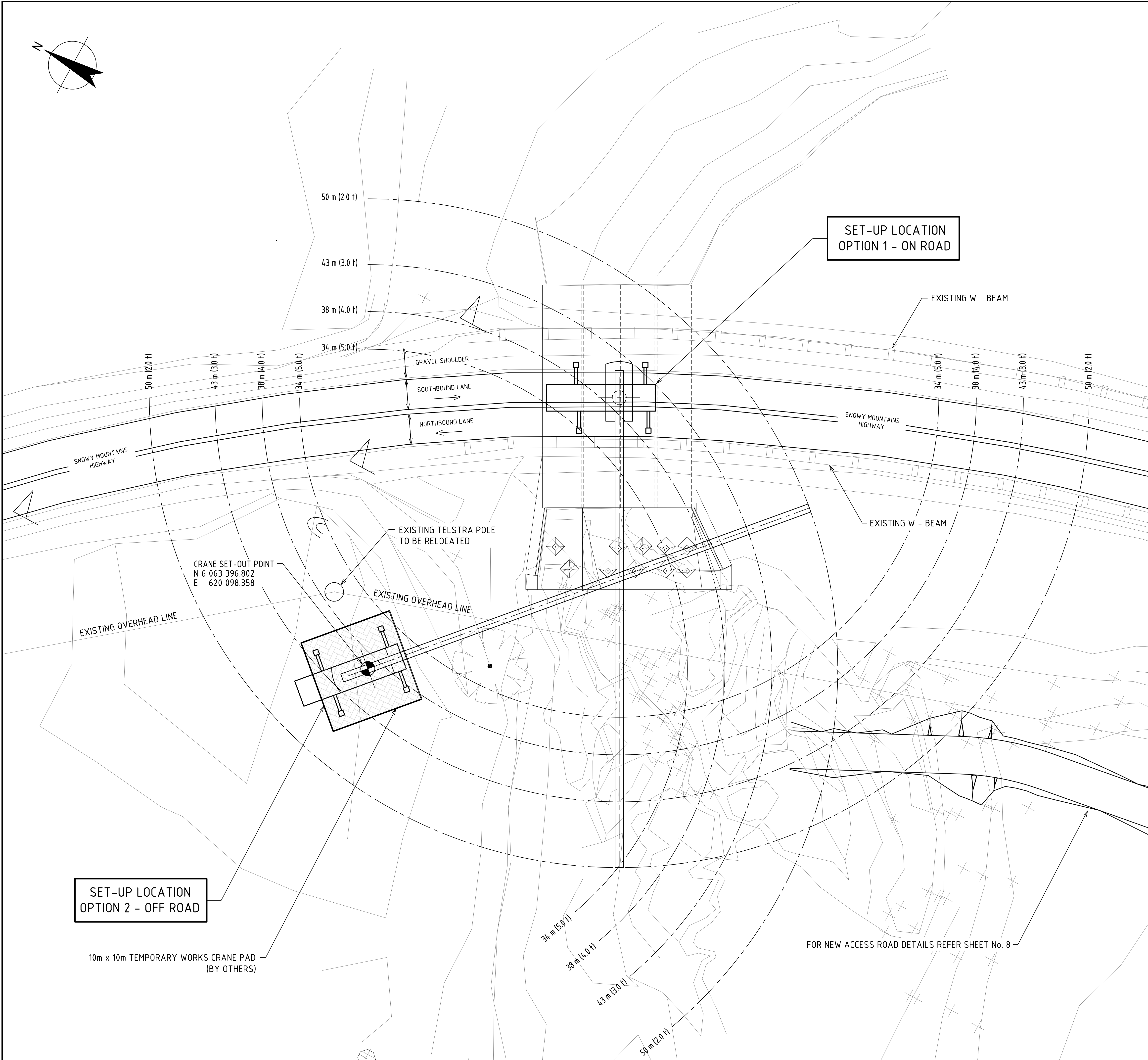
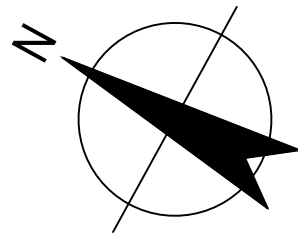
LOCALITY PLAN
THE CULVERT SITE IS APPROXIMATELY
3.5 km BY ROAD FROM TALBINGO

NOT TO SCALE



GHD Tower, Level 3
24 Honeysuckle Drive, Newcastle NSW 2300 Australia
PO Box 5403 Hunter Rgn Mail Cent. NSW 2310
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E ntlmail@ghd.com W www.ghd.com

REGISTRATION No OF PLANS		DS2018 / 001306	
ISSUE STATUS: 100% DETAIL DESIGN			
SHEET No	1	No OF SHEETS	12
ISSUE		B	



CRANE SPECIFICATIONS:

MODEL No. 100t LIEBHERR LTM 1100-5.2

BASIC CAPACITY ESTIMATES SHOWN IN THE TABLE ARE BASED ON FULL COUNTERWEIGHT ASSEMBLY AND WORKING WITH MAIN JIB ONLY. (NO FLY JIB).

OUTREACH (m)	CAPACITY (t)
34	5.0
38	4.0
43	3.0
50	2.0


NOTE:

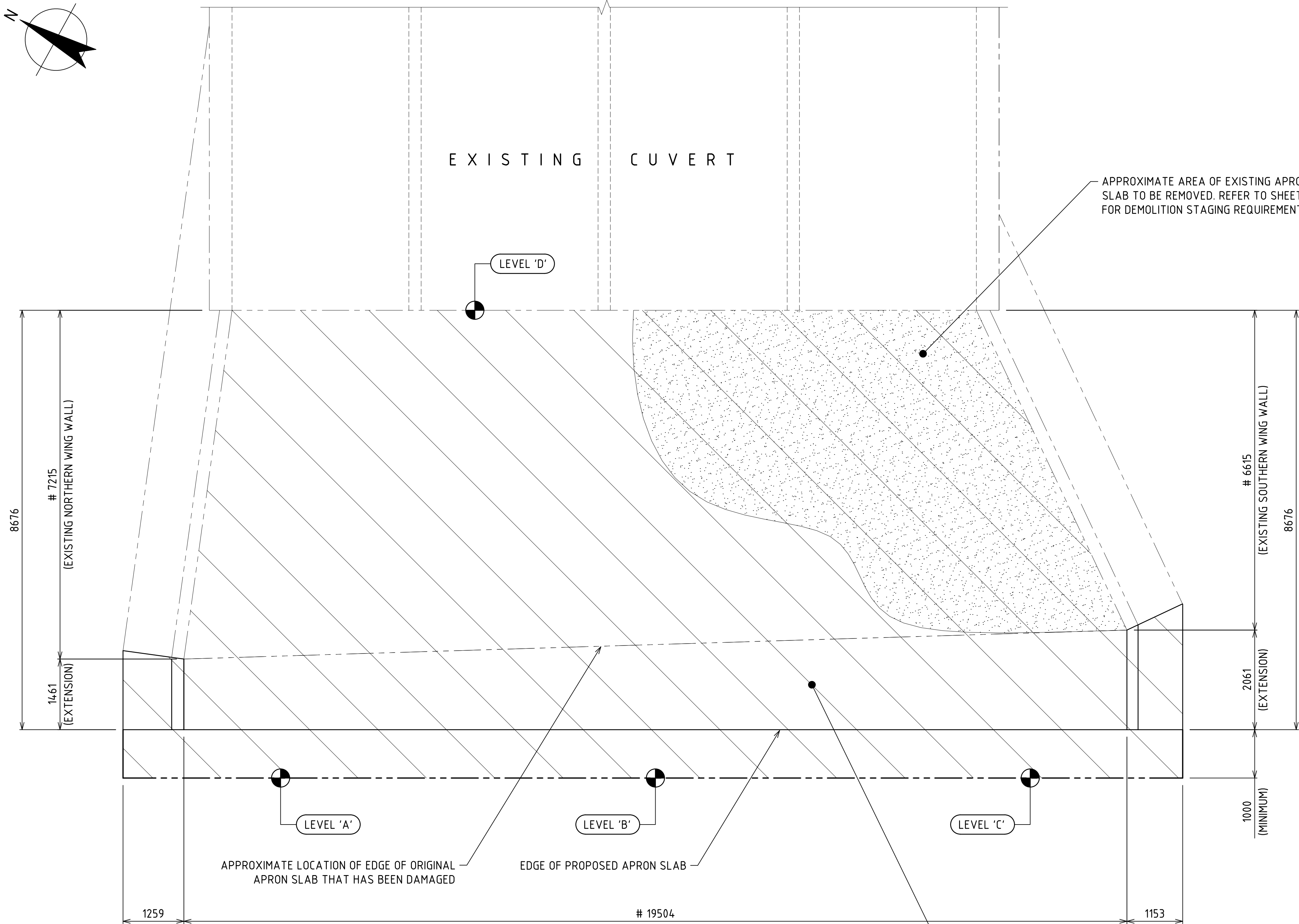
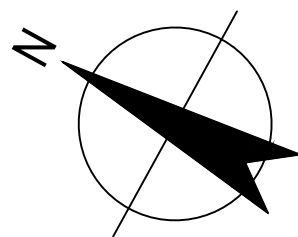
- THE LIFTING CAPACITIES AND RADIUSES SHOWN ON THIS DRAWING FOR THE CRANE MODEL NOTED ARE PROVIDED FOR INFORMATION ONLY AND HAVE NOT BEEN VERIFIED OR CHECKED FOR USE.
- CRANE LIFT STUDY MUST BE COMPLETED BY CRANE SUPPLIER PRIOR TO CONSTRUCTION.

GENERAL NOTES:

SCALE 0 2 4 6 8 10m OR AS SHOWN

- ALL DIMENSIONS ARE IN MILLIMETRES.
- CHAINAGES AND REDUCED LEVELS ARE IN METRES.
- REDUCED LEVELS ARE TO AHD.
- LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

B	17.08.18	100% DETAIL DESIGN	C.R.	T.F.	S.F.
A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
CRANE REACH DIAGRAM - 100t LIEBHERR LTM 1100-5.2					
<div>GHD</div> <div>GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com</div>			<div><div><div>NSW GOVERNMENT</div></div><div>Transport Roads & Maritime Services</div></div>		
PREPARED		CHECKED	REGISTRATION No OF PLANS		
DESIGN T.F.			DS2018 / 001306		
DRAWING C.RYE			RMS BRIDGE NUMBER		5460
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
DIRECTOR			SHEET No. 2		ISSUE B



EXISTING CUVERT

APPROXIMATE AREA OF EXISTING APRON SLAB TO BE REMOVED. REFER TO SHEET 4 FOR DEMOLITION STAGING REQUIREMENTS.

LEVEL 'D'

LEVEL 'A'

LEVEL 'B'

LEVEL 'C'

APPROXIMATE LOCATION OF EDGE OF ORIGINAL APRON SLAB THAT HAS BEEN DAMAGED

EDGE OF PROPOSED APRON SLAB

19504
(EXISTING APRON SLAB)

SITE PREPARATION PLAN

NOTE: PREPARATION WORK CAN BE COMPLETED IN STAGES TO SUIT CONSTRUCTION SEQUENCE IF REQUIRED.
DENOTES APPROXIMATE DIMENSION AS DETERMINED FROM EXISTING SURVEY.

HATCHING DENOTES AREA WHERE ALL EXISTING LOOSE ROCK, BOULDERS AND EXISTING ALLUVIAL MATERIAL TO BE REMOVED TO EXPOSE CLEAN SOUND GRANITE BEDROCK.

GENERAL NOTES:

- SCALE 0 1 000 2 000 3 000mm OR AS SHOWN
- ALL DIMENSIONS ARE IN MILLIMETRES.
 - CHAINAGES AND REDUCED LEVELS ARE IN METRES.
 - REDUCED LEVELS ARE TO AHD.
 - LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

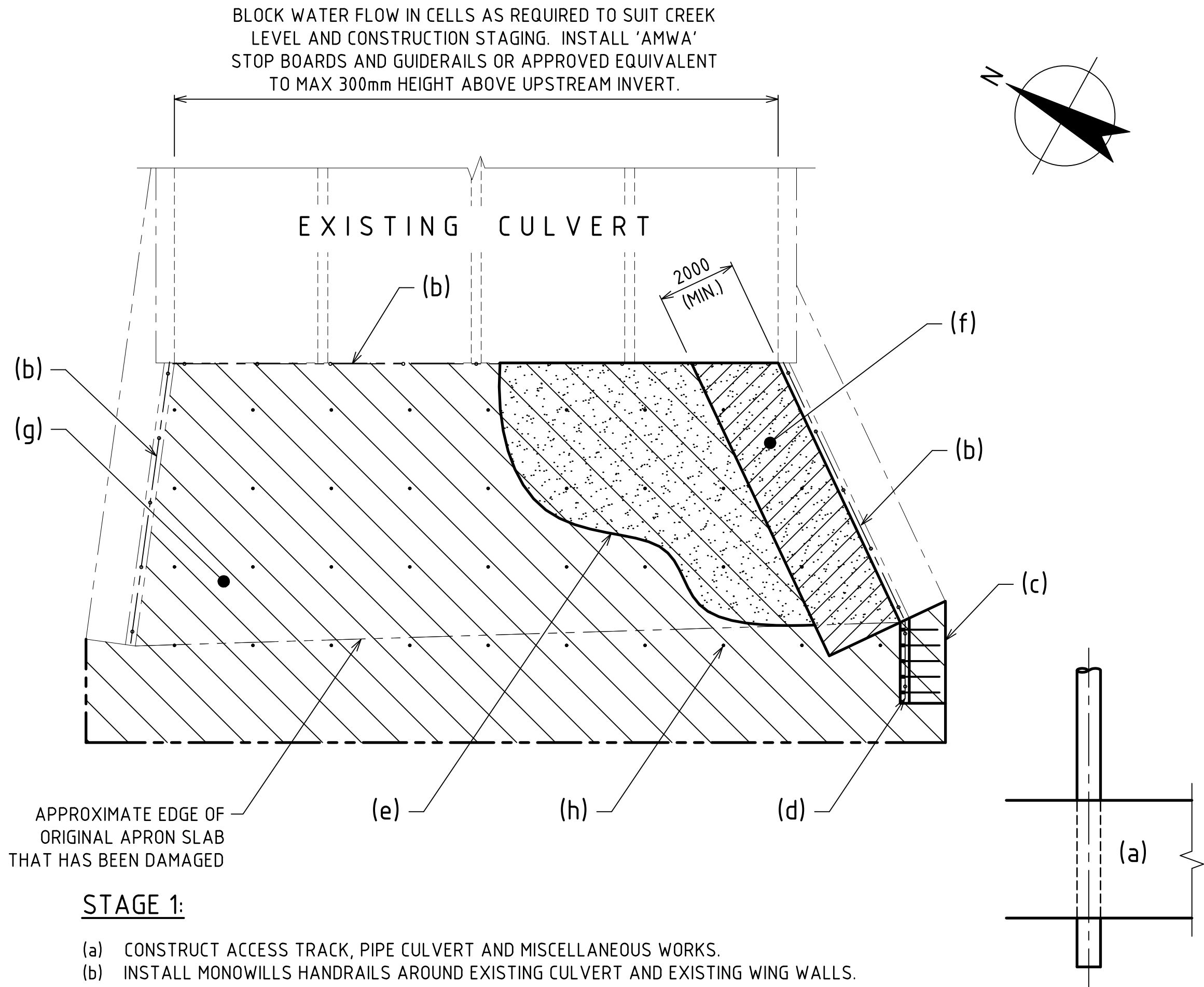
SCHEDULE OF SURVEYED LEVELS

LOCATION	AHD R.L.	SHD R.L.
NATURAL ROCK LEVEL 'A'	386.550	387.727
NATURAL ROCK LEVEL 'B'	384.600	385.777
NATURAL ROCK LEVEL 'C'	385.325	386.502
DOWNSTREAM CULVERT INVERT LEVEL 'D'	387.448	388.625

FLOW DEPTH TABLE

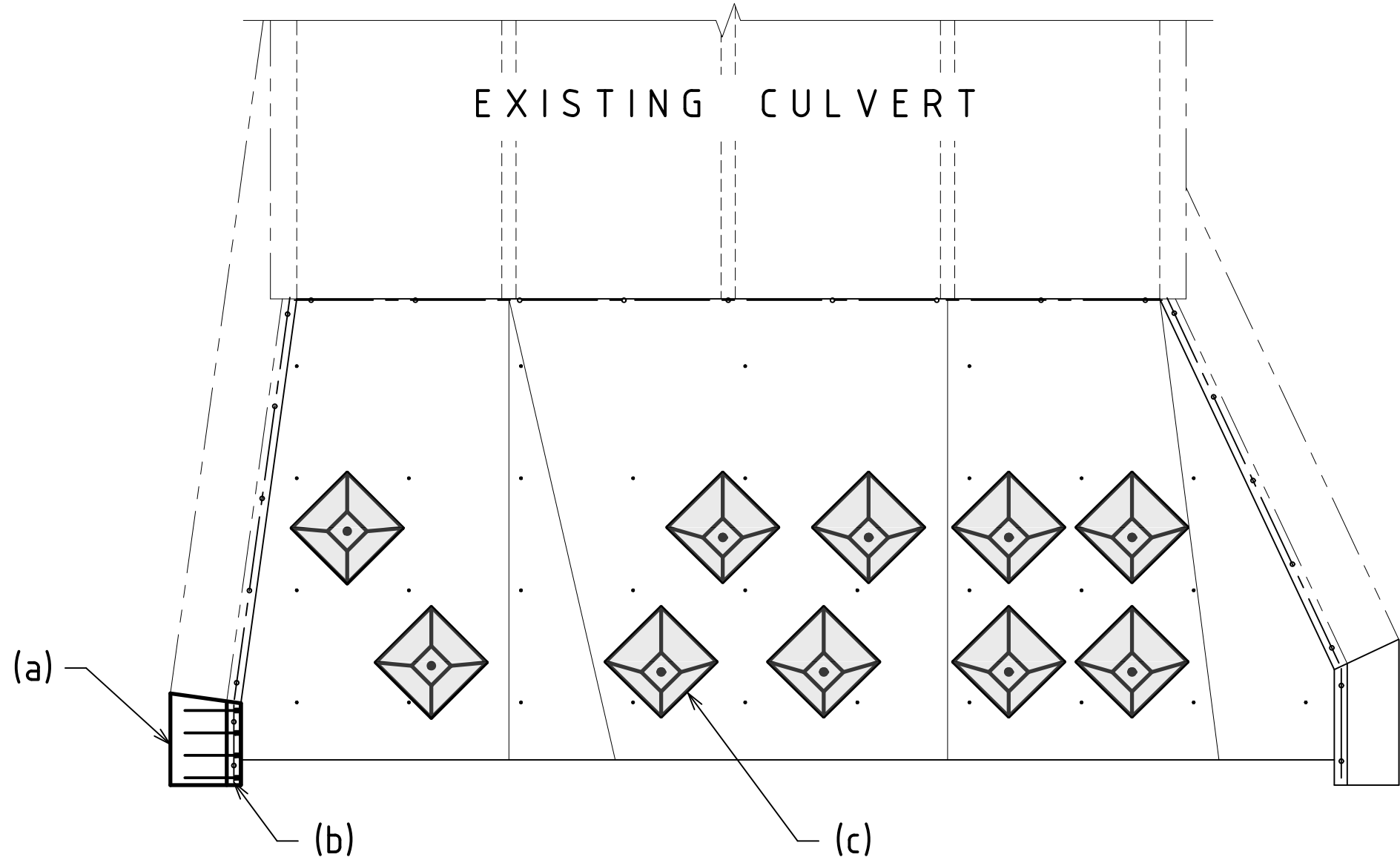
FLOW RATE (m ³ /s)	WATER LEVEL ABOVE INVERT (m)
0	0.0
2	0.2
5	0.4
10	0.6
15	0.7
20	0.9

B	17.08.18	100% DETAIL DESIGN		T.F.	S.F.
A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY SNOWY VALLEYS COUNCIL					
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GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
PREPARED DESIGN T.F.		CHECKED		REGISTRATION No OF PLANS DS2018 / 001306	
DRAWING C.RYE				RMS BRIDGE NUMBER 5460	
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
DIRECTOR			SHEET No. 3		ISSUE B



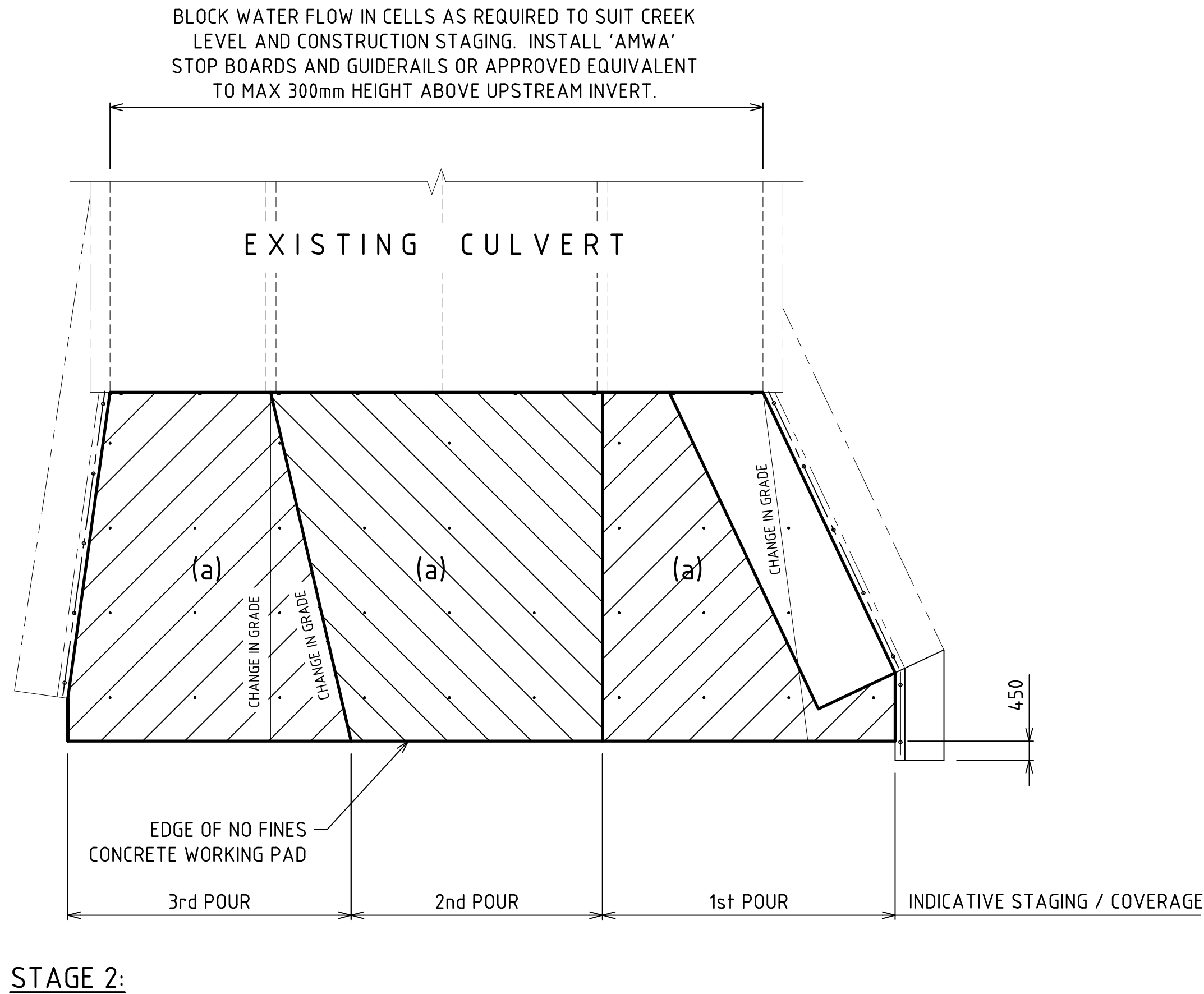
STAGE 1:

- CONSTRUCT ACCESS TRACK, PIPE CULVERT AND MISCELLANEOUS WORKS.
- INSTALL MONOWILLS HANDRAILS AROUND EXISTING CULVERT AND EXISTING WING WALLS.
- CONSTRUCT WING WALL EXTENSION TO SOUTHERN WING WALL AND INSTALL CAST IN REID BAR COUPLERS. REFER SECTION 'G' & 'H' ON SHEET No. 7 FOR DETAILS.
- INSTALL MONOWILLS HANDRAILS IN TOP OF NEW SOUTHERN WING WALL.
- AFTER WING WALL EXTENSION HAS ACHIEVED $f'c = 32 \text{ MPa}$, REMOVE EXISTING APRON SLAB AREA.
- IMMEDIATELY FOLLOWING STEP (e) REMOVE ALL EXISTING LOOSE ROCK AND ALLUVIAL MATERIAL FROM 2m WIDE AREA SHOWN HATCHED. DRILL AND FIX N20 (HOT DIP GALVANISED) AT 2000 CENTRES EACH WAY. MINIMUM 250 EMBEDMENT INTO EXISTING BEDROCK WITH HILTI HIT-RE500 OR APPROVED EQUIVALENT. REFER SECTION 'F' ON SHEET No. 7 DO NOT INSTALL IN LOCATIONS THAT ARE UNDER NEW PRECAST CONCRETE BLOCKS. CAST NO FINES CONCRETE IN THIS AREA TO REINSTATE SUPPORT TO SOUTHERN WINGWALL.
- REMOVE ALL EXISTING LOOSE ROCK AND ALLUVIAL MATERIAL FROM REMAINING AREA SHOWN HATCHED. DRILL AND FIX N20 (HOT DIP GALVANISED) AT 2000 CENTRES EACH WAY. MINIMUM 250 EMBEDMENT INTO EXISTING BEDROCK WITH HILTI HIT-RE500 OR APPROVED EQUIVALENT. REFER SECTION 'F' ON SHEET No. 7 DO NOT INSTALL IN LOCATIONS THAT ARE UNDER NEW PRECAST CONCRETE BLOCKS.



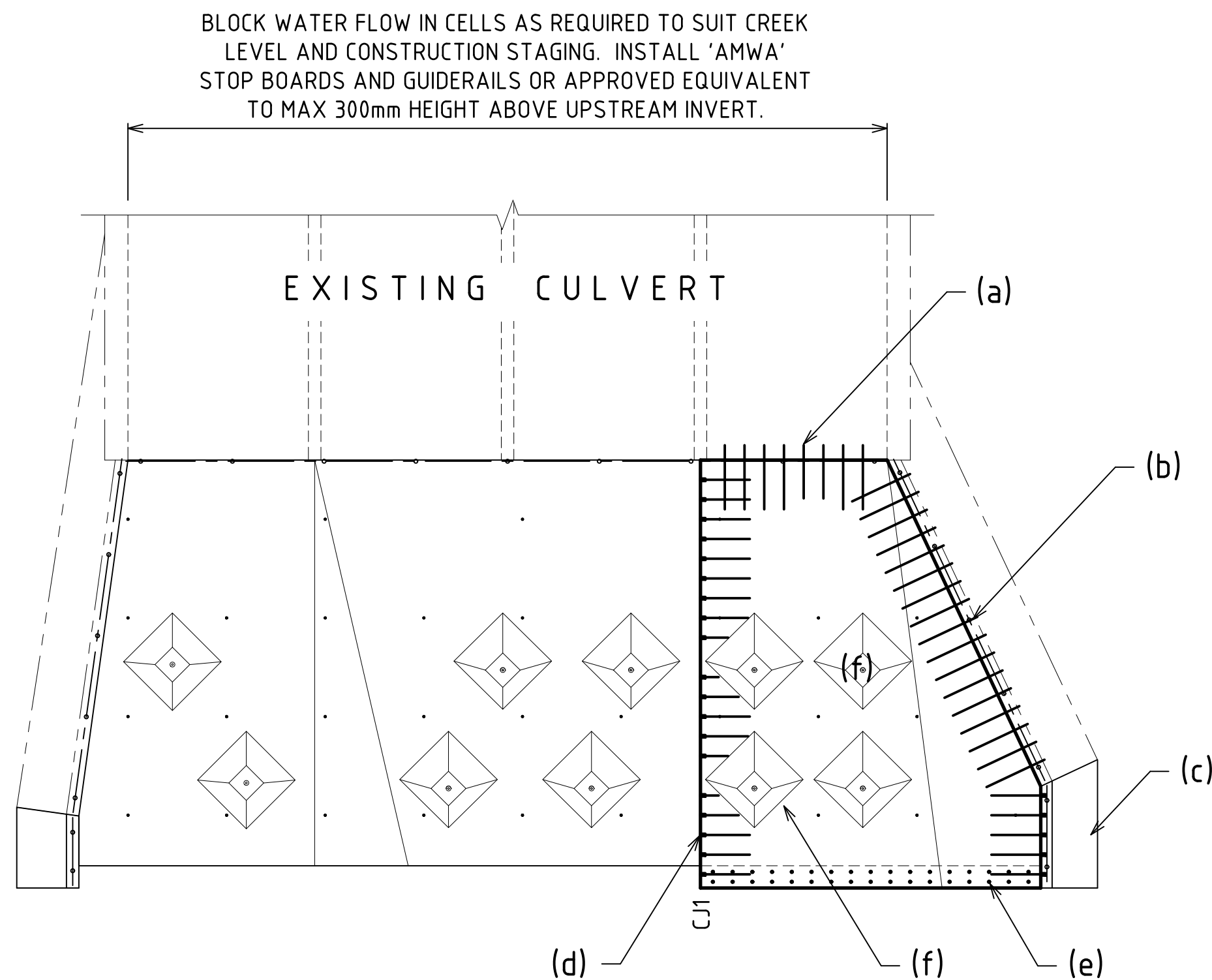
STAGE 3:

- CONSTRUCT WING WALL EXTENSION TO NORTHERN WING WALL AND INSTALL CAST IN REID BAR COUPLERS. REFER SECTION 'G' & 'H' (SIMILAR) ON SHEET No. 7 FOR DETAILS. NOTE: THIS STAGE CAN BE CONSTRUCTED IN STAGE 1 IF ACCESS AND WATER LEVELS PERMIT.
- INSTALL MONOWILLS HANDRAILS ON TOP OF NEW NORTHERN WING WALL.
- PLACE MASS CONCRETE PRECAST BLOCKS ON TOP OF NO-FINES CONCRETE IN APPROXIMATE LOCATION / SPACING SHOWN. REFER DETAIL 'A' ON SHEET No. 6



STAGE 2:

- CONSTRUCT NO FINES CONCRETE WORKING PAD TO ACHIEVE PLANAR INCLINED WORKING PLATFORM IN STAGES AS REQUIRED, STARTING AT SOUTHERN END.
- COMPLETE NO FINES CONCRETE PLACEMENT UNTIL FULL APRON AREA IS COVERED. CONCRETE LEVEL TO BE 250mm MINIMUM LOWER THAN FINISHED TOP OF APRON SLAB CONCRETE LEVEL. NOTE: FINISHED CONCRETE LEVELS ARE SHOWN ON SHEET No. 6



STAGE 4:

- DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE OF EXISTING CULVERT.
- DRILL AND FIX REINFORCEMENT BARS INTO EXISTING SOUTHERN WING WALL CONCRETE.
- INSTALL RBA16 REID BARS INTO SOUTHERN WING WALL EXTENSION.
- INSTALL CAST IN REID BAR COUPLER RBA16CG AT 400 CENTRES MAX. WITH MIN 1000 LONG RBA16 REID BAR AT SOUTH SIDE OF CJ1 JOINT.
- DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
- PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
- POUR NEW APRON SLAB PORTION (250mm THICK MINIMUM).

GENERAL NOTES:


- SCALE 0 1 2 3 4 5m OR AS SHOWN
1 0.5
- ALL DIMENSIONS ARE IN MILLIMETRES.
 - CHAINAGES AND REDUCED LEVELS ARE IN METRES.
 - REDUCED LEVELS ARE TO AHD.
 - LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

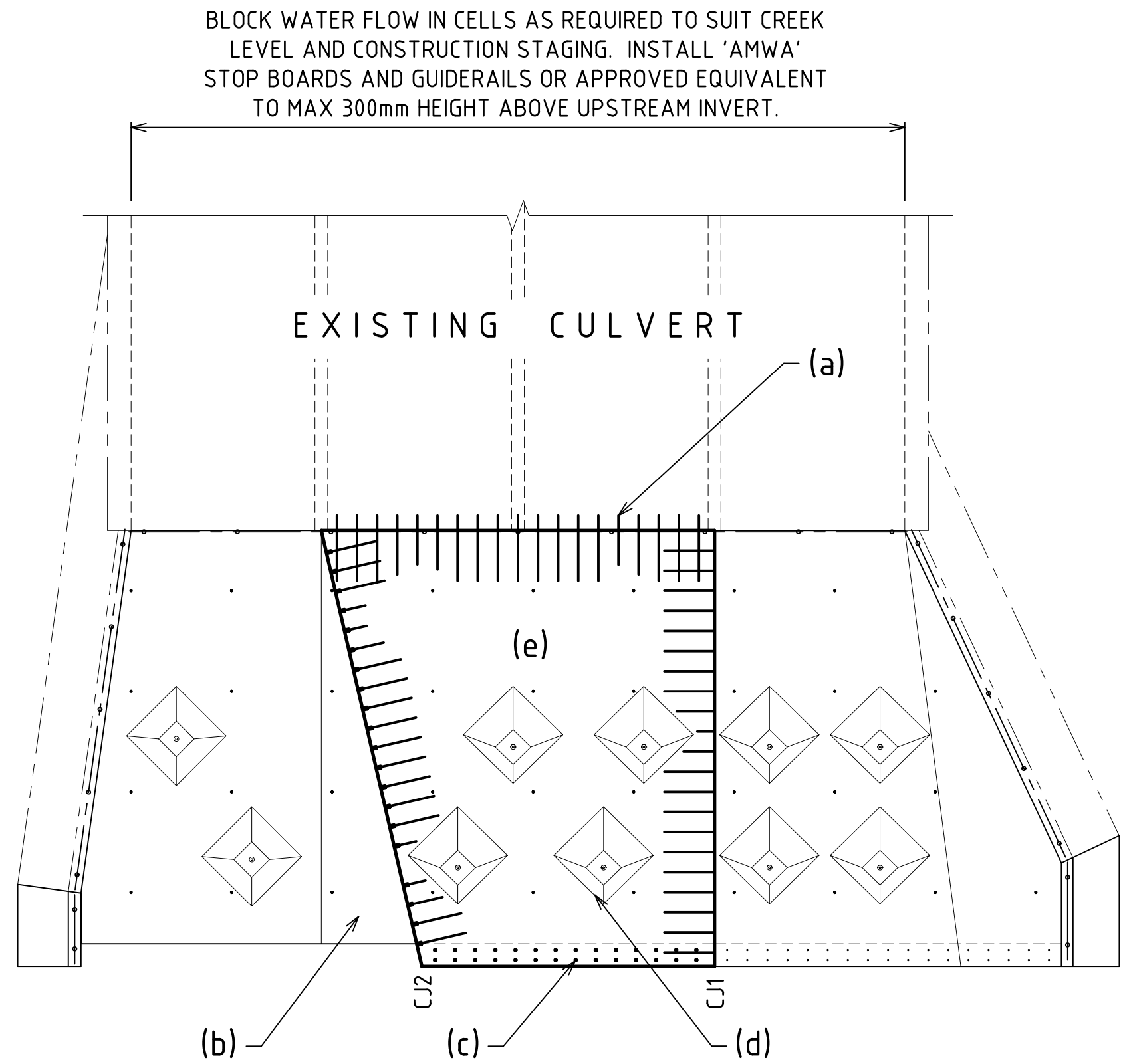
CONCRETE NOTES:

- CONCRETE EXPOSURE CLASSIFICATION B1.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF CAST INSITU REINFORCED CONCRETE WALLS SHALL BE 40 MPa FOR PRECAST CONCRETE AND 40 MPa FOR APRON SLAB AND WINGWALL EXTENSIONS.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF MASS CONCRETE AND NO FINES CONCRETE SHALL BE 25 MPa .
- EDGES SHALL BE CHAMFERED 20×20 AND RE-ENTRANT ANGLES FILLETED 20×20 UNLESS NOTED OTHERWISE.
- CJ DENOTES CONSTRUCTION JOINT.
- NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 45MM IF CAST AGAINST FORMWORK, 55MM IF CAST AGAINST NO FINES CONCRETE OR MEMBRANE AND 75MM IF CAST AGAINST THE GROUND.
- UNLESS SHOWN OTHERWISE ON THE DRAWINGS LAPS ON ADJACENT BARS ON ANY FACE SHALL BE STAGGERED (OFFSET) BY NO LESS THAN THE LAP LENGTH.
- UNLESS OTHERWISE SPECIFIED, THE MINIMUM DEVELOPMENT LENGTHS AND LENGTHS OF LAPS SHALL BE AS FOLLOWS:

BAR SIZE: mm	N12	N16	N20	N24	N28	N32	N36
a) HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW THE BAR:	460	650	940	1250	1580	.....	.....
b) OTHER BARS:	350	500	720	960	1210	.....	.....

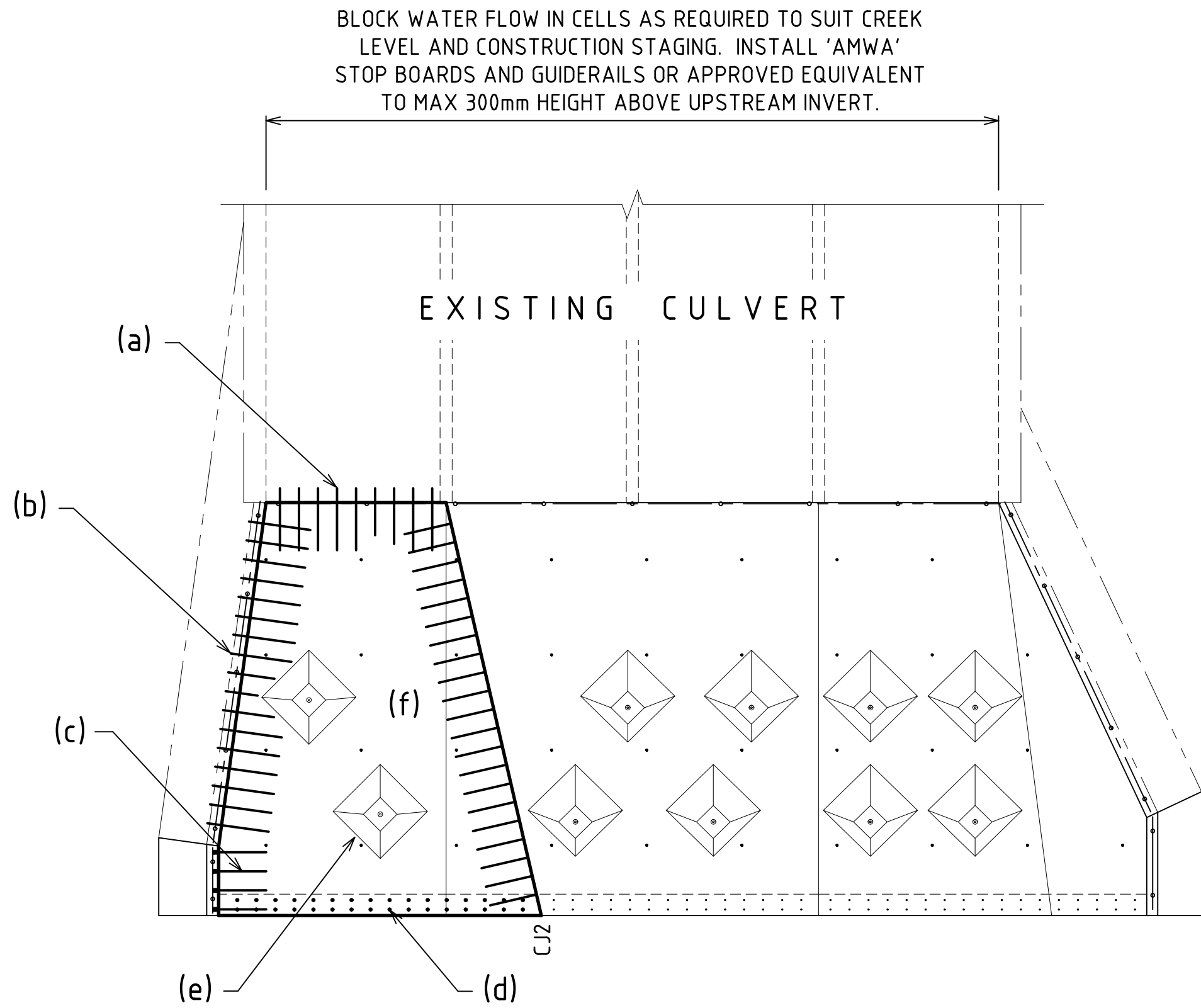
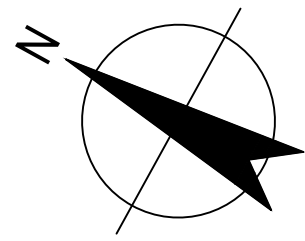
- REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR DOWELS, TIE BARS AND PRECAST BLOCKS.

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A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.	
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ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
CONSTRUCTION STAGING DIAGRAM - SHEET 1					
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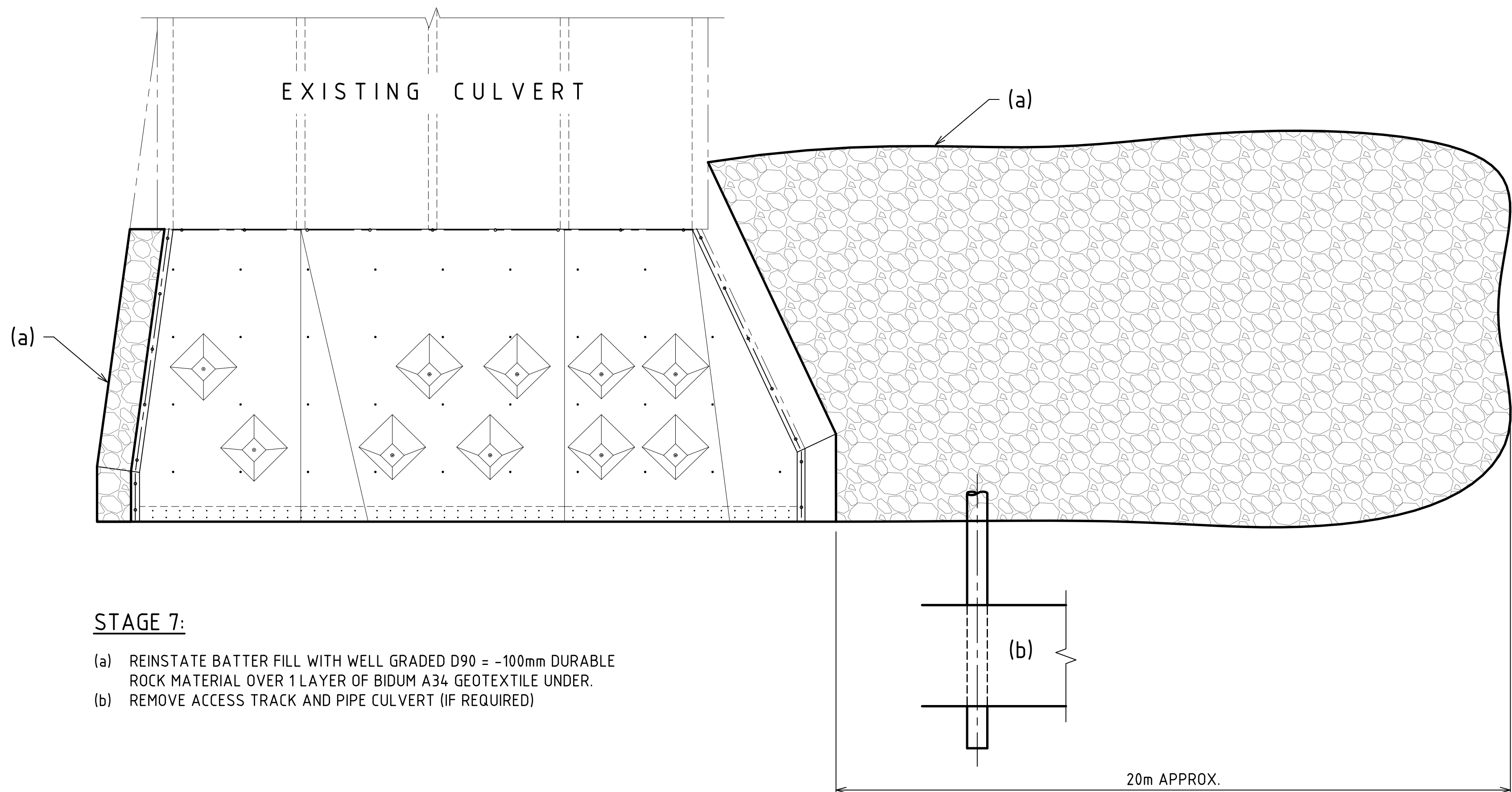
STAGE 5:

- (a) DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE.
(b) INSTALL CAST IN REID BAR COUPLER RBA16CG AT 400 CENTRES MAX. WITH MIN 1000 LONG RBA16 REID BAR AS SOUTH SIDE OF CJ2 JOINT AND INSTALL RBA16 BARS ALONG 'CJ1'
(c) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
(d) PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
(e) POUR NEW APRON SLAB PORTION (250mm THICK MINIMUM).



STAGE 6:

- (a) DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE.
(b) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING NORTHERN WING WALL.
(c) INSTALL RBA16 REID BARS INTO NORTHERN WING WALL EXTENSION AND ALONG 'CJ2'
(d) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
(e) PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
(f) POUR NEW APRON SLAB PORTION (250mm MINIMUM THICKNESS).



STAGE 7:

- (a) REINSTATE BATTER FILL WITH WELL GRADED D90 = -100mm DURABLE ROCK MATERIAL OVER 1 LAYER OF BIDUM A34 GEOTEXTILE UNDER.
(b) REMOVE ACCESS TRACK AND PIPE CULVERT (IF REQUIRED)

GENERAL NOTES:

SCALE 0 1 2 3 4 5m
1 0.5 OR AS SHOWN


- ALL DIMENSIONS ARE IN MILLIMETRES.
- CHAINAGES AND REDUCED LEVELS ARE IN METRES.
- REDUCED LEVELS ARE TO AHD.
- LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

CONCRETE NOTES:

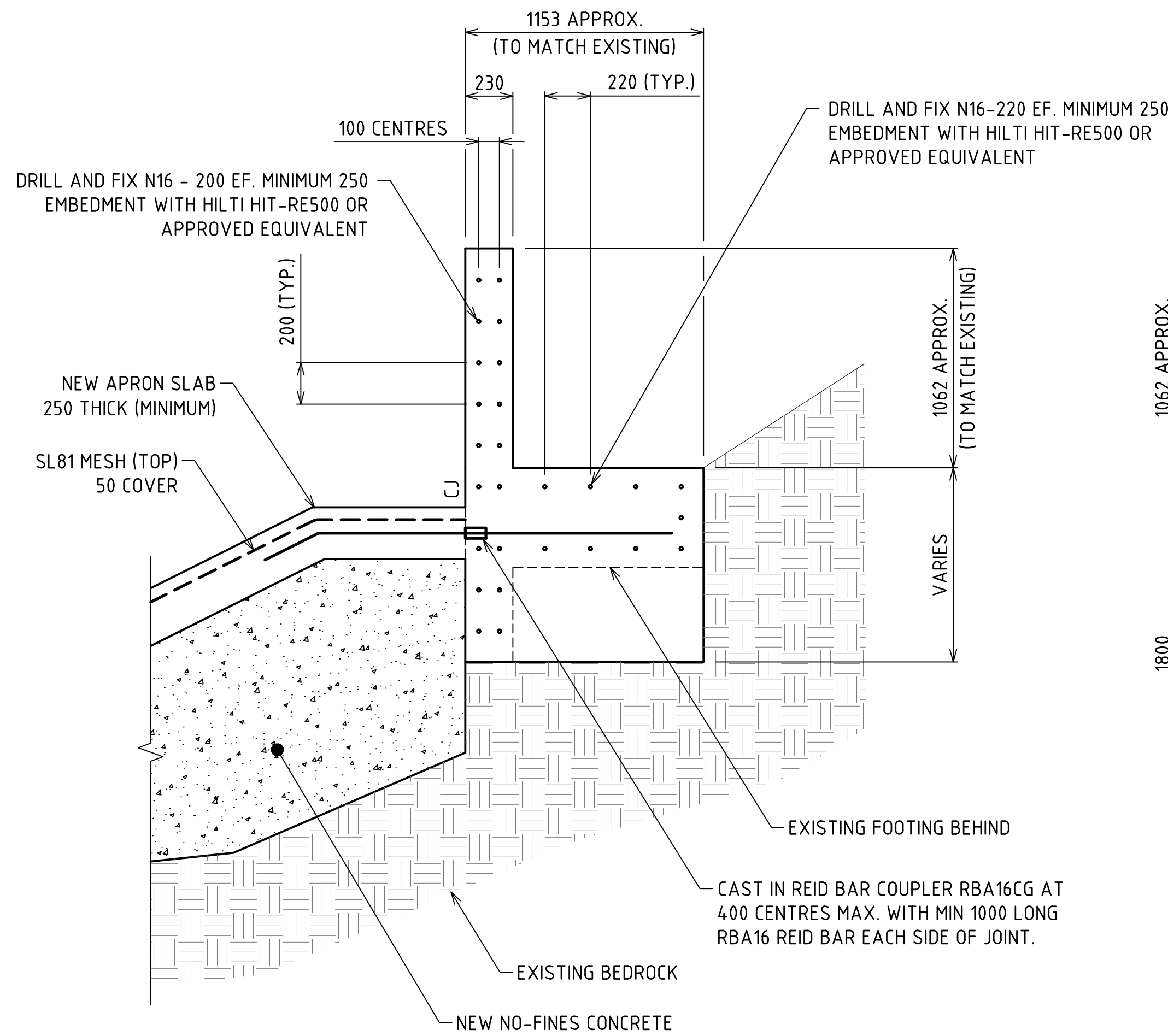
- CONCRETE EXPOSURE CLASSIFICATION B1.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF CAST INSITU REINFORCED CONCRETE WALLS SHALL BE 40MPa FOR PRECAST CONCRETE AND 40MPa FOR APRON SLAB AND WINGWALL EXTENSIONS.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF MASS CONCRETE AND NO FINES CONCRETE SHALL BE 25MPa.
- EDGES SHALL BE CHAMFERED 20 x 20 AND RE-ENTRANT ANGLES FILLETED 20 x 20 UNLESS NOTED OTHERWISE.
- CJ DENOTES CONSTRUCTION JOINT.
- NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 45MM IF CAST AGAINST FORMWORK, 55MM IF CAST AGAINST NO FINES CONCRETE OR MEMBRANE AND 75MM IF CAST AGAINST THE GROUND.
- UNLESS SHOWN OTHERWISE ON THE DRAWINGS LAPS ON ADJACENT BARS ON ANY FACE SHALL BE STAGGERED (OFFSET) BY NO LESS THAN THE LAP LENGTH.
- UNLESS OTHERWISE SPECIFIED, THE MINIMUM DEVELOPMENT LENGTHS AND LENGTHS OF LAPS SHALL BE AS FOLLOWS:

BAR SIZE: mm	N12	N16	N20	N24	N28	N32	N36
a) HORIZONTAL BARS WITH>300mm OF CONCRETE CAST BELOW THE BAR:	460	650	940	1250	1580	.....	.....
b) OTHER BARS:	350	500	720	960	1210	.....	.....

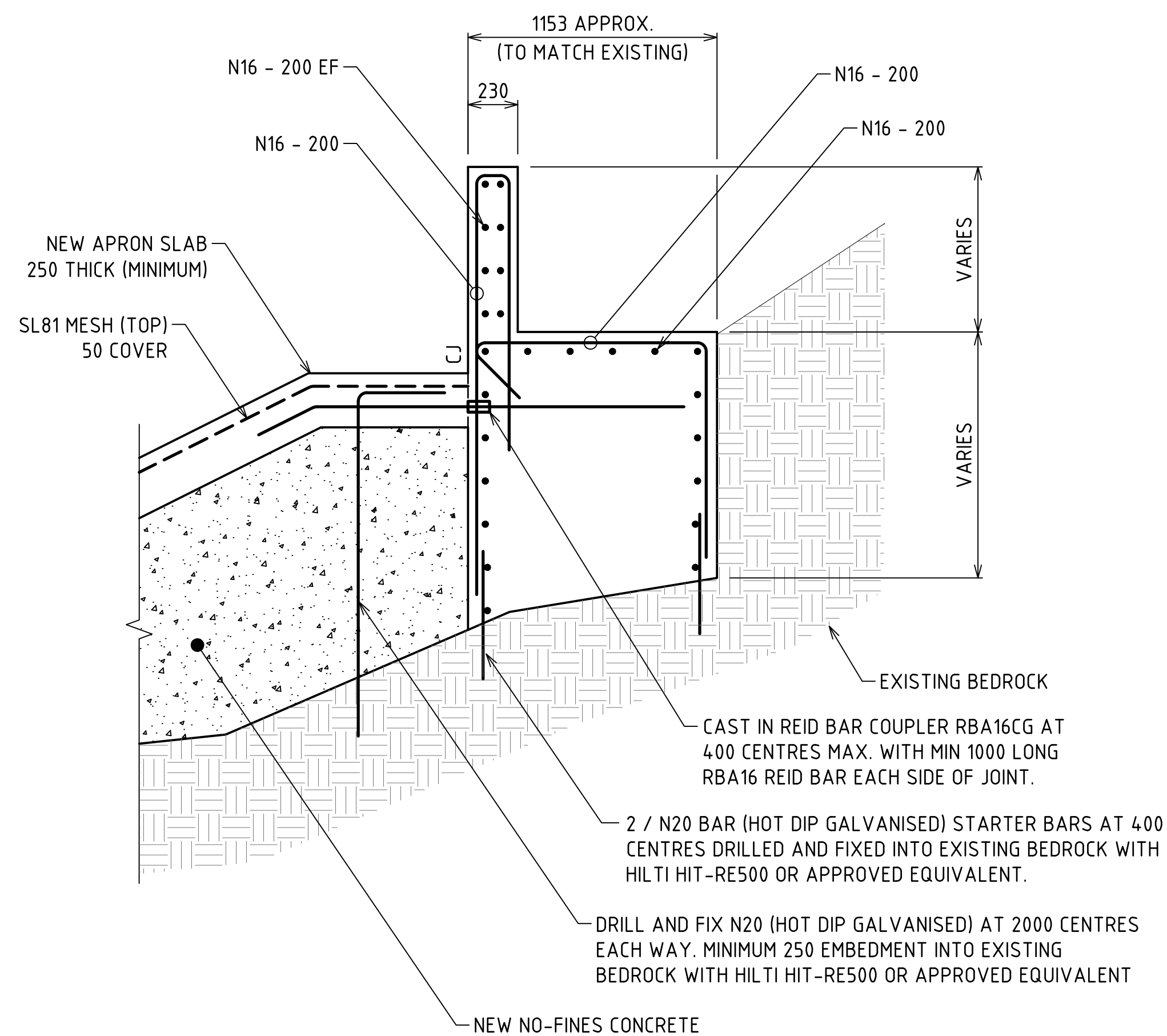
- REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR DOWELS, TIE BARS AND PRECAST BLOCKS.

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JOUNAMA CREEK CULVERT						
CULVERT REPAIRS						
CONSTRUCTION STAGING DIAGRAM - SHEET 2						
GHD			 Transport Roads & Maritime Services			
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APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN			
DIRECTOR			SHEET No.		5	ISSUE B

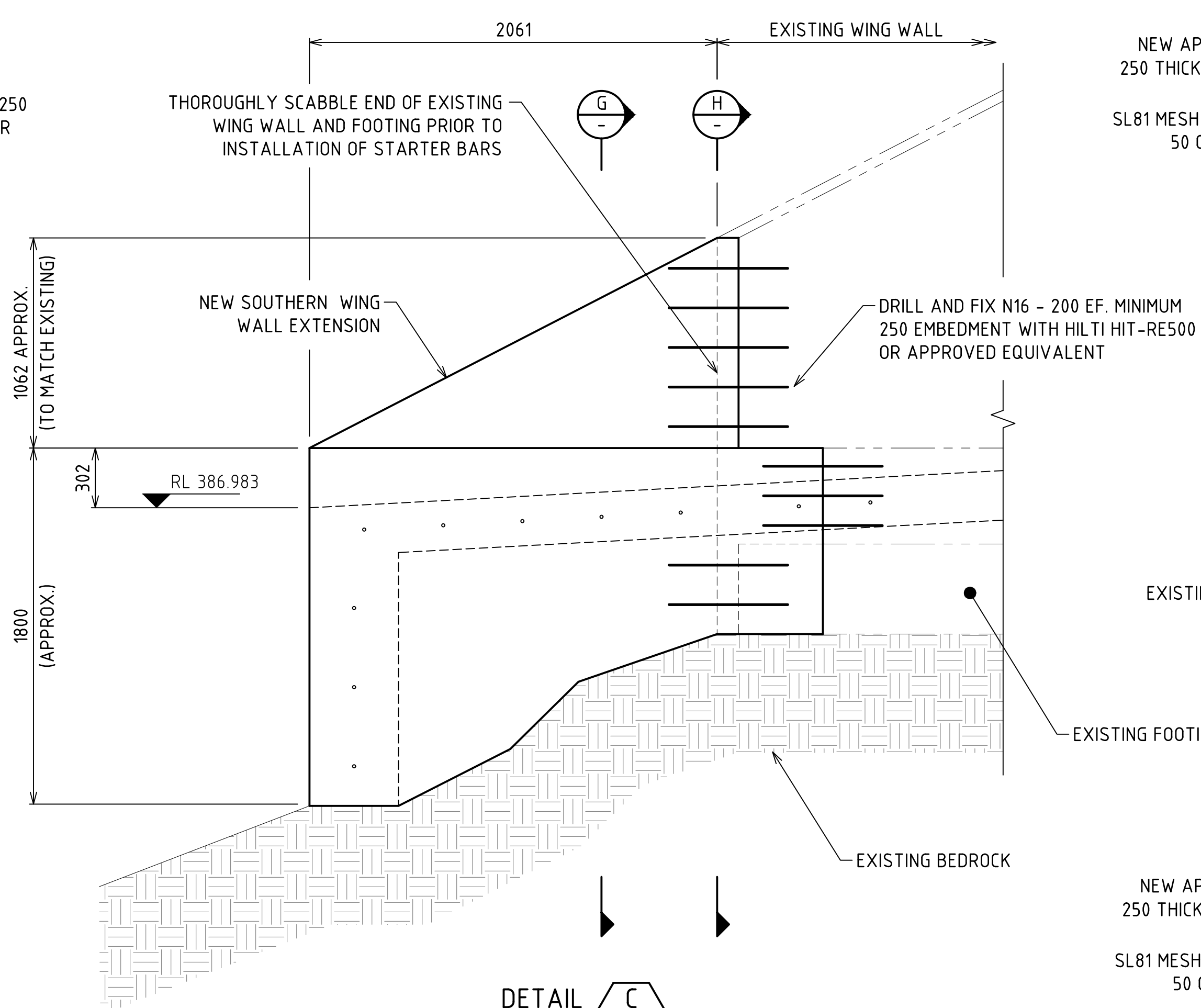
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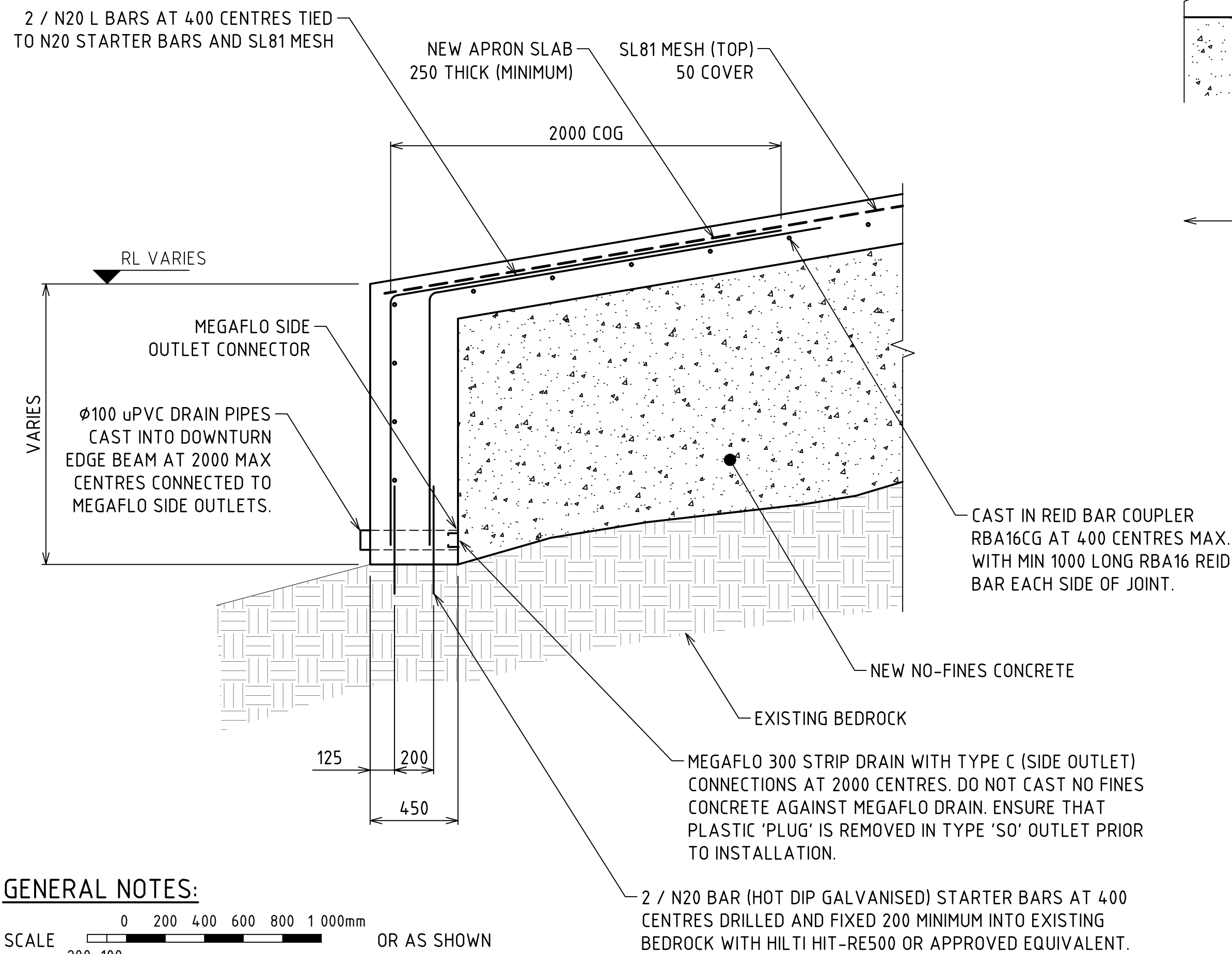
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SCALE 1:20



SECTION G
SCALE 1:20



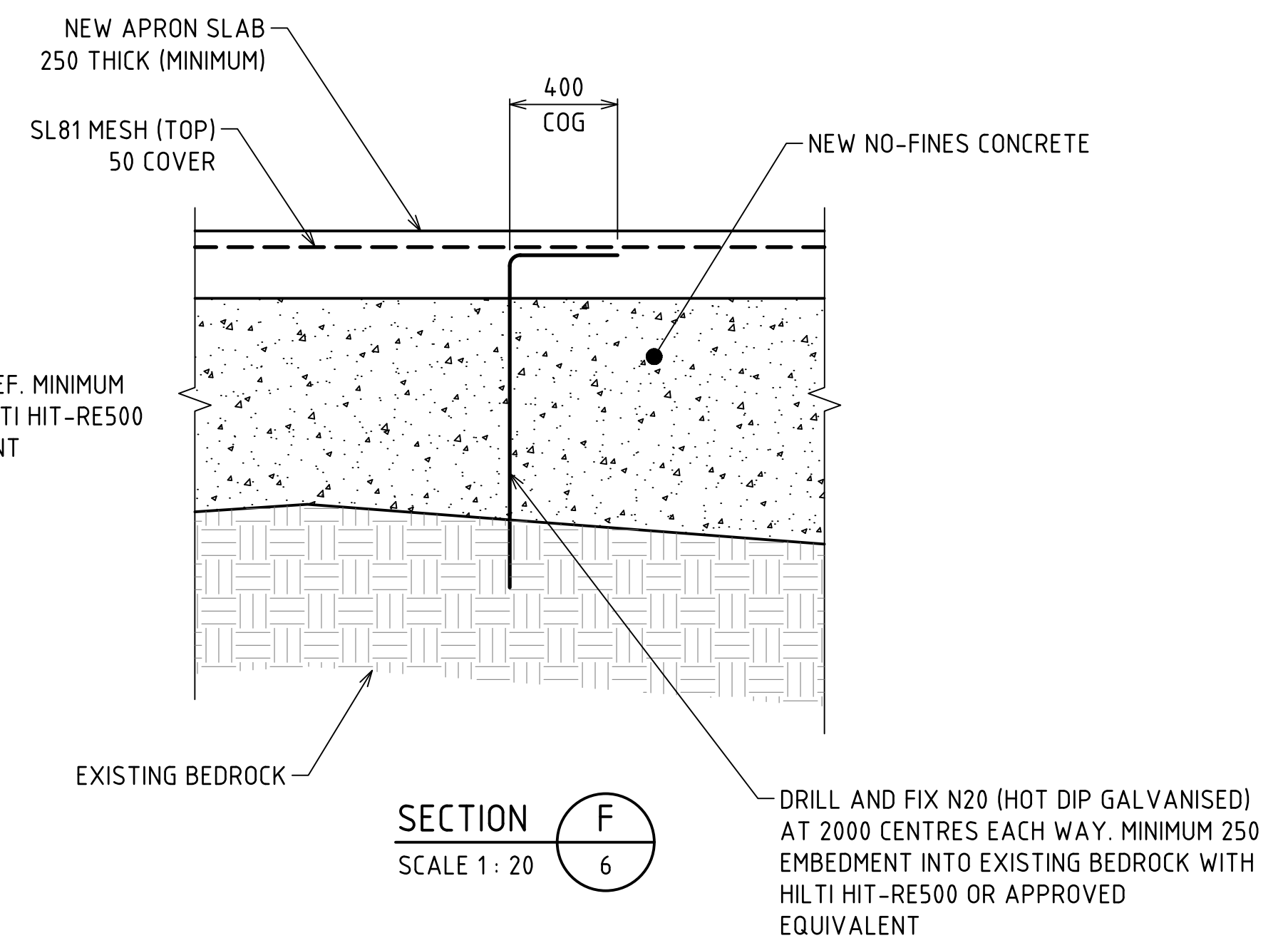
DETAIL C
SCALE 1:20



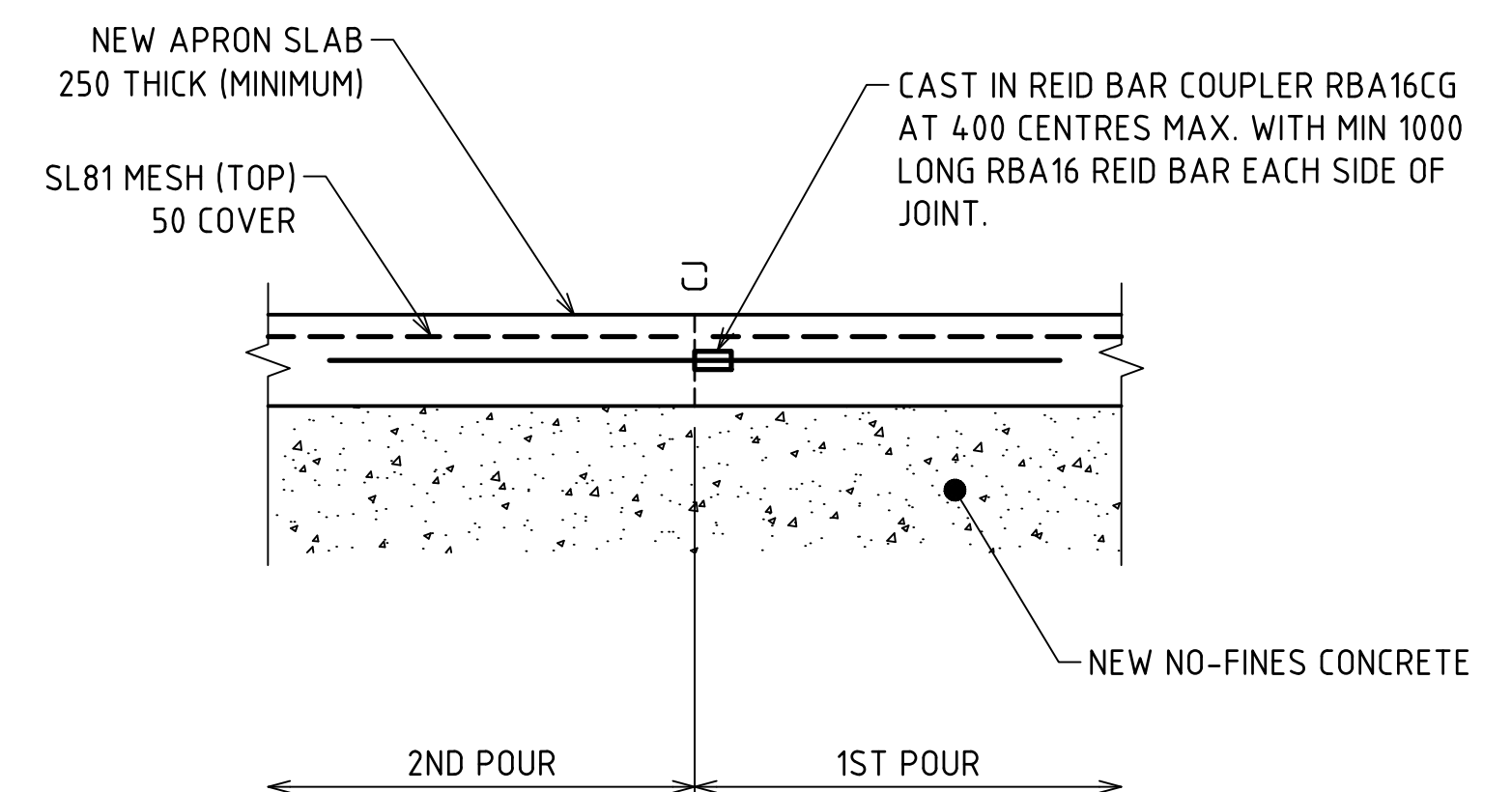
GENERAL NOTES:

- SCALE 0 200 400 600 800 1 000mm OR AS SHOWN
200 100
- FOR GENERAL NOTES AND CONCRETE NOTES RELATING TO THIS DRAWING REFER TO SHEET No.4


DETAIL D
SCALE 1:20



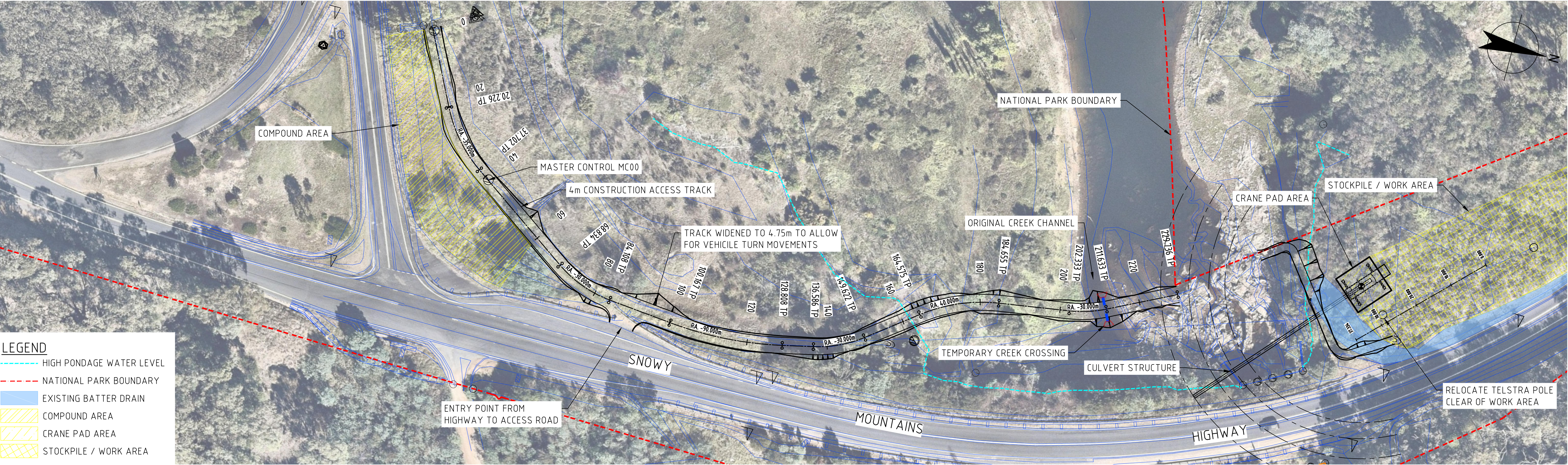
SECTION F
SCALE 1:20



SECTION E
SCALE 1:20

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B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
CONCRETE DETAILS - SHEET 2					
<div>GHD</div> <div>GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com</div>			<div>Transport Roads & Maritime Services</div>		
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DRAWING C.R.YE				RMS BRIDGE NUMBER 5460	
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DIRECTOR			SHEET No. 7		ISSUE B

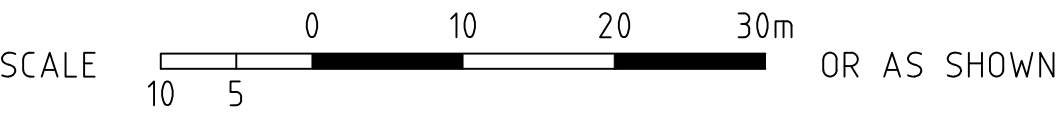
THIS DRAWING IS CONFIDENTIAL AND SHALL ONLY BE USED FOR THE PURPOSE OF THE NOMINATED PROJECT



- LEGEND**
- HIGH PONDAGE WATER LEVEL
 - - - NATIONAL PARK BOUNDARY
 - EXISTING BATTER DRAIN
 - COMPOUND AREA
 - CRANE PAD AREA
 - STOCKPILE / WORK AREA

PLAN
SCALE 1:500

GENERAL NOTES:



- ALL DIMENSIONS ARE IN MILLIMETRES.
- CHAINAGES AND REDUCED LEVELS ARE IN METRES.
- REDUCED LEVELS ARE TO AHD.
- LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
- MAX PONDAGE WATER LEVEL 392.4m SHD = 391.223m AHD
- FOLLOWING COMPLETION OF WORKS THE 600 Ø PIPE CROSSING WITHIN THE CREEK CHANNEL IS TO BE REMOVED.
- THE GRAVEL ACCESS ROAD BELOW JOUNAMA PONDAGE HIGH WATER LEVEL OF 391.223m AHD IS TO BE REMOVED AND REINSTATED TO NATURAL VEGETATION UPON COMPLETION OF WORKS. GRAVEL ACCESS ELSEWHERE TO BE PERMANENT.
- REMOVE TOPSOIL FROM ROAD FOOTPRINT AND COMPACT SUBGRADE IN ACCORDANCE WITH RMS SPECIFICATION R44. PLACE MIN 300mm THICK DGS GRAVEL ACCESS ROAD. PLACE AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R71.
- GUARDRAIL TERMINALS TO BE RELOCATED TEMPORARILY AT THE HIGHWAY ENTRY POINT TO THE ACCESS ROAD. TERMINALS TO BE REINSTATED UPON COMPLETION OF WORKS.
- REMOVE VEGETATION AS REQUIRED FROM COMPOUND AREA, CRANE PAD AREA AND STOCKPILE / WORK AREA.

DATUM R.L. 381.0

VERTICAL ALIGNMENT

HORIZONTAL ALIGNMENT

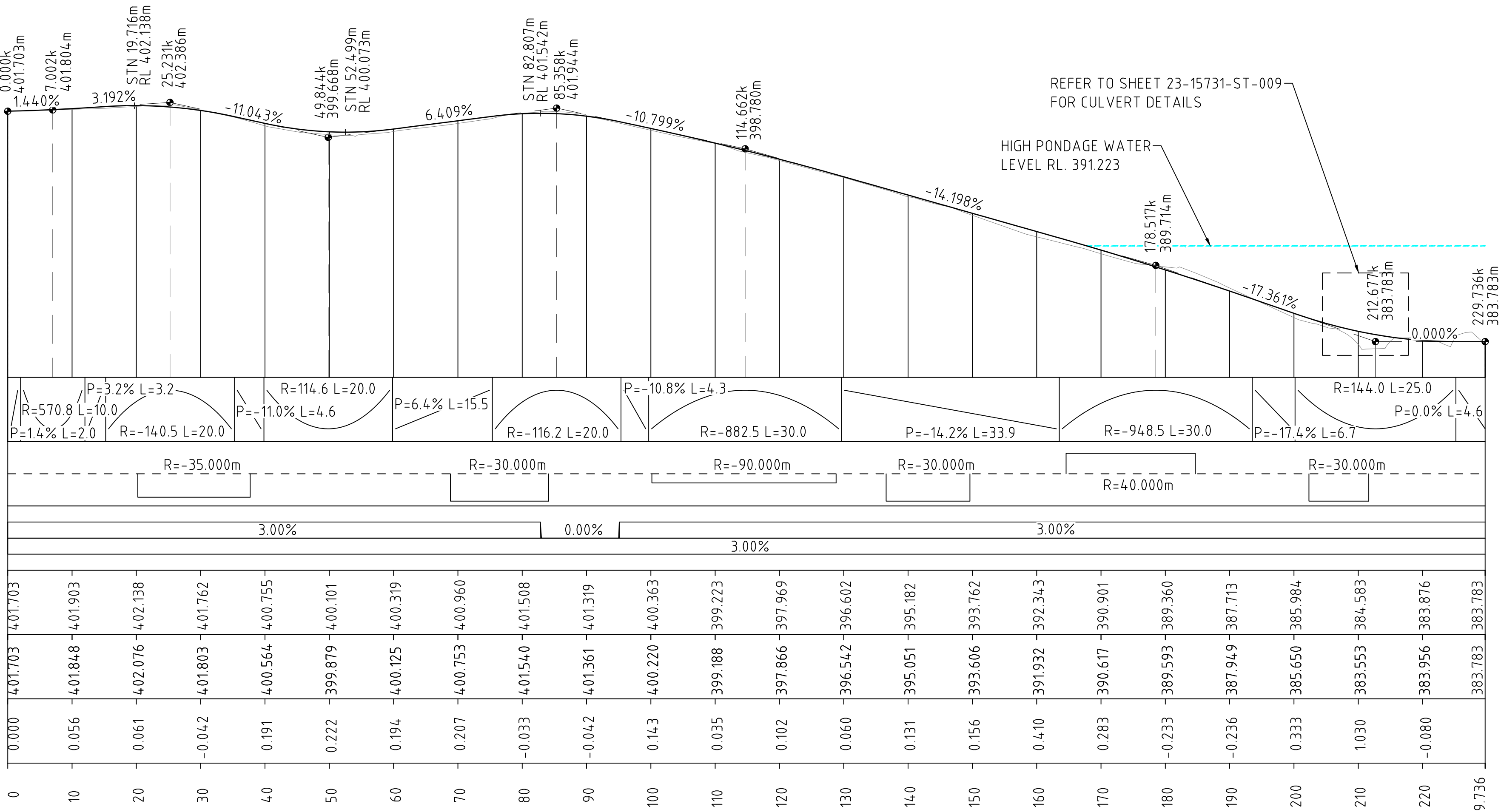
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DESIGN SURFACE LEVELS


EXISTING SURFACE LEVELS

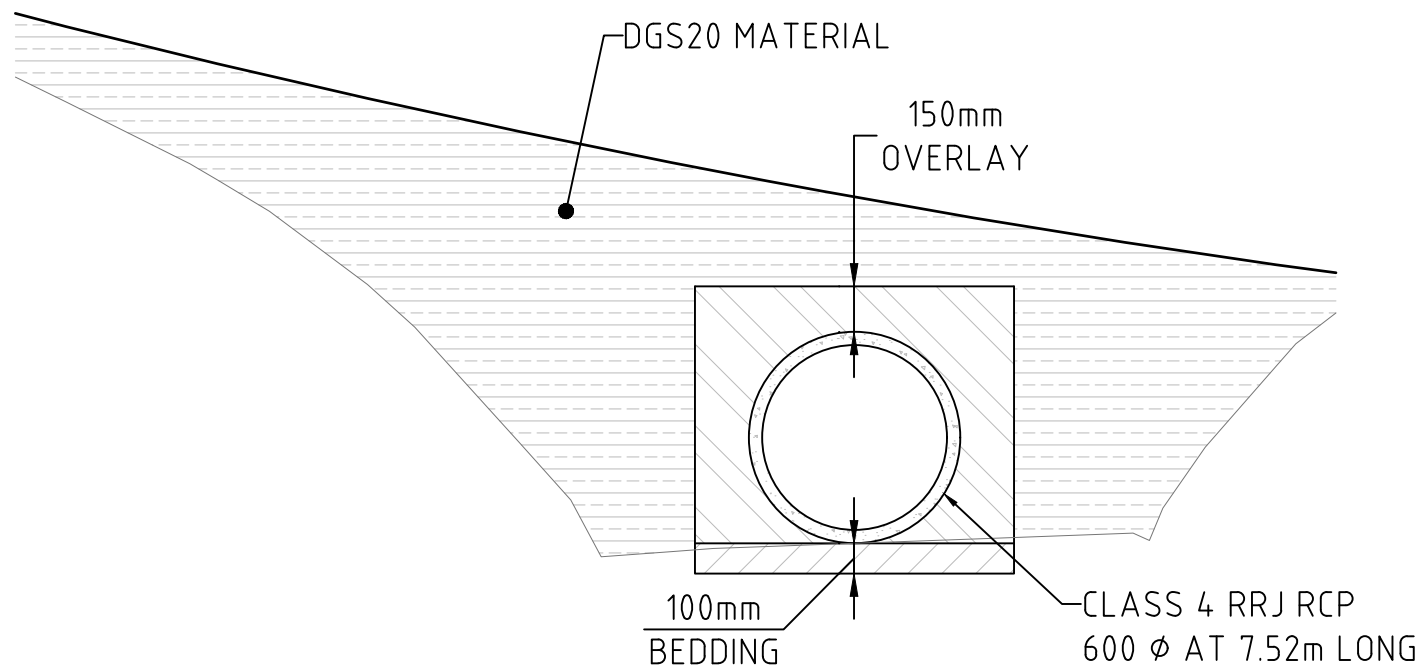
LEVEL DIFF (Fill + / Cut -)

CHAINAGE



LONGITUDINAL SECTION - ACCESS TRACK CONTROL MC00
SCALE 1:500H 1:250V

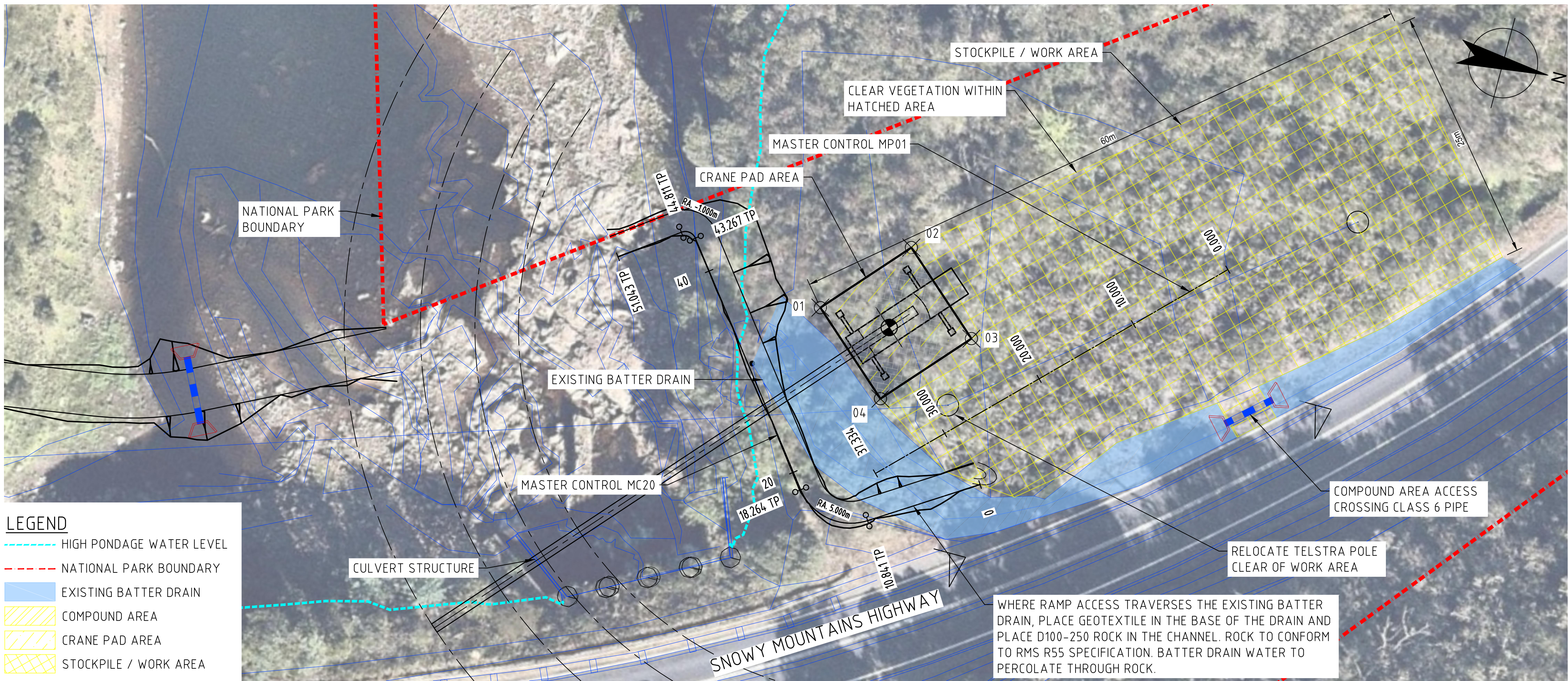
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Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
ACCESS ROAD PLAN AND LONG SECTION					
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
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TEMPORARY PIPE CROSSING DETAIL
SCALE 1:100

TEMPORARY PIPE CROSSING INSTALLATION NOTES

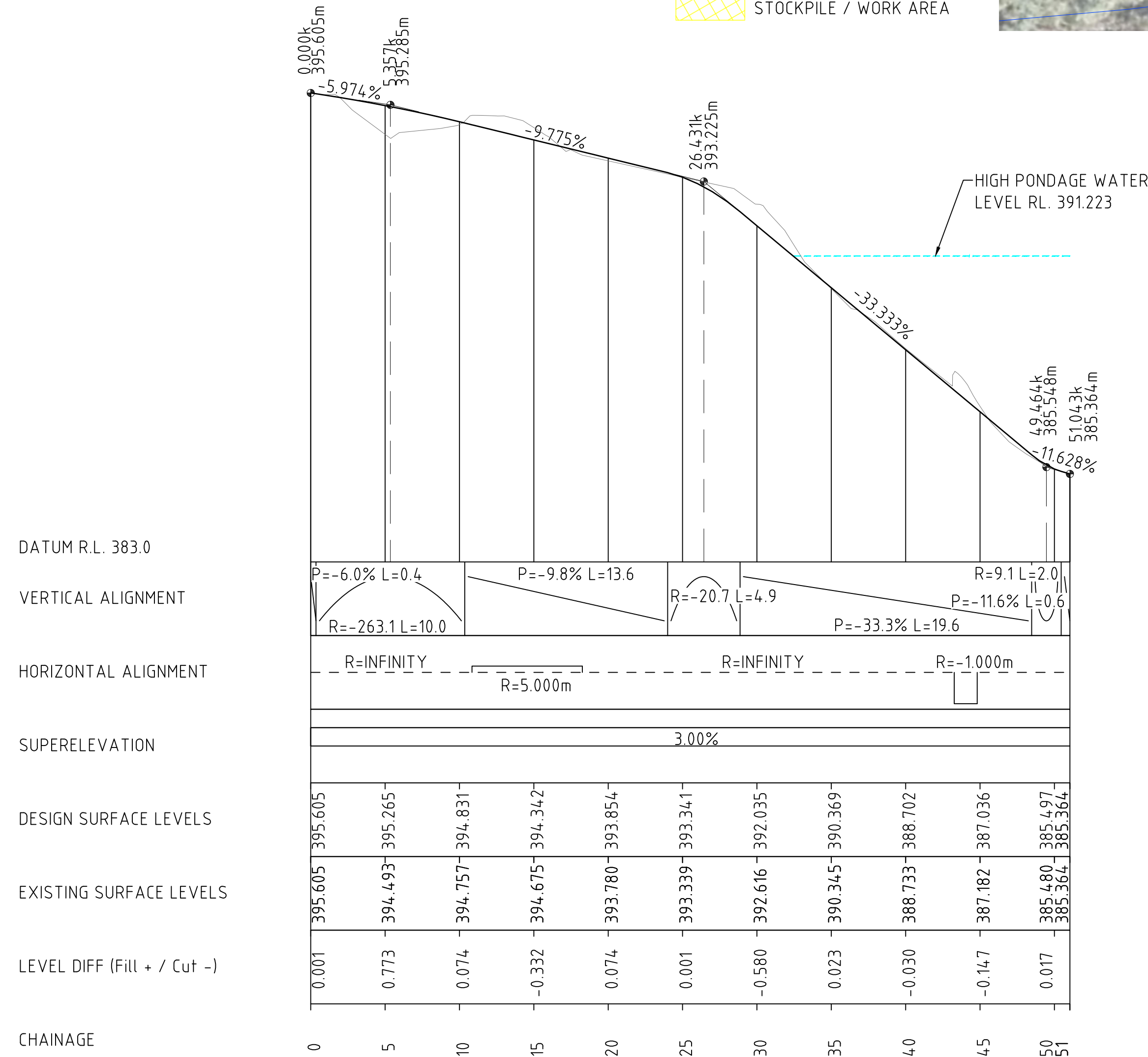
1. FILL CREEK CHANNEL WITH DGS20 MATERIAL AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R71.
2. EXCAVATE THROUGH COMPACTED MATERIAL TO BED LEVEL TO A WIDTH SUITABLE FOR INSTALLATION OF 600mm Ø PIPE CULVERT.
3. PREPARE BEDDING, LAY PIPES AND BACKFILL IN ACCORDANCE WITH RMS SPECIFICATION R11 TO TOP OF OVERLAY ZONE.
4. PLACE AND COMPACT DGS MATERIAL ABOVE TOP OF OVERLAY ZONE UNTIL DESIGN LEVEL IS ACHIEVED



PLAN
SCALE 1:250

LEGEND

- HIGH PONDAGE WATER LEVEL
- - - NATIONAL PARK BOUNDARY
- EXISTING BATTER DRAIN
- COMPOUND AREA
- CRANE PAD AREA
- STOCKPILE / WORK AREA



LONGITUDINAL SECTION - CRANE ACCESS CONTROL MC20
SCALE 1:250H 1:100V

CRANE PAD COORDINATES

POINTS	EASTING	NORTHING
01	620098.233	6063390.23
02	620090.751	6063396.866
03	620097.387	6063404.347
04	620104.868	6063397.711

NOTE: CRANE PAD TO HAVE MAXIMUM FALL OF 500mm IN ANY DIRECTION

DATUM R.L. 391.0

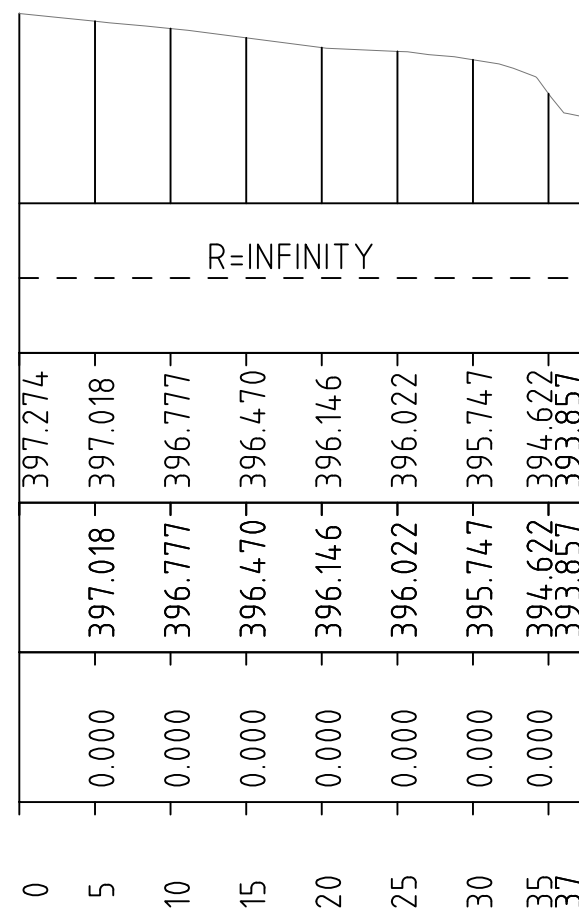
HORIZONTAL ALIGNMENT

DESIGN SURFACE LEVELS

EXISTING SURFACE LEVELS

LEVEL DIFF (Fill + / Cut -)

CHAINAGE




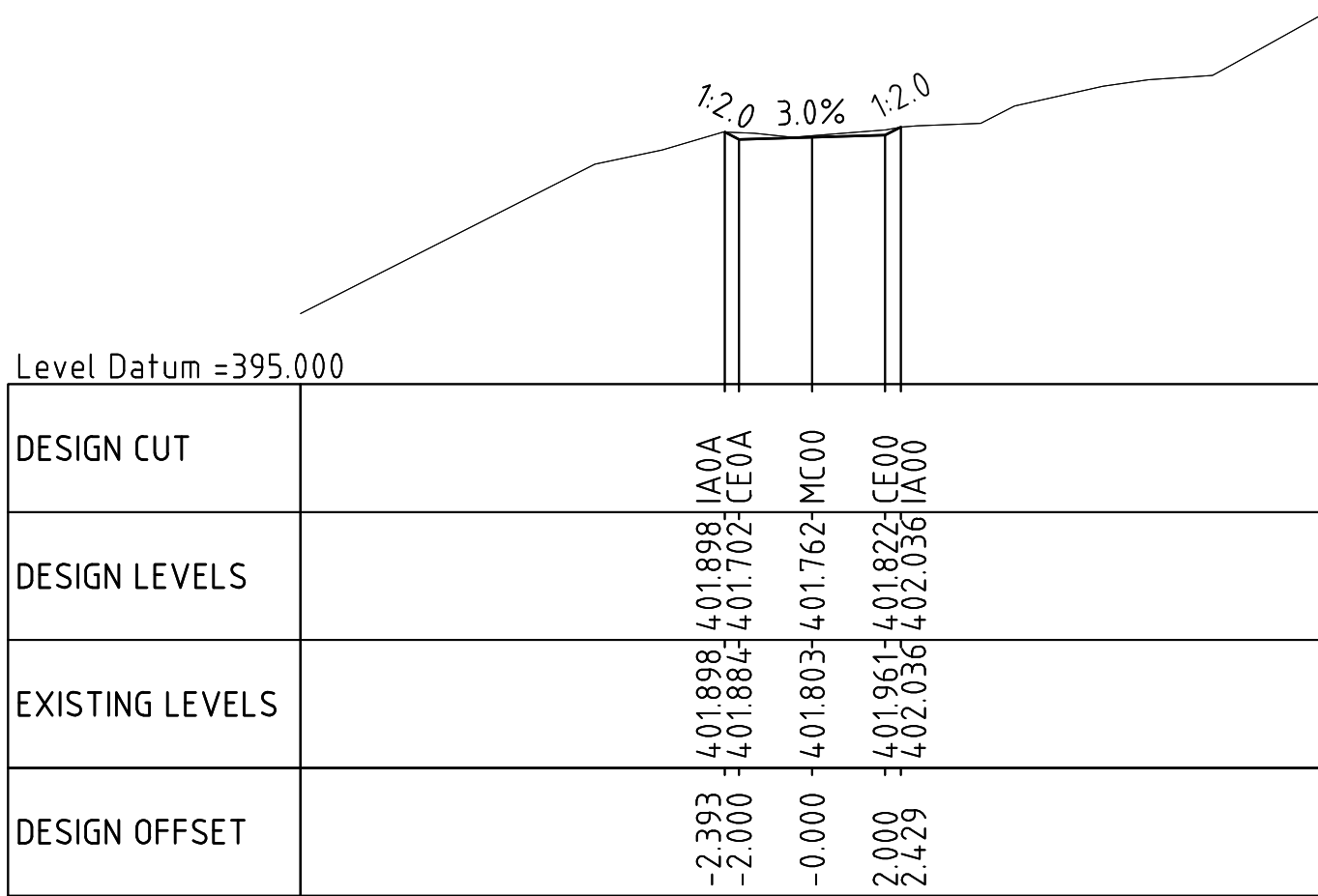
LONGITUDINAL SECTION - SITE COMPOUND CONTROL MP01
SCALE 1:250H 1:100V

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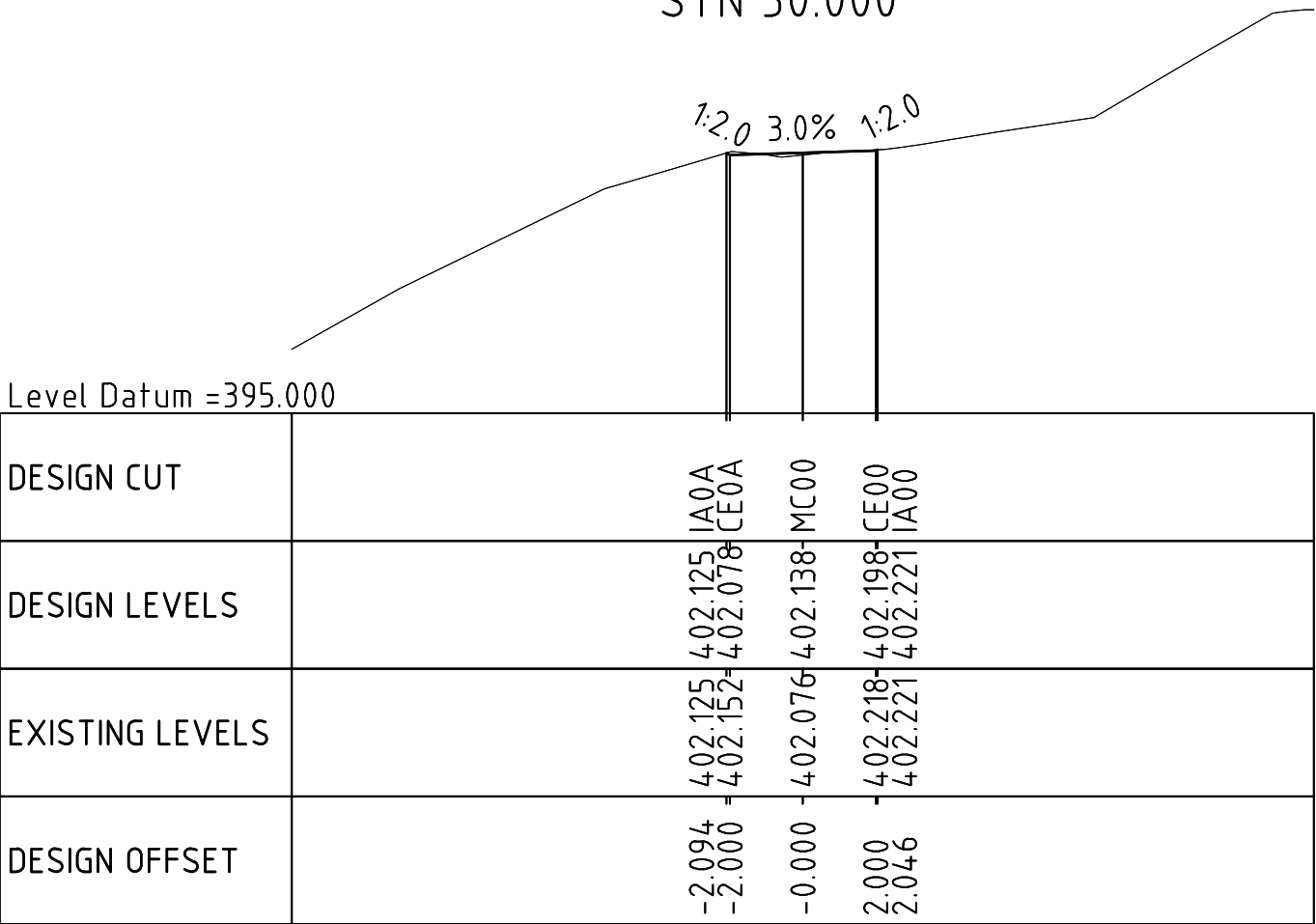
SCALE 10 5 0 10 20 30m OR AS SHOWN

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. CHAINAGES AND REDUCED LEVELS ARE IN METRES.
3. REDUCED LEVELS ARE TO AHD.
4. LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
5. MAX PONDAGE WATER LEVEL 392.4m SHD = 391.223m AHD
6. REMOVE TOPSOIL FROM ROAD FOOTPRINT AND COMPACT SUBGRADE IN ACCORDANCE WITH RMS SPECIFICATION R44. PLACE MIN 300mm THICK DGS GRAVEL ACCESS ROAD. PLACE AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R44.
7. REMOVE VEGETATION AS REQUIRED FROM COMPOUND AREA, CRANE PAD AREA AND STOCKPILE / WORK AREA. PLACE AND COMPACT 100mm DGS20 OVER COMPOUND AREA
8. COMPOUND AREA ACCESS CROSSING - PREPARE BEDDING, LAY PIPES AND BACKFILL IN ACCORDANCE WITH RMS SPECIFICATION R11 TO TOP OF OVERLAY ZONE. PLACE AND COMPACT DGS MATERIAL ABOVE TOP OF OVERLAY ZONE UNTIL DESIGN LEVEL IS ACHIEVED

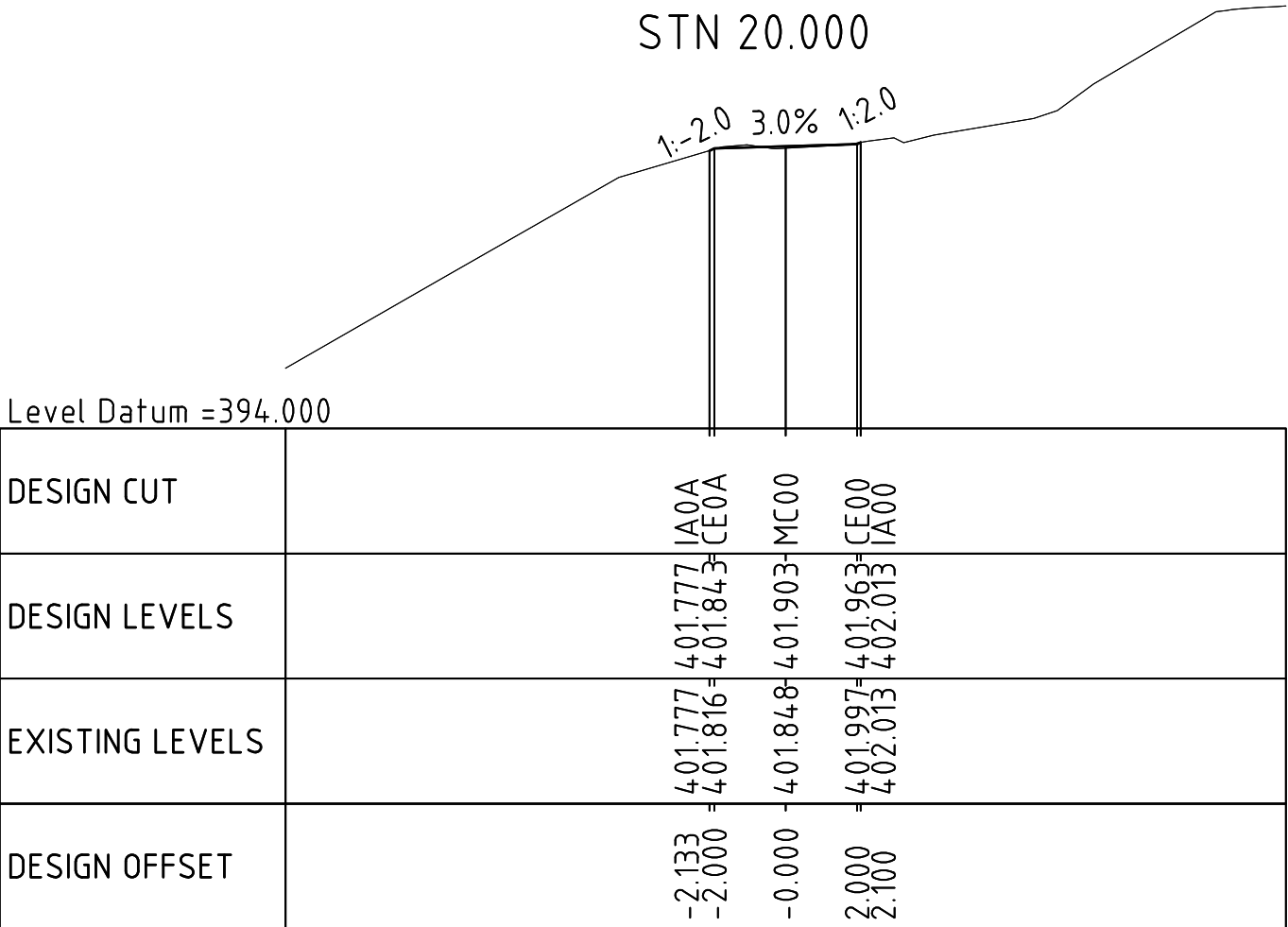
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Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
EXCAVATOR ACCESS PLAN AND LONG SECTION					
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APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
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			ISSUE		B



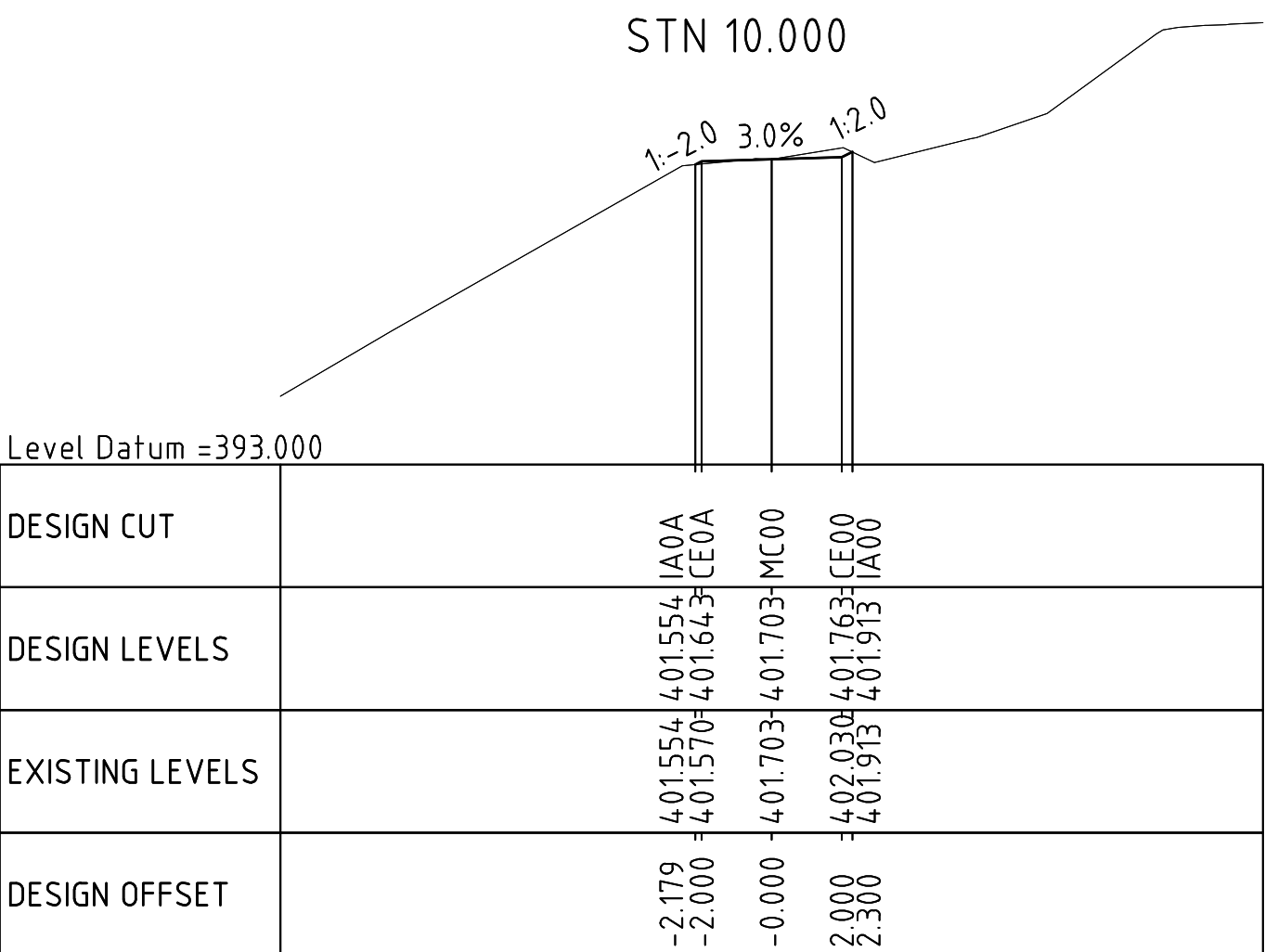
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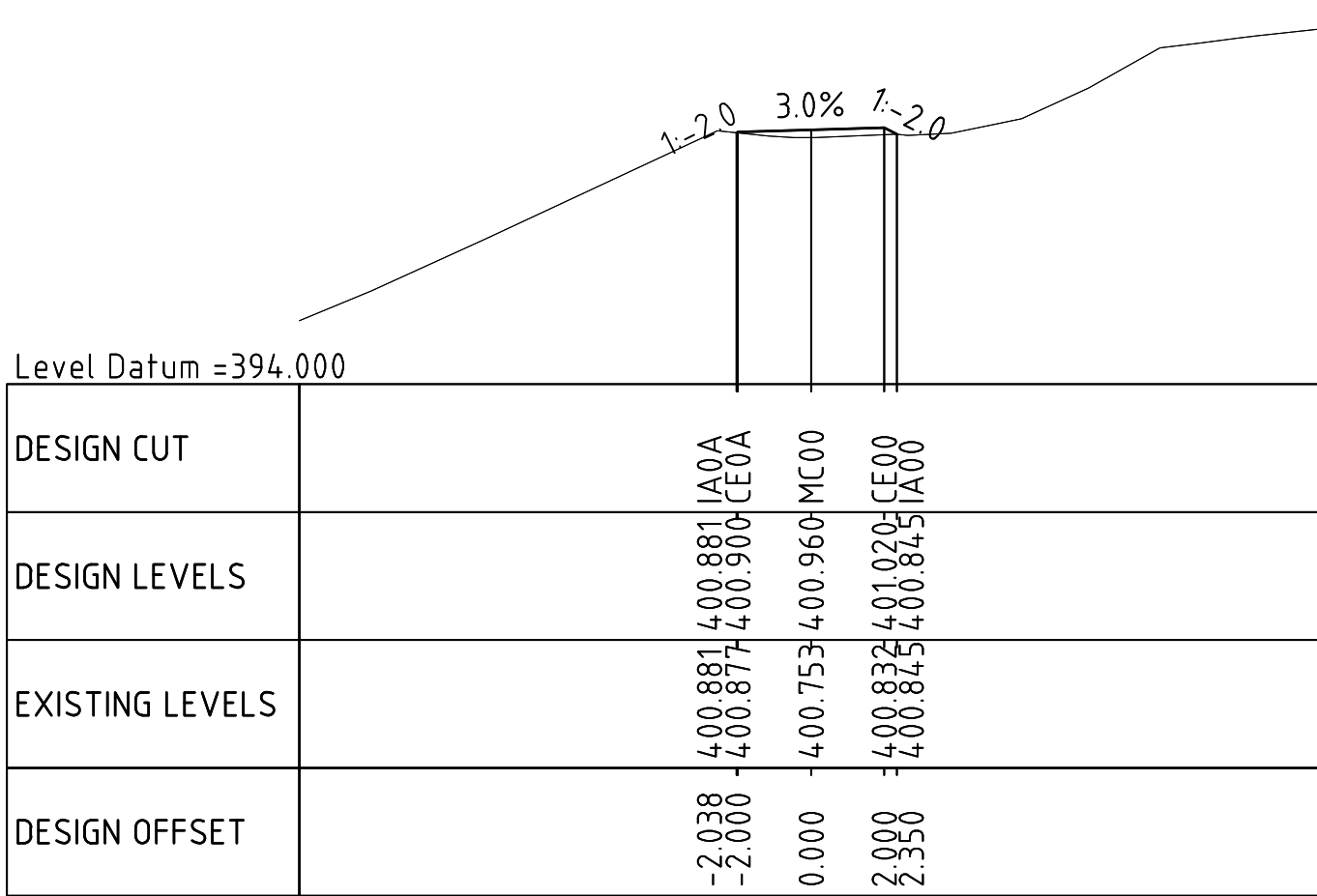
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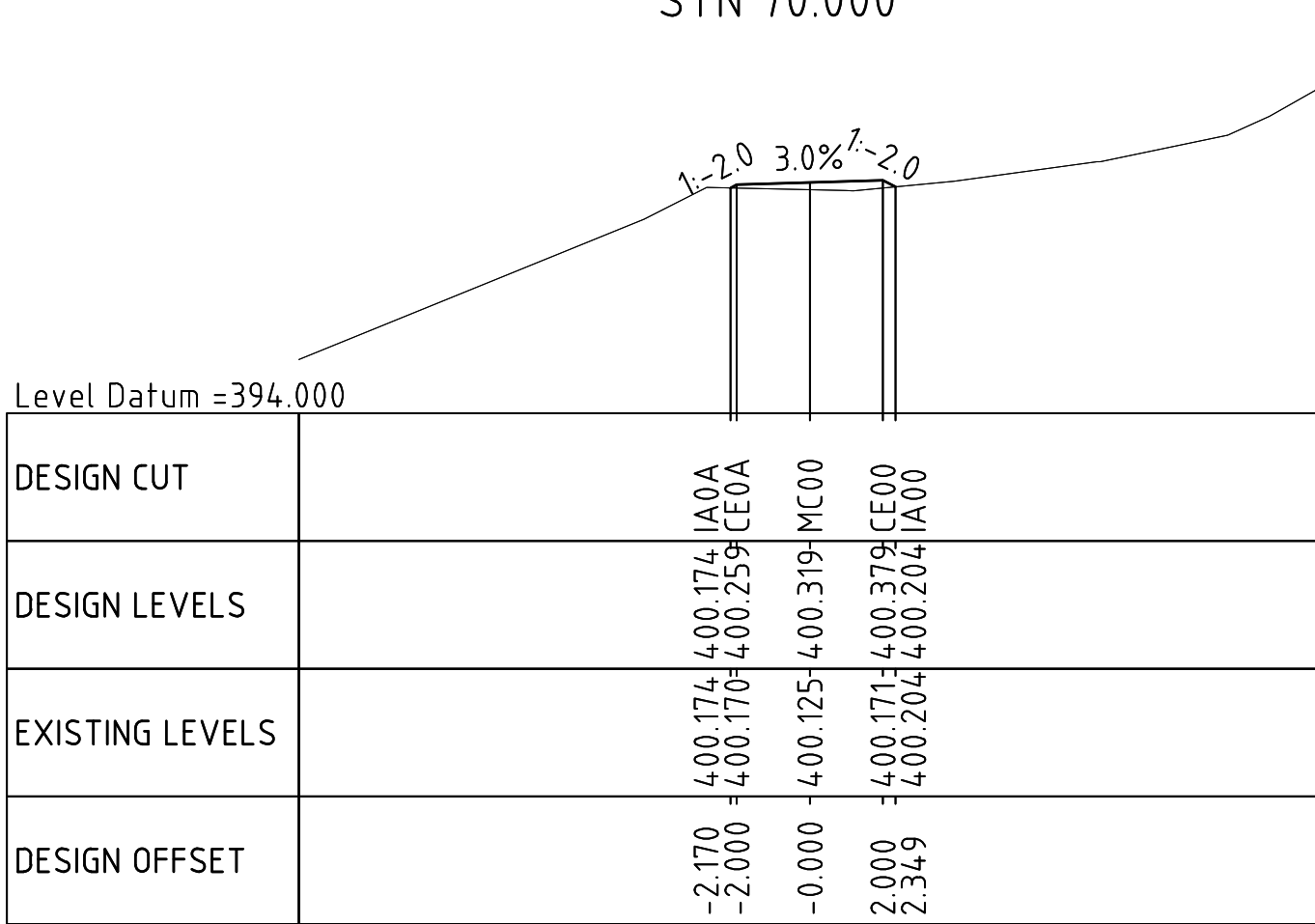
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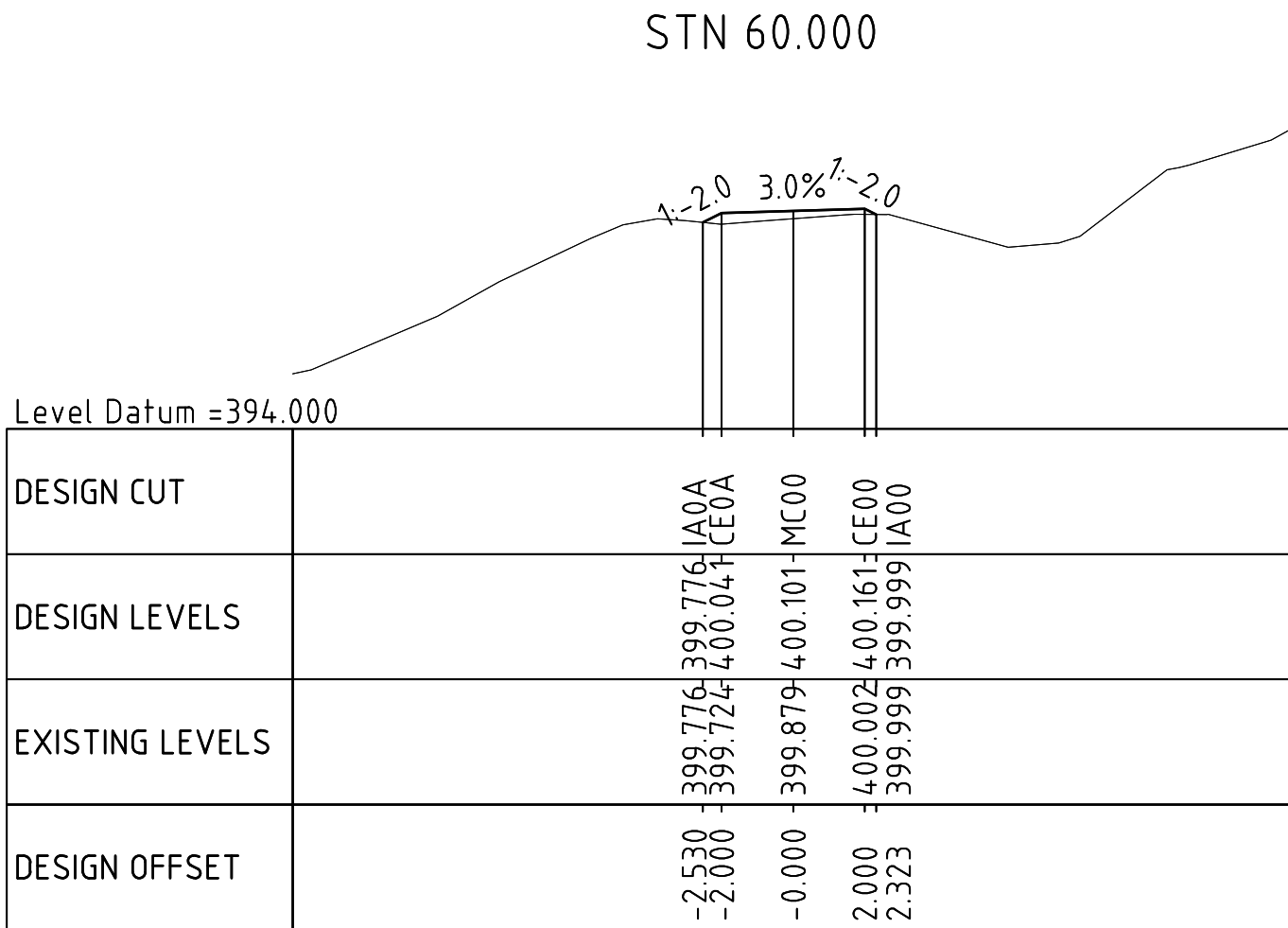
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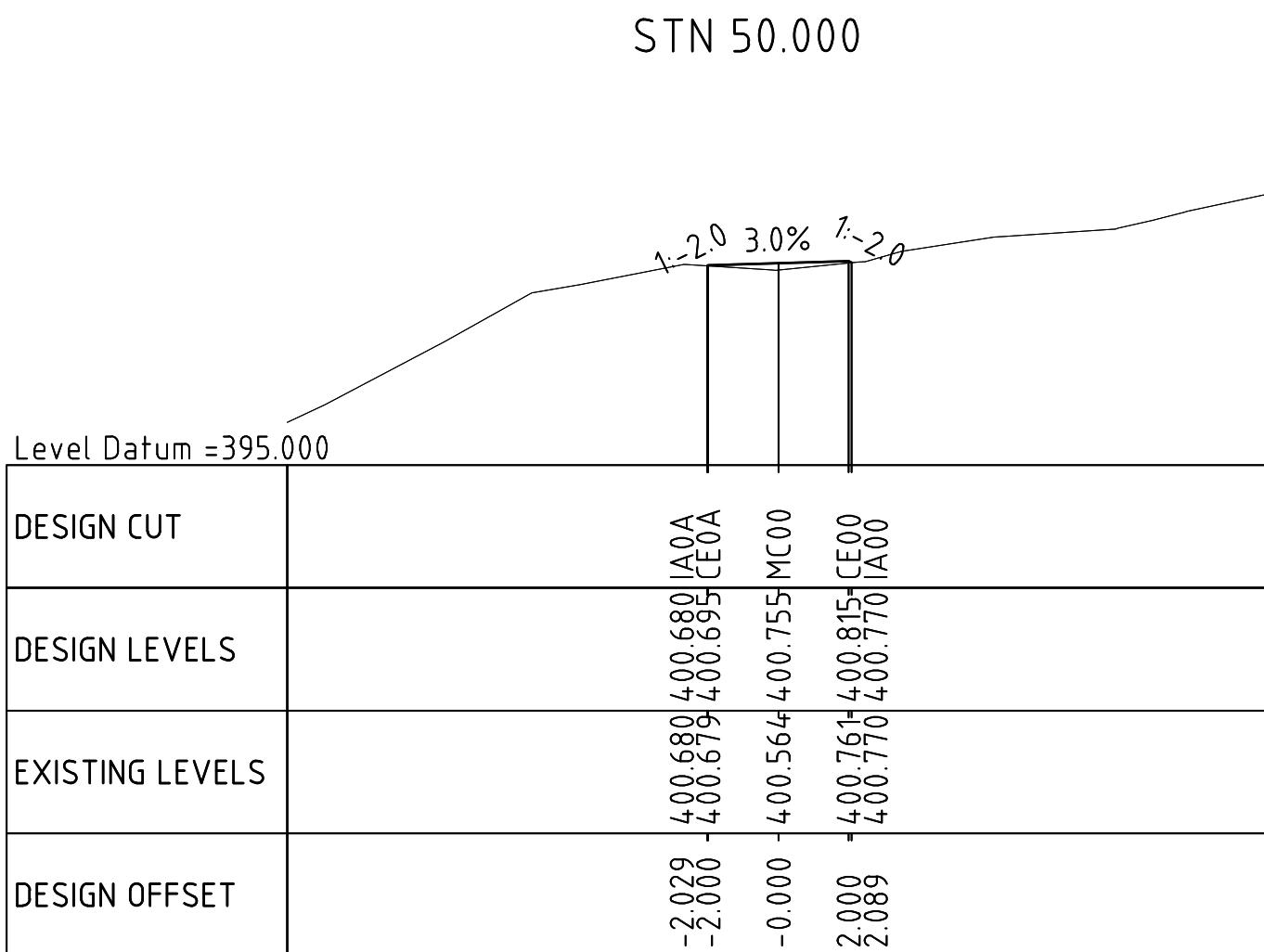
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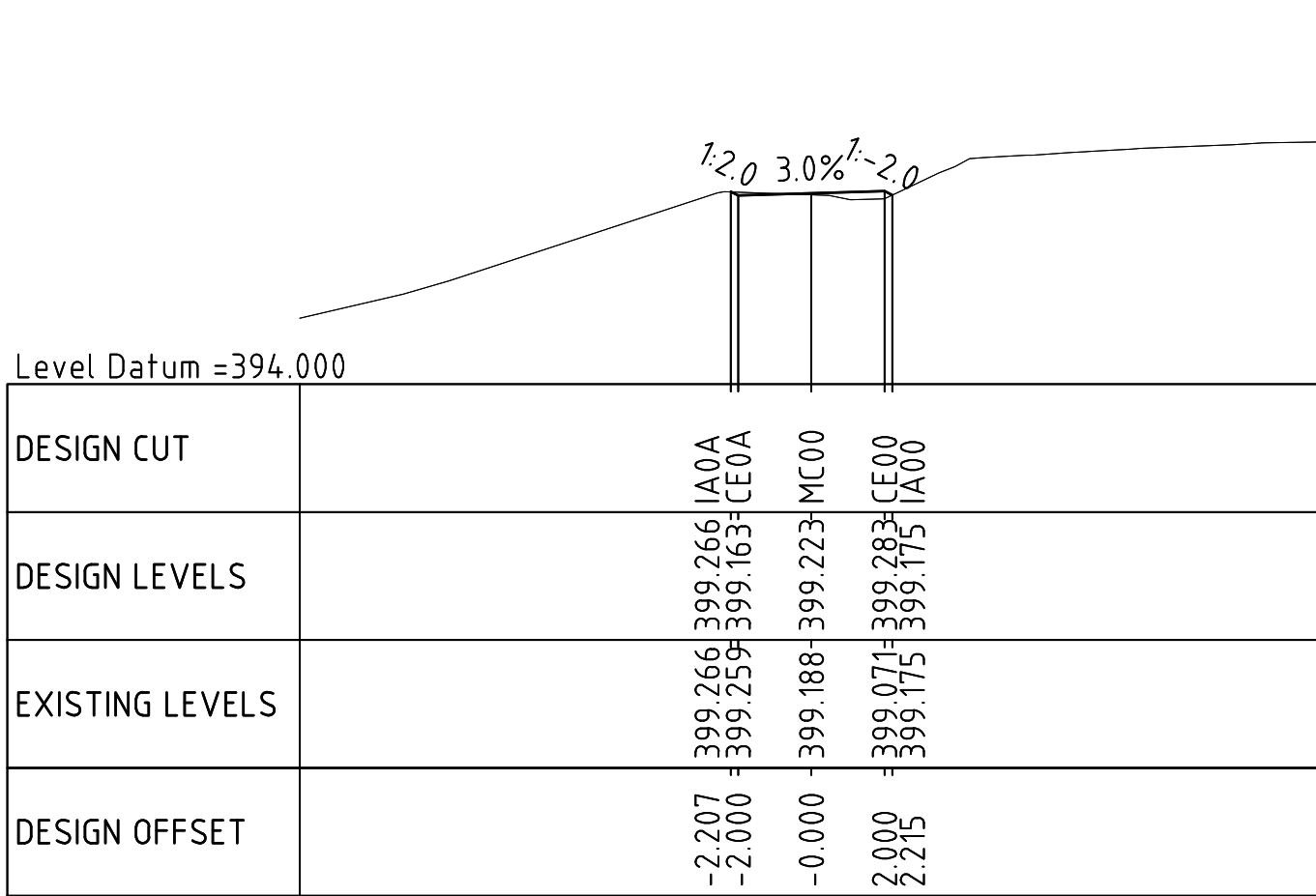
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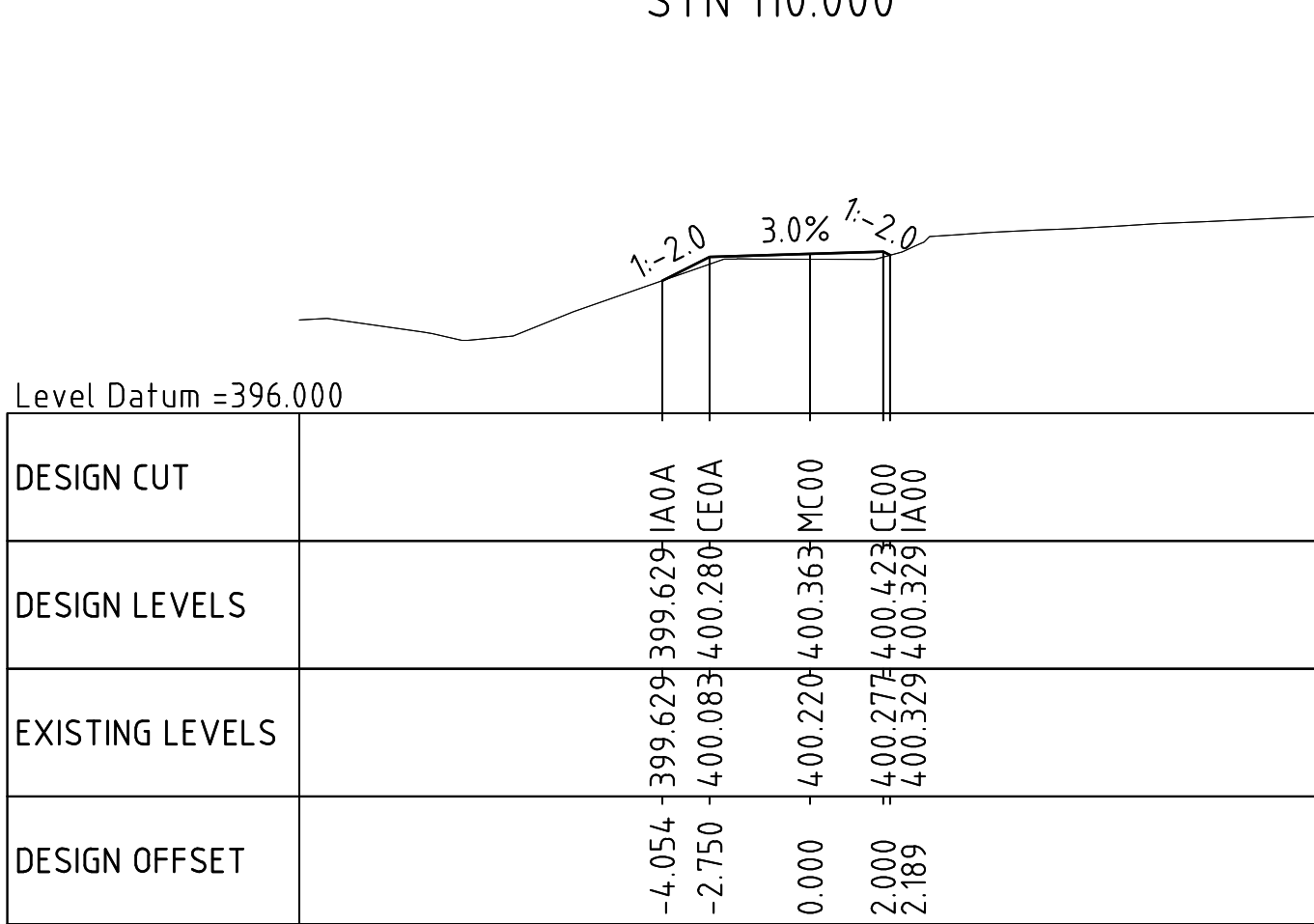
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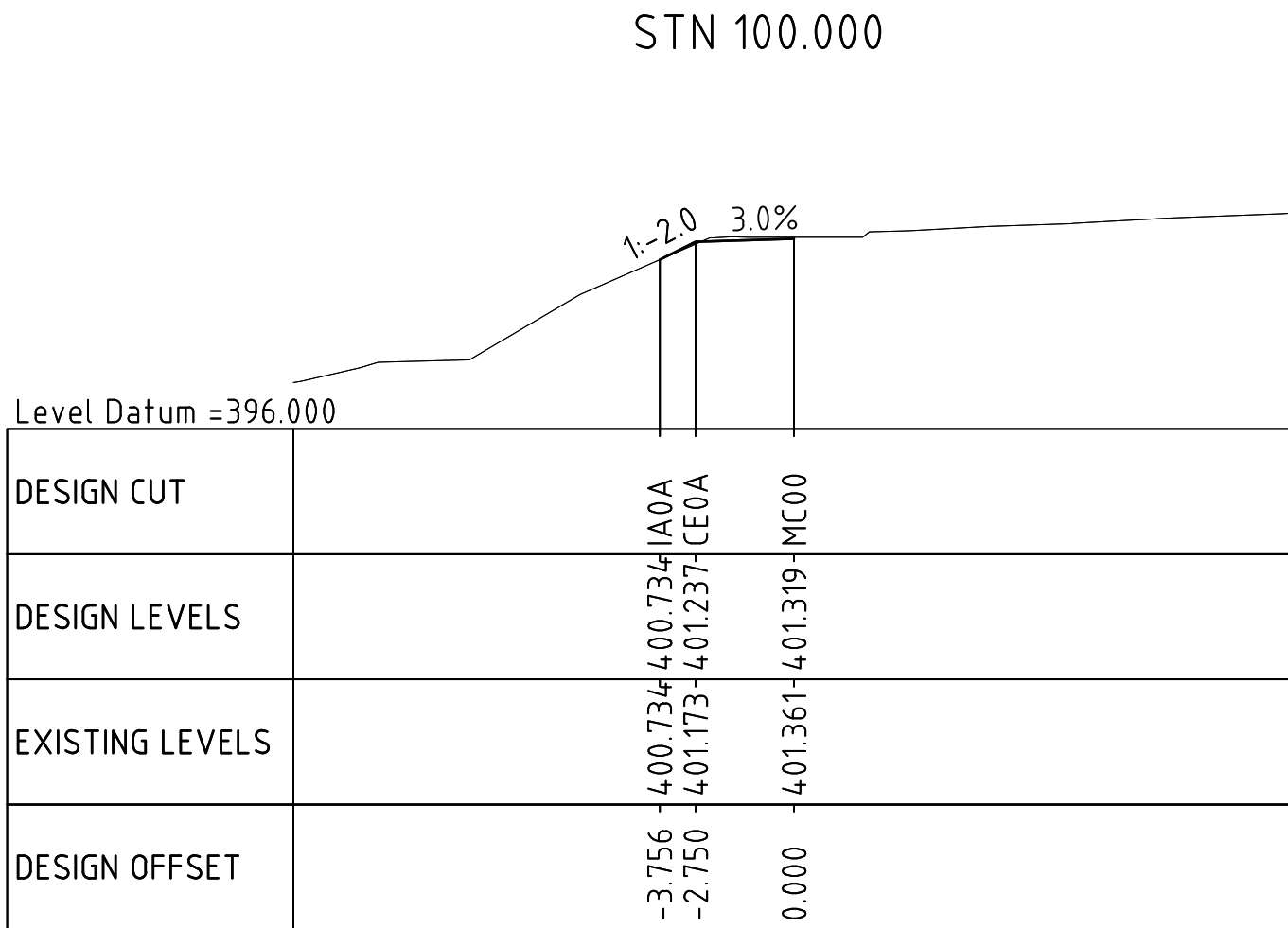
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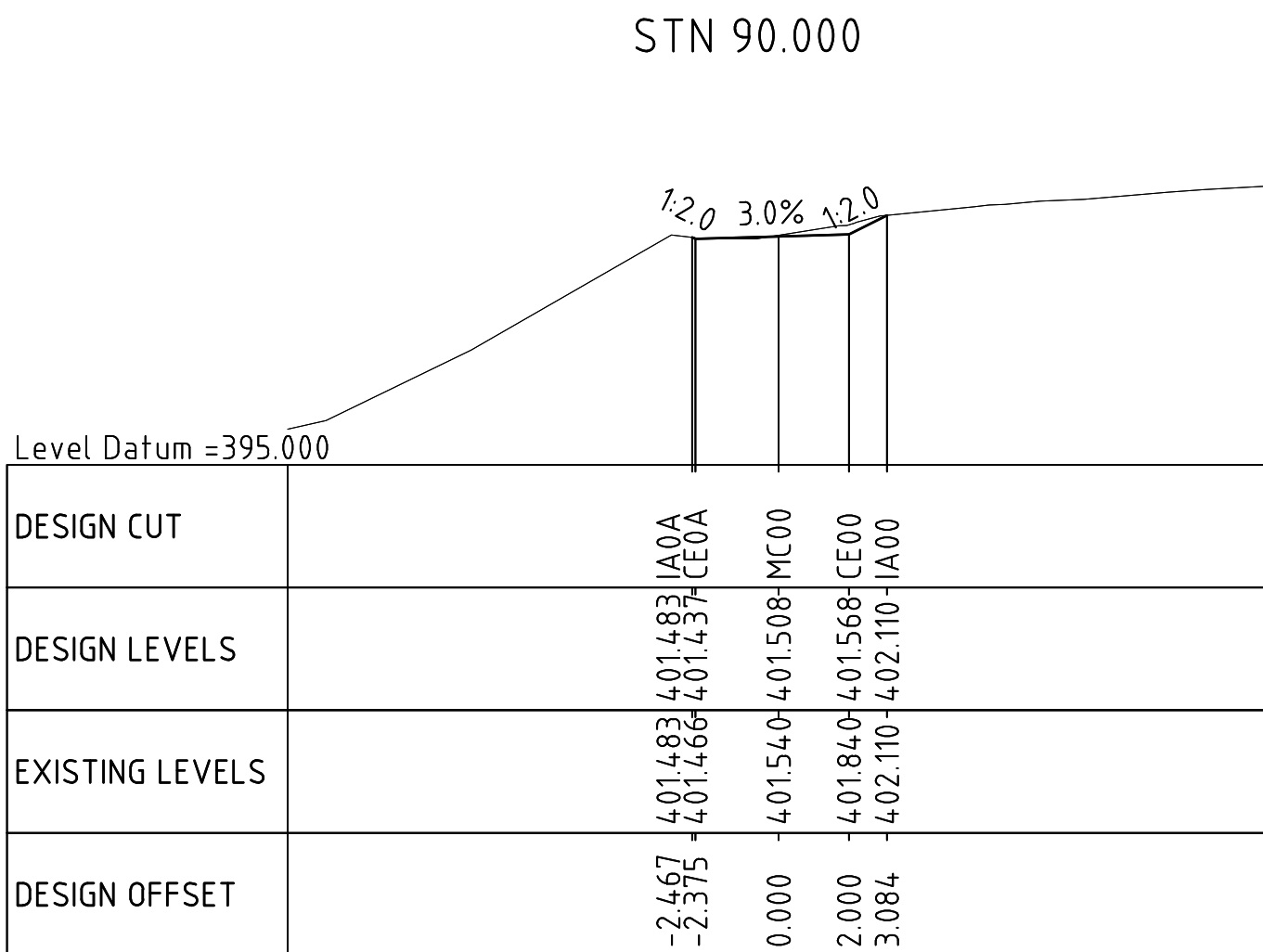
STN 110.000



STN 100.000




STN 90.000



STN 80.000

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

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JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
ACCESS ROAD - CROSS SECTIONS - SHEET 1					
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.....			SHEET No. 10		ISSUE B
DIRECTOR					

Appendix D

Biodiversity assessment

Jounama Creek culvert scour repairs

Biodiversity Assessment

May 2019



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Jounama Creek culvert scour repairs




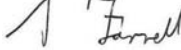

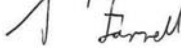
Biodiversity Assessment

May 2019

Prepared by: GHD Pty Ltd

Roads and Maritime Services Publication Number:

Document control

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) proposes to conduct culvert scour repairs on the Snowy Mountains Highway (HW04) over the Jounama Creek/Jounama Pondage, near Talbingo. The proposal involves repairing the concrete apron on the downstream side of the culvert to ensure that future flood events in Jounama Creek do not further undermine the culvert and to eliminate the risk of structural failure of the culverts and road embankments.

Key features of the proposal include:

- Constructing a temporary access track off the Snowy Mountains Highway for a length of about 240 metres on the southern side of Jounama Pondage
- A construction pad for crane access and stockpiling materials on the northern side of Jounama Pondage
- Construction of an access ramp from the northern crane pad and stockpile site for a length of about 50 metres on the northern side of Jounama Pondage
- Removal of existing apron slab and loose material
- Extension of existing wingwalls
- Constructing a new apron slab
- Reinstating road batters
- A site compound and stockpile sites (including existing stockpile sites 4.3 kilometres and 8.6 kilometres north-west of the proposal site along the Snowy Mountains Highway).

Legislative requirements

As the proposal is for the purpose of a road and is being carried out by Roads and Maritime, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). As part of the Review of Environmental Factors (REF) being prepared for the proposal, a biodiversity assessment is required to assess the potential impacts of the proposal on threatened biota listed under the:

- NSW *Biodiversity Conservation Act 2016* (BC Act)
- NSW *Fisheries Management Act 1994* (FM Act)
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EP&A Act includes in Section 1.7 an assessment of significance, which uses five factors to assist in determining if the proposed activity 'is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats.

Methods

A desktop review was conducted to obtain records of threatened and migratory species, populations and ecological communities listed under the BC Act, FM Act and EPBC Act with the potential to occur in the locality. The desktop review included searches of local, state and Commonwealth databases and a review of previous environmental reports prepared in the locality.

Flora and fauna field surveys were conducted in the study area between 5 February to 7 February 2018. Surveys included:

- Flora surveys (in accordance with the Biodiversity Assessment Method)
- Targeted Booroolong Frog surveys
- Nocturnal fauna surveys
- Fauna habitat assessment
- Diurnal bird surveys
- Anabat detection and analysis
- Bat harp trapping
- Opportunistic fauna observations.

Results

Flora surveys in the study area did not detect any threatened flora species or ecological communities.

Fauna surveys identified three listed species, including:

- Gang-gang Cockatoo – Vulnerable, BC Act
- Eastern Bentwing-bat – Vulnerable, BC Act (recorded to a probable call confidence during Anabat detection)
- Booroolong Frog – Endangered, BC Act and EPBC Act.

The Murray Crayfish, listed as vulnerable under the FM Act, is known to occur in Jounama Pondage.

A number of other listed species are also considered likely to occur in the study area and locality.

Potential impacts

The proposal could potentially impact on one bird, one mammal and one amphibian species listed under the BC Act, which are known to occur within the study area and one crustacean listed under the FM Act, which is considered likely to occur in the study area. The amphibian species is also listed under the EPBC Act.

The proposal would remove 0.2 hectares of native vegetation, of which 0.16 hectares is native regrowth shrubland and 0.04 hectares is derived native grassland. The area of vegetation to be removed is low quality habitat which is likely of little importance to the fauna within the study area.

There is no emergent or in-stream vegetation located in the pondage in the vicinity of the proposal site. Potential aquatic impacts of the proposal include water quality impacts, such as sedimentation and a localised increase in pH. The proposal would require the blocking off of individual culvert cells at varying stages of construction to divert water around the immediate work area. This has the potential to increase flows through the open culverts, with flowing water having the highest potential to result in water quality impacts during construction. However, works would preferably be conducted during the low streamflow period when the increased flow rate would not be expected to be significant. The majority of the work would occur during periods when the proposal site would also be dry and is therefore unlikely to impact on aquatic habitat.

Roads and Maritime would implement a number of safeguards and mitigation measures to minimise the impacts of the proposal on native flora and fauna, particularly biota listed under the BC Act, FM Act and EPBC Act. Assessments of significance were completed with reference to Section 1.7 of the EP&A Act and EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1*. The assessments concluded the proposal is unlikely to have a significant impact on any biota listed under the BC Act or FM Act and therefore a species impact statement is not required. The proposal is also unlikely to have a significant impact on any biota listed under the EPBC Act and a referral is therefore not required.

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Glossary of terms

Definitions

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	Where an event or circumstance is a direct consequence of the action (CoA 2012)
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
Indirect impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (CoA 2012)
Life cycle	Is the series or stages of reproduction, growth, development and aging and death of an organism (DEC, 2004).
Likely	Taken to be a real chance or possibility (DEC, 2004).
Locality	The area within a 10 kilometre radius of the proposal site.
Matters of NES	A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact. (OEH 2014).
Mitigation measure	Any measure that decreases the severity of an impact,. For biodiversity this includes facilitating the safe movement of wildlife and/or preventing wildlife mortality.
Movement habitat	Any form of habitat that may be used by fauna species to aid movement through an area. This may include, for example, remnant native vegetation corridors or permanent and ephemeral streams.
Population	<p>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:</p> <ul style="list-style-type: none"> • The <i>local population</i> of a threatened <i>plant</i> 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 <i>local population</i> of <i>resident fauna</i> 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 <i>local population</i> of <i>migratory or nomadic fauna</i> species comprises those individuals that are likely to occur in the study area from time to time.
Proposal area/ Proposal site	The area of land that is directly impacted on by a proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014). In this case the portion of land within which the culvert scour repairs would occur, including the site compound, access tracks and stockpile site.
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014). The study area incorporates the land within a 500 metre radius of the proposal site.
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Viable	The capacity to successfully complete each stage of the life cycle under normal conditions.

Abbreviations

BC Act	<i>Biodiversity Conservation Act 2016 (NSW).</i>
BVT	Biometric Vegetation Type
CEMP	Construction Environmental Management Plan
DP&E	Department of Planning and Environment
DotEE	Department of the Environment and Energy
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth).</i>
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
LGA	Local Government Area
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
TSPD	Threatened Species Profile Database
VIS	Vegetation information system

1 Introduction

1.1 Proposal background

Roads and Maritime Services NSW (Roads and Maritime) proposes to conduct culvert scour repairs on the Snowy Mountains Highway (HW04) over the Jounama Creek/Jounama Pondage to ensure the long term stability of the Snowy Mountains Highway road embankment ('the proposal') (see location in Figure 1-1).

In recent times, the concrete apron on the downstream side of the culvert outlet has been severely undermined and has failed. The proposal is required to restore the downstream apron to ensure that future flood events in Jounama Creek do not further undermine the culvert and eliminate the risk of structural failure of the culverts and embankments.

The proposal is located about 2.3 kilometres north-east of Talbingo in Roads and Maritime's South West Region. The proposal site is located in the Snowy Valleys Council local government area (LGA). The culverts are located at the western end of the rock fill road embankment.

Jounama Creek flows from east to west through the study area and joins Jounama Pondage at the proposal site. The proposal site is located within Roads and Maritime owned land. Kosciuszko National Park is located to the east of the Snowy Mountains Highway, with a small parcel also located to the west of the highway, adjacent to the proposal site on the northern side of Jounama Pondage.

1.2 The proposal

Key features of the proposal include (see Figure 1-2):

- Constructing a temporary access track off the Snowy Mountains Highway for a length of about 240 metres on the southern side of Jounama Pondage
- A construction pad for crane access and stockpiling materials on the northern side of Jounama Pondage
- Construction of an access ramp from the northern crane pad and stockpile site for a length of about 50 metres on the northern side of Jounama Pondage
- Storage of plant and equipment on properties adjoining Murray Jackson Drive
- Construction of access foot ramps to upstream and downstream culvert faces
- Removal of existing apron slab and loose material
- Extension of existing wingwalls
- Construction of a new apron slab and associated energy dissipaters
- Reinstating road batters
- Site compound and stockpile sites (including existing stockpile sites 4.3 kilometres and 8.6 kilometres north-west of the proposal site along the Snowy Mountains Highway).

Utility relocation may be required for a Telstra cable servicing a private property to the north of the proposal site. A section of this Telstra cable is located underground near the proposed access track, which would need to be located to avoid damage during construction.

The proposed site compound and stockpile sites are described in section 1.2.3.

The Snowy Mountains Highway would remain operational during the entire construction period. However, there may be some short term closures for heavy vehicle access.

1.2.1 Construction activities

Construction activities are expected to start in early 2019. The expected construction duration is between three to four months. However the construction period may extend over about 18 months due to fluctuating water levels in Jounama Pondage and adverse weather conditions such as snow, high rainfall and flooding in Jounama Creek. Timeframes given below assume

that works would occur continuously without impact to the program from water pondage levels, however, in reality this is highly unlikely to occur. Construction would occur in three stages (see below) and it is primarily Stage B activities that would be impacted by fluctuating pondage water levels. The three stages are:

- Stage A – pre-construction activities, including site preparation and construction of access roads. This involves bulk earthworks, drainage, access road / access ramp construction, crane pad construction, stockpile / work area and compound area construction. The expected duration for this stage of work is about two to four weeks
- Stage B – includes works on the Jounama Creek culvert structure. This work has been separated into seven stages, labelled Stage 1 to 7. Stage B is expected to take two months
- Stage C – includes post-construction activities, such as demobilisation of site compound, removal of any temporary fences, removal of the submerged portion of the access road, and rehabilitation of disturbed areas. This stage is expected to take about two to four weeks.

Stage A - Pre-construction activities

Pre-construction activities would include:

- Establishing the site (fencing, site compound, work area and stockpile sites)
- Establishing plant and vehicle parking areas on properties off Murray Jackson Drive
- Installing environmental control measures and erosion and sediment controls
- Access road, access ramp and hardstand construction activities as detailed in the section below.
- Hardstand areas for stockpile / work areas / compound areas and the crane pad
- Setting up temporary stockpile sites
- Establishing the site compound including site office and toilet facilities
- Establishing a turning area for vehicles, plant and equipment (this would occur within the northern stockpile / work area and either at Talbingo or the National Parks Blowering Works Depot for larger vehicles, if necessary)
- Setting up temporary traffic controls and adjustments to the existing road guard fence to allow for site access.

Southern access road, northern access ramp and hardstand construction activities

Access road, access ramp, crane pad and hardstand construction activities would include:

- Removing trees and vegetation clearing (0.32 hectares of native and introduced vegetation)
- Access road, access ramp, crane pad and hardstand work, including:
 - Stripping, stockpiling and management of topsoil, for site rehabilitation upon completion
 - Excavating material and placing fill for new sections of road, ramp, pad or hardstand
 - Constructing access road / ramp / pad / hardstand including placing and compacting gravel
 - Adjusting safety barriers.
- Drainage work, including:
 - Installing one new culvert along the edge of the Snowy Mountains Highway to allow access to the northern work area and one new culvert in the original Jounama Creek channel (within Jounama Pondage) to allow construction plant to cross the channel. The culvert in the original Jounama Creek channel would be temporary
 - Excavating material around culvert locations, placing bedding material, installing pre-cast reinforced concrete pipe culverts, placing and compacting gravel backfill material and installing concrete headwalls
 - Placement of rock in the batter drain where the northern access ramp traverses (next to the crane pad), to allow batter drain water to percolate through the rock while providing access for the excavator to cross the drain to the ramp.

Suitable excavated material would be re-used as fill. Unsuitable materials that cannot be re-used would be transported to licensed facilities for disposal.

Stage B – Culvert repair activities

Culvert repair activities have been separated into seven stages, as follows:

- Stage 1 – Construct southern wingwall extension, demolish remaining apron slab section, remove all loose rock and alluvial material within two metres of the southern wingwall, cast no-fines concrete in this area to reinstate support to the southern wing wall, remove any remaining loose material within the new apron footprint
- Stage 2 – Construct no-fines concrete working pad in three stages as per drawings (see Appendix C)
- Stage 3 – Construct northern wingwall extension, place mass concrete precast blocks on top of no-fines concrete
- Stage 4 – Southern section of apron slab – Install reinforcement and pour new apron slab
- Stage 5 – Central section of apron slab – Install reinforcement and pour new apron slab
- Stage 6 – Northern section of apron slab – Install reinforcement and pour new apron slab
- Stage 7 – Reinstate batter fill with well graded rock material over one layer of geotextile.

Stage C – Post-construction activities

Post-construction activities would include:

- Site clean-up and rehabilitation, including:
 - Removing and revegetating southern compound area and Murray Jackson Drive plant parking areas
 - Removing the submerged section of southern access road in the bedrock channel area
 - Removing safety access foot ramps and handrails
 - Removing temporary erosion and sedimentation controls
 - Removing temporary traffic controls
 - Removal of the temporary concrete culvert structure across the original Jounama Creek channel within Jounama Pondage
 - Removal of a portion of the temporary access road. It is intended to retain the northern access ramp, the northern stockpile area and the southern access road above the pondage high water mark
 - Revegetating disturbed areas
 - Reinstatement of all other disturbed areas.

1.2.2 Earthworks

Earthworks would be required for the construction of the access track and installation of the crane pad, stockpile site and access ramp on the northern side of the culvert. This would involve removing about 150 millimetres of topsoil from the access track route, over an area of about 0.16 hectares. An additional 0.16 hectares of earthworks would also occur for the construction of the northern crane pad, stockpile site and access ramp, although these areas have minimal topsoil present. The crane pad, stockpile site, access ramp and access track are shown in Figure 1-2.

Rock and gravel material required for backfill, hardstand areas and access would be imported for the proposal.

All excavated topsoil would be stockpiled and re-used to rehabilitate the compound areas following completion of construction.

1.2.3 Ancillary facilities

Site compounds

A site compound would be established in the road reserve on the northern side of Murray Jackson Drive at its intersection with the Snowy Mountains Highway, south of the proposal site (see Figure 1-2).

The site compound would be used to store plant and equipment, to provide a site office, limited parking and amenities for construction staff. Chemicals and fuels for construction would be stored in appropriate storage areas within the site compound.

A layer of gravel would be put down over a small area of the site compound and the site office installed on stilts to minimise disturbance to the existing native grassland present, which would be slashed rather than removed. This would allow the site to naturally regrow to its existing condition following decommissioning of the site compound.

Stockpile sites

Four potential stockpile sites are proposed for the proposal, including two existing stockpile sites located along the Snowy Mountains Highway, north-west of the proposal site (see Figure 1-1). These are located about 4.3 kilometres and 8.6 kilometres north-west of the proposal site, near the Yolde camping ground and the Kosciuszko National Parks Blowering Works Depot, respectively. The existing stockpile site located near the Kosciuszko National Parks Blowering Works Depot is known as the Bowlers Creek stockpile site and is owned by Roads and Maritime.

A stockpile site would also be located on the northern side of the proposal site (Figure 1-2) and within the existing Snowy Valleys Council depot in Tumut. The proposed stockpile site on the northern side of the proposal site would also include a 10 metre by 10 metre crane pad. Following completion of the proposal this site would be maintained as a permanent stockpile site with barrier rail and locked access. The site would provide a permanent access area for culvert inspection and maintenance.

Stockpiles would primarily be used for storing construction materials, however, it is likely that most materials would be delivered to the site and installed directly without requiring stockpiling.

The stockpile sites would be subject to the criteria set out in Roads and Maritime's 'Stockpile Site Management Guideline' (Roads and Maritime 2015c), 'QA Specification R44 – Earthworks', QA Specification G36 and QA Specification G38. Stockpile sites would be managed in line with the following guidelines where practicable:

- Located in areas not prone to flash flooding and more than 50 metres from a watercourse
- Have ready access to the road network or direct access to the construction corridor
- Located in previously disturbed areas that do not require the clearing of native woodland vegetation
- Located in areas of low ecological and heritage conservation significance
- Located outside the drip line of trees
- Located on relatively level land.

Drainage

The proposal site would require temporary drainage to be installed in the original Jounama Creek channel (within Jounama Pondage) to the south of the culvert, to allow construction plant to cross the channel. This would involve installation of a concrete pipe culvert with concrete headwall and would be removed following completion of the proposal.

It would be necessary to block off culvert cells during construction to divert water around the immediate work area. Not all culverts would be blocked off at the same time. Up to three culverts would be blocked off at a time to allow flow through the remaining culvert(s). This would impact on flow rates through the open culverts, however as the proposal site is located on bedrock it is unlikely to create additional sediment due to concentration of water flows. All culvert cells would be reopened when creek streamflow is above 2 cubic metres per second.

1.2.4 Construction environmental management plan

A construction environmental management plan (CEMP) would be prepared to guide construction activities ensuring works are carried out to Roads and Maritime specifications and to incorporate all safeguards described in this biodiversity assessment.

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Roads and Maritime's duties under section 5.5 of the *Environmental Planning and Assessment Act 1979* (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 section 112 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the Jounama Creek culvert scour repairs, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The following legislation and State Environmental Planning Policies have been consulted and are relevant to the proposal.

1.3.1 NSW Environmental Planning and Assessment Act 1979

The proposal can be assessed under Part 5 of the EP&A Act. Roads and Maritime is the determining authority.

Under section 5.5 of the EP&A Act, Roads and Maritime must consider the effect of an activity on:

- Any conservation agreement entered into under the *National Parks and Wildlife Act 1974* (NP&W Act)
- Any plan of management adopted under the NP&W Act for the conservation area to which the agreement relates
- Any joint management agreement entered into under the *Biodiversity Conservation Act 2016* (BC Act)
- Any biodiversity Stewardship Agreement or Conservation Agreement entered into under the BC Act
- Any wilderness area (within the meaning of the *Wilderness Act 1987*) in the locality
- Areas of Outstanding Biodiversity Value
- Threatened species, populations and ecological communities, and their habitats and whether there is likely to be a significant effect
- Any other protected fauna or protected native plants within the meaning of the NP&W Act.

Section 5AA of the EP&A Act require that the significance of the impact on threatened species, populations and endangered ecological communities listed under the BC Act or *Fisheries Management Act 1994* (FM Act) is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Secretary's Environmental Assessment Requirements, or a biodiversity development assessment report (BDAR) in accordance with the Biodiversity Offsets Scheme and Biodiversity Assessment Method.

1.3.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* came into effect on 25 August 2017, which replaced the *Threatened Species Conservation Act 1995* (TSC Act) and the animal and plant provisions of the *National Parks and Wildlife Act 1974*. The aim of the Act is to conserve biodiversity and deliver ecologically sustainable development through a market-based approach particularly for higher risk projects. Ecological outcomes for lower risk projects would be achieved through self-assessment of risk. The market based approach would have a regional and state focus rather than a local focus on biodiversity.

Section 7.3 of the BC Act includes an assessment of significance (5 part test), which uses five factors to assist in determining if the proposed development or activity 'is likely to significantly affect threatened species or ecological communities, or their habitats'. These five factors must be taken into account by a consent or determining authority when considering a development proposal or development application. This enables a decision to be made as to whether there

is likely to be a significant effect on the species or ecological community, and hence if a species impact statement is required.

1.3.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations including conserving fish stocks and fish habitat and promoting ecologically sustainable development.

The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the proposal. If a significant impact on a threatened species, population or ecological community is likely, a SIS must be completed and consultation with the NSW Department of Primary Industries (Fisheries and Aquaculture) (referred to as Fisheries NSW) is required.

Key Fish Habitats

One of the objectives of the FM Act is to conserve key fish habitats. These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

In freshwater systems, most permanent and semi-permanent rivers, creeks, lakes, lagoons, billabongs, weir impoundments and impoundments up to the top of the bank are considered key fish habitats. Small headwater creeks and gullies (known as first and second order streams) that flow for a short period after rain and farm dams on such systems are excluded, as are artificial waterbodies except for those that support populations of threatened fish or invertebrates.

NSW Department of Primary Industries maps showing the distribution of key fish habitats within the Tumut local government area (now the Snowy Valleys LGA combined with the Tumbarumba LGA) indicate that Jounama Creek and Jounama Pondage in the study area are considered key fish habitat.

Approvals

The FM Act requires a permit for certain work including dredging, reclamation or work that blocks fish passage.

Dredging is defined under the FM Act as any work that involves excavating water land, or any work that involves the removal of material from water land and includes the removal of woody debris, snags, gravel beds, cobbles, rocks, boulders, rock bars or aquatic vegetation from water land.

Reclamation refers to using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or draining water from water land for the purpose of its reclamation.

The proposal would involve dredging and reclamation work. Public authorities are exempt from obtaining a permit for dredging or reclamation work under Part 7 of the FM Act (refer Section 199). In accordance with Section 199 of the FM Act, notification would be given to the Minister and any matters raised by the Minister would be considered within 28 days after the giving of the notice.

The proposal is unlikely to result in any obstruction to fish passage during the culvert scour repairs at Jounama Creek to any greater degree than that which is already present. A permit is therefore not required under Section 219 of the FM Act to block fish passage. See consultation from Fisheries NSW in Appendix E.

1.3.4 Biosecurity Act 2015

The *Biosecurity Act 2015* reforms the management of pests, diseases, weeds and contaminants in NSW. For local government, the Biosecurity Act repealed the Noxious Weeds Act 1993 which established local councils (or in some areas, county councils) as Local Control Authorities (LCAs).

The *Biosecurity Act 2015* provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

1.3.5 Water Management Act 2000

The *Water Management Act 2000* controls the carrying out of activities in or near water sources in NSW, the extraction and use of water and the construction of works such as dams and weirs. 'Water sources' are defined as a river, lake, estuary, or a place where water occurs naturally on or below the surface of the ground or NSW coastal waters.

The proposal is exempt from the requirement to obtain a 'controlled activity' approval under section 38 of the *Water Management (General) Regulation 2011* for work on waterfront land as it is being conducted by a public authority.

Under clause 61 of the *Water Management Act 2000*, a person may apply to the Minister for Water for an access licence (section 56) if the application is for a specific purpose access licence and a management plan provides that an application for the licence may be made. Under clause 18 of the *Water Management (General) Regulation 2011*, Roads and Maritime is exempt from obtaining an access licence for road construction and road maintenance, including dust suppression, according to Schedule 5 Part 1.

Under section 91B of the *Water Management Act 2000*, a water supply work approval authorises its holder to construct and use a specified water supply work at a specified location (eg for pumping water from a river). No extraction of water from Jounama Pondage is required for the proposal, a water supply work approval would therefore not be required.

1.3.6 State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*). SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat
- Encouraging the identification of areas of core Koala habitat
- Encouraging the inclusion of areas of core Koala habitat in environment protection zones.

While SEPP 44 does not apply under Part 5 of the EP&A Act, this biodiversity assessment considers the intent of the SEPP.

SEPP 44 applies to each LGA listed in Schedule 1, which includes the Tumut LGA. The Tumut LGA has amalgamated with the Tumbarumba LGA to form the Snowy Valleys LGA. The proposal site occurs within the Snowy Valleys LGA. Schedule 2 of SEPP 44 lists preferred feed tree species of the Koala.

Ribbon Gum (*Eucalyptus viminalis*) trees occur in the study area, along Jounama Creek and are a preferred feed tree species. Therefore potential Koala habitat is present. However, the results of field surveys and habitat assessment for the Koala indicate that the study area does not contain habitat for the species (see likelihood of occurrence assessment in Appendix B). The first record of a Koala in the locality and within Kosciuszko National Park in over 70 years was in 2016, along the shores of Blowering Dam, with no subsequent records.

The study area is therefore unlikely to contain core Koala habitat, defined by SEPP 44 as ‘*an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*’

1.3.7 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a mechanism for assessing the environmental impact of activities and developments, where matters of national environmental significance may be affected by the proposed activities. Matters of national environmental significance relevant to this biodiversity assessment include:

- Migratory species protected under international agreements
- Ramsar wetlands of international importance
- Listed threatened species and communities.

In September 2015, a ‘strategic assessment’ approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Part 5 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Roads and Maritime projects assessed via an REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the “avoid, minimise, mitigate and offset” hierarchy
- Do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact.

Roads and Maritime must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the ‘*Matters of National Environmental Significance: Significant impact guidelines 1.1: Environment Protection and Biodiversity Conservation Act 1999*’ (DotE 2013).

1.3.8 Tumut Local Environment Plan 2012

The proposal site is located within the Snowy Valleys LGA, which was created with the amalgamation of the Tumut and Tumbarumba Shire Councils. Currently, the *Tumut Local Environmental Plan 2012* (Tumut LEP) is still relevant to the proposal. Under the Tumut LEP, the proposal site is located in the SP2 – Infrastructure land use zone with the Snowy Mountains Highway a ‘Classified Road’.

The provisions of the Tumut LEP do not apply to the proposal due to the application of the ISEPP. Nevertheless, consideration is given to the provisions of the LEP.

1.4 Purpose of this report

GHD has been engaged by Roads and Maritime to undertake a biodiversity assessment for the Jounama Creek culvert scour repairs on the Snowy Mountains Highway to assess the potential ecological impacts of the proposal. This biodiversity assessment has been prepared in accordance with the Roads and Maritime 'Biodiversity Assessment Practice Note – EIA – N06 – Resource 4. Biodiversity assessment template for REFs' (2016).

The primary objectives of the biodiversity assessment are to:

- Identify potential biodiversity constraints and opportunities, including known or likely presence of species, populations and ecological communities and their habitats listed under the NSW BC Act, NSW FM Act and Commonwealth EPBC Act
- Identify the potential for any matters of National Environmental Significance (NES) listed under the EPBC Act
- Identify the potential impacts of the proposal on threatened biota and their habitats and advise on potential development design options and specific mitigation/management actions to avoid or minimise impacts on biodiversity values
- Identify, describe and map ecological communities present within the proposal site and study area
- Assess the significance of impacts on threatened biota and matters of NES and identify the likely requirement or otherwise for further approvals under the EP&A Act and/or the EPBC Act
- Recommend safeguards and environmental management measures to avoid, minimise or offset potential impacts on threatened biota and biodiversity values
- Consider the principles of ecologically sustainable development (ESD) in relation to the proposals' potential impact on ecology.

1.5 Scope and limitations

This report has been prepared by GHD for Roads and Maritime Services and may only be used and relied on by Roads and Maritime Services for the purpose agreed between GHD and Roads and Maritime Services as set out in section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than Roads and Maritime Services arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report. The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.6 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.6 Assumptions

The services undertaken by GHD in connection with preparing this biodiversity assessment:

- Were limited to those specifically detailed in section 1.4 of this report
- Did not include preparation of a species impact statement or Commonwealth referral
- Are based on the footprint presented in this report.

1.7 Proposal site and existing environment

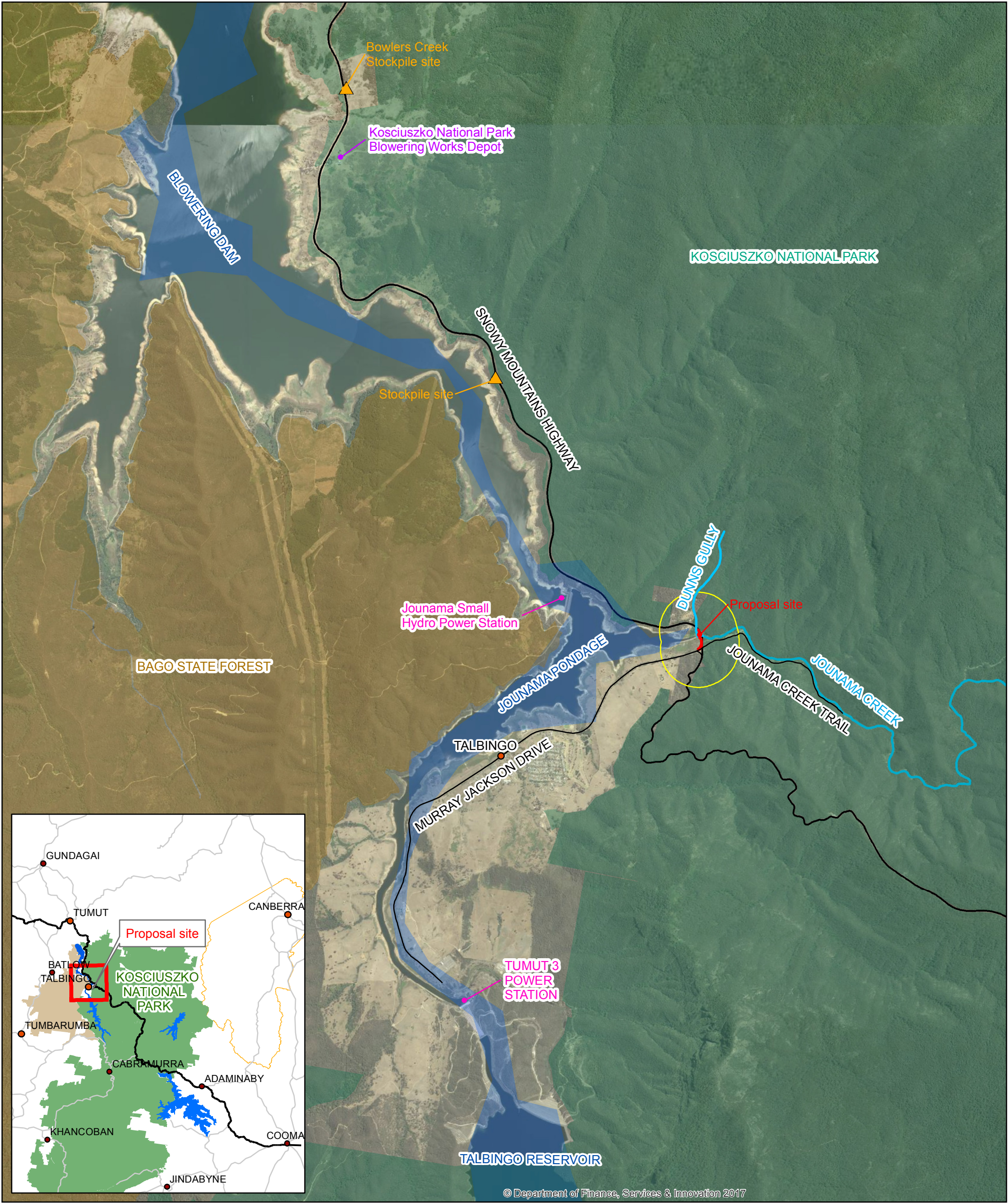
The proposal site is located along the Snowy Mountains Highway, about 2.3 kilometres north-east of Talbingo. The proposal site has a total area of about 0.41 hectares and is located within the Snowy Valleys (Tumut) LGA.

The study area includes the proposal site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. For the purpose of this report the study area is defined as the area within 500 metres of the proposal site.

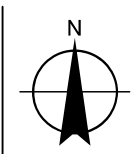
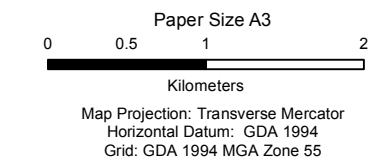
Jounama Creek, a permanent watercourse, flows from east to west through the study area and drains into Jounama Pondage at the proposal site. Dunns Gully, an ephemeral watercourse, flows north to south and drains into Jounama Pondage to the west of the proposal site. Jounama Creek and Dunns Gully are the only named watercourses in the study area (see Figure 1-2).

Kosciuszko National Park is located to the east of the Snowy Mountains Highway, with a small parcel also located to the west of the highway, next to the proposal site on the northern side of Jounama Pondage. The terrain of the study area is hilly to undulating.

The locality is defined as the area within a 10 kilometres radius of the proposal site.



- LEGEND
- Stockpile site
 - Kosciuszko National Park
 - Road
 - Bago State Forest
 - Waterway
 - Waterbody
 - Proposal site
 - Study area



Roads and Maritime Services
Jounama Creek culvert scour repairs biodiversity assessment

Job Number 23-1573100
Revision A
Date 28 Sep 2018

Location of the proposal

Figure 1.1



LEGEND

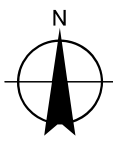
- ★ Jounama Creek camping ground
- ▲ Residence
- Talbingo walking track
- Road
- Waterway
- ▭ Culvert/batter work area
- ▭ Crane pad
- ▭ Compound/stockpile site
- ▭ Access ramp
- ▭ Southern access track
- ▭ Study area
- ▭ Kosciuszko National Park
- ▭ Waterbody

Paper Size A3

0 40 80 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Roads and Maritime Services
Jounama Creek culvert scour repairs biodiversity assessment

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Date	28 Sep 2018

The proposal

Figure 1.2

2 Methods

2.1 Personnel

Four key people have been involved in preparing this report.

Table 2.1: Key personnel and their role in writing the report

Name	Title	Qualifications	Role
Leigh Maloney	Senior Ecologist	BAppSc (EnvSc) (Hons)	Senior ecologist and technical review
Craig Grabham	Senior Ecologist	BAppSc (Parks, Rec and Heritage) (Hons)	Anabat analysis
Melissa Cotterill	Ecologist	BSc (Biology)	GIS mapping and report drafting
Alex Williams	Graduate ecologist	BEnvSc&Mgt	Report drafting and fieldwork assistance

2.2 Background research

2.2.1 Landscape analysis

A brief landscape analysis was conducted to gauge the landscape value of the vegetation in the study area. The landscape assessment has taken into account the spatial configuration of vegetation, vegetation cover, connectivity and adjacent native vegetation.

Vegetation within a two kilometre radius of the proposal site was viewed using satellite imagery. This analysis is strictly limited to an analysis of the overstorey vegetation. The class and quality of overstorey were not comprehensively assessed for vegetation in the surrounding landscape.

2.2.2 Database review

A search of relevant databases was conducted to obtain records of threatened and migratory species, populations and ecological communities within the region. The search included all species, populations and ecological communities listed under the NSW BC Act, NSW FM Act and Commonwealth EPBC Act with the potential to occur in the locality. The assessment included a review of:

- BioNet Atlas – threatened species web application, species sightings. Licensed data for Snowy Valleys local government area. Search of all terrestrial threatened flora and fauna species (within a 10 kilometre radius of the proposal site) (searched January 2018) (OEH 2018a)
- BioNet Atlas – threatened species web application, threatened biodiversity profiles (2018b) NSW, online profiles
- BioNet Atlas – vegetation classification for plant community types in the study area
- DotEE (2018a) EPBC Act Protected Matters Search Tool – for a 10 kilometre radius around the proposal site (searched January 2018)
- DotEE (2018b) Species profile and threats database, online profiles
- NSW Department of Primary Industries (DPI) priority weed declarations – Riverina region (DPI 2018) (searched January 2018)

2.2.3 Previous reports

Previous reports prepared for Roads and Maritime for the Jounama Creek culvert upgrade project were reviewed for background information, including:

- 'Jounama Creek culvert repair: Concept design report' (GHD 2017)
- 'Snowy Mountains Highway (HW04) constraints report: Biodiversity assessment' (Umwelt 2017).

2.3 Habitat assessment

Fauna surveys comprised habitat assessment for all fauna groups and observations of fauna signs. Fauna habitat resources were assessed to identify areas of potential habitat within the study area. Specific resources such as shelter, basking, roosting, nesting and foraging sites for birds, bats, arboreal mammals, amphibians, ground-dwelling mammals and reptiles were noted.

Habitat details recorded included presence or absence of:

- Hollow-bearing trees (arboreal mammals, hollow-nesting birds and microchiropteran bats)
- Feed trees (e.g. *Allocasuarina* spp. And mistletoe)
- Roost sites (hollow-bearing trees or for bats)
- Waterbodies (amphibians)
- Nests (birds)
- Rocky outcrops and ground debris (reptiles)
- Other features likely to provide potential habitat for threatened fauna.

Searches for potential mammal, amphibian, and reptile habitat were undertaken and recorded during flora and fauna surveys (see section 2.4 below). Opportunistic sightings of all fauna species were also recorded.

2.4 Field survey

Flora and fauna field surveys were carried out by two ecologists between 5 February to 7 February 2018. Where appropriate, field surveys were conducted with reference to relevant NSW and Commonwealth guidelines including:

- OEH survey guidelines for threatened species, including the Booroolong Frog (*Litoria booroolongensis*) *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009)
- Biodiversity Assessment Method (OEH 2017)
- Commonwealth survey guidelines for threatened species, including the Booroolong Frog *Survey Guidelines for Australia's Threatened Frogs* (DEWHA 2010)
- *Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004).

The primary objectives of the field surveys were to:

- Determine the presence and/or potential for threatened flora and fauna species, populations, ecological communities, listed under the NSW BC Act and Commonwealth EPBC Act, and their habitats to occur in the study area
- Determine the value of the habitat in the study area for flora and fauna species, particularly for threatened species and species of conservation significance, and describe potential impacts that would result from the proposal
- Describe the flora and fauna species, habitat, populations and ecological communities in the study area in relation to their occurrence and quality in the locality. This included ground truthing, reference to aerial photographs and vegetation mapping
- Determine the condition and extent of vegetation removal required for the proposal.

Biodiversity survey effort for this proposal is summarised in Table 2.2.

Table 2.2: Survey effort for biodiversity assessment

Survey method	Effort
Flora plots (see Figure 2-1)	Two plots (20 metres by 50 metres) meeting requirements of the Biodiversity Assessment Method (BAM)
Flora transect	A random meander transect was conducted at the proposed access road and within and around the proposal site to record incidental species
Diurnal bird surveys (see Figure 2-1)	Four transects of about 500 metres for 30 minutes in woodland habitat in the study area by two ecologists, totalling two person hours
Nocturnal fauna surveys (see Figure 2-1)	Spotlighting by two ecologists for 60 minutes on two nights, totalling four person hours
Targeted Booroolong Frog surveys (see Figure 2-1)	Spotlighting, call playback and active searching were conducted by two ecologists for 60 minutes on two nights, totalling four person hours
Anabat detection and analysis (see Figure 2-1)	One Anabat detector for a period of two survey nights
Bat harp trapping	One harp trap for a period of two survey nights
Fauna habitat assessment	Potential fauna habitat identified within areas of potential vegetation clearing and adjacent areas.
Opportunistic fauna observations	Opportunistic fauna observations for all fauna species encountered during other surveys and habitat assessment.

2.4.1 Weather conditions

Weather conditions during surveys are summarised in

Table 2.3 Table 2.3. Weather observations were obtained from Tumbarumba, the nearest station to the proposal.

Table 2.3: Weather conditions during surveys

Survey and dates	Weather conditions
5 February 2018	Clear, daytime maximum temperature about 31 degrees celsius, no rain
6 February 2018	Clear, daytime maximum temperature about 30 degrees celsius, no rain
7 February 2018	Clear, daytime maximum temperature about 33.8 degrees celsius, no rain

2.4.2 Flora

Flora surveys were conducted in the study area using plot surveys (Figure 2-1) and random meandering transect surveys in accordance with the BAM.

The random meander technique (Cropper 1993) was used for transect surveys and conducted to search likely habitat for threatened flora. As rare plants often exist in discrete populations in specific areas, a random search can increase the probability of finding rare plant populations. A random search effort also encompasses a greater portion of the landscape, as the search is not limited to specific areas (only the stratification unit), and is useful in surveying difficult terrain and irregular shaped search areas.

Two plots of dimensions 20 metres by 50 metres were surveyed in the study area. Within each plot the following vegetation and habitat characteristics were recorded:

- Description of vegetation
- Dominant canopy vegetation
- Dominant understorey vegetation
- Groundcover species and abundance
- Percent native and exotic plant cover
- Number of trees with hollows
- Total length of fallen logs
- Overstorey regeneration
- Any signs of previous disturbance and grazing.

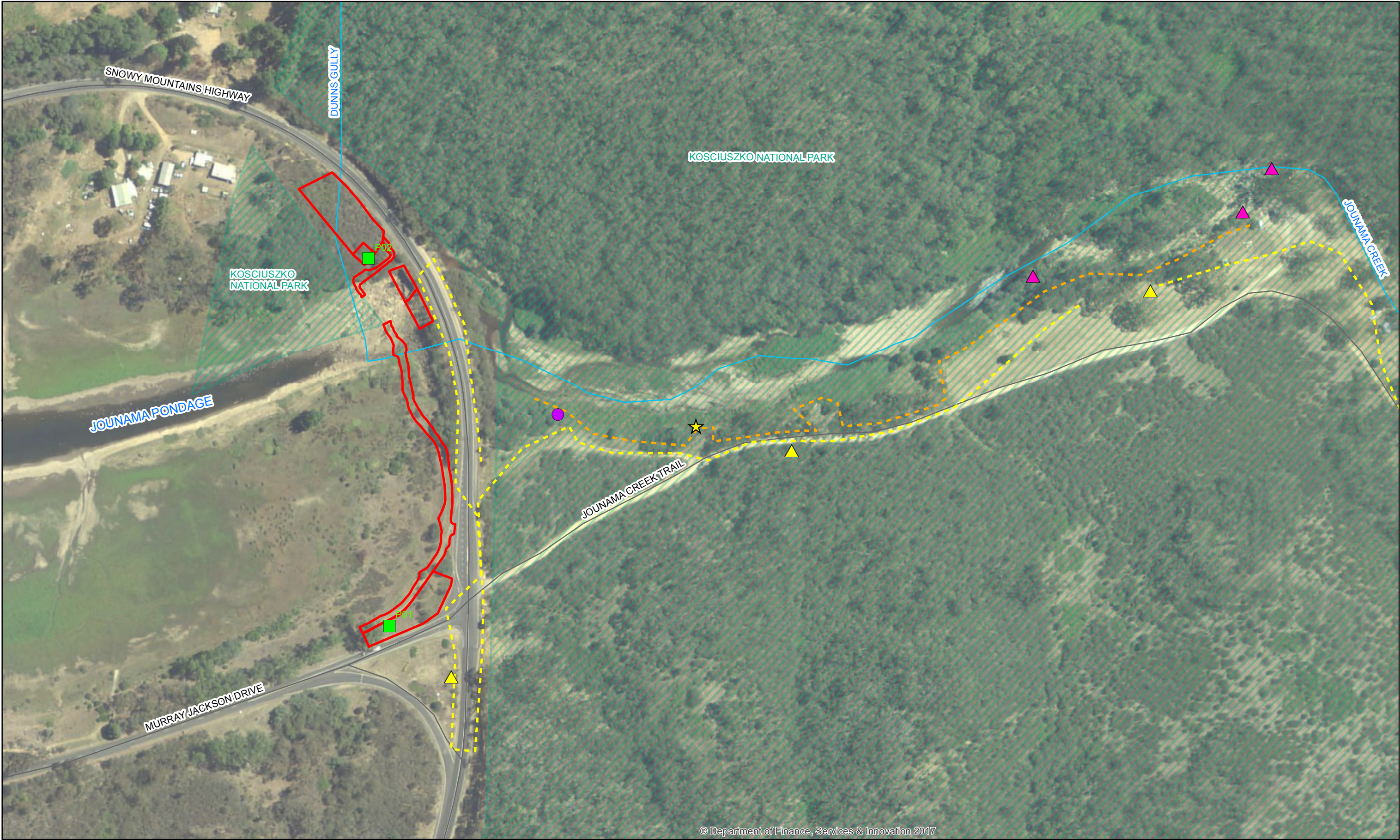
2.4.3 Vegetation communities

Surveys of vegetation communities in the study area were carried out to characterise vegetation formation, class, structure and condition. Plant community composition is important for areas that have the potential to be a threatened ecological community.

Flora surveys enabled determination of the composition and extent of ecological communities occurring in the study area. The study area was investigated by random meandering transect to identify vegetation communities present and to identify any areas with the potential to be classified as a threatened ecological community.

Native vegetation in the study area was initially assigned a vegetation community name based on observed floristic and structural characteristics. Intact native vegetation communities were defined according to BioNet vegetation classification, Plant Community Types (PCT).

Introduced or highly modified native vegetation was defined based on structure and species composition.



2.4.4 Fauna surveys

Fauna surveys comprised morning diurnal bird surveys, targeted Booroolong Frog surveys, bat surveys using an Anabat call detector and harp trapping, and spotlighting (mammals, amphibians and nocturnal birds). Habitat assessments were conducted for all fauna groups and observations of fauna signs. Fauna habitat resources were assessed to identify areas of potential habitat within the study area. Specific resources such as shelter, basking, roosting, nesting and foraging sites for birds, bats, arboreal mammals, amphibians, ground-dwelling mammals and reptiles were noted (see section 2.3).

Targeted Booroolong Frog surveys

Targeted surveys for the Booroolong Frog (*Litoria booroolongensis*) were conducted throughout the project site and study area for two nights on 5 and 6 February 2018. The Booroolong Frogs calling time is usually between October to March. Ideal survey timing is between December and February when temperatures are greater than 10 degrees celsius, there is no rain and not within three days after substantial rain events causing raised water levels in stream habitat.

Surveys included call playback surveys along sections of Jounama Creek containing suitable cobble bank habitat within the study area. Spotlighting along the creek and active searches for the species were conducted following call playback, totalling about 60 minutes on each night.

Diurnal and nocturnal birds

Bird surveys were conducted in the study area during the mornings of 6 and 7 February 2018, at two locations (see Figure 2-1). The bird survey involved a walking transect along about 500 metres through areas of potential bird habitat, and stationary surveys. Birds were identified by direct observation and call identification.

In addition to the dedicated bird surveys, any additional species observed at other times (such as during flora surveys) were recorded as opportunistic observations (Appendix A).

Spotlighting for arboreal fauna was conducted for four person hours on two nights and involved two ecologists conducting walking transects through areas of suitable habitat. Nocturnal mammals and birds were targeted during the spotlight period by systematically scanning native vegetation.

Microchiropteran bats

Harp trapping

Targeted harp trap surveys for microchiropteran bats were completed at one location along Jounama Creek. One harp trap was assembled and placed along a potential bat fly way for two nights. Due to access constraints, no harp traps could be placed within or over the culverts.

Vegetation was used on either side of the trap to deter bats from flying around the trap. The trap consists of a metal frame with numerous strands of fishing line tied vertically between the frame and pulled taut. A calico bag is connected to the frame underneath the fishing lines, with a plastic flap attached to each side of the bag to prevent any bats caught from escaping the bag.

The harp trap was checked for bats at dawn every morning.

Anabat detection

Targeted Anabat detection surveys for microchiropteran bats were completed at one location in the study area.

An Anabat detectors (Titley Scientific Brisbane) was placed in a potential bat fly-way along the creek (see Figure 2-1).

Data was analysed for identification of bat species by Craig Grabham. Calls were identified using zero-crossing analysis and AnalookW software (version 3.8s, Chris Corben 2011). The sonogram and call characteristics (e.g. characteristic frequency and call shape) were visually compared with reference calls and/or species call descriptions from published guidelines.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills et al. 1996 and Duffy et al. 2000) as summarised in Table 2.4. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Table 2.4: Confidence rating applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species (eg <i>Chalinolobus gouldii</i> / <i>M. Mormopterus</i> sp. and <i>Nyctophilus</i> spp). The calls of <i>Nyctophilus geoffroyi</i> and <i>N. gouldi</i> cannot be distinguished during the analysis process and are therefore lumped together.

2.5 Limitations

Field surveys were conducted outside the optimal survey period for many species when many plants have finished flowering and are unable to be detected. For any threatened flora species that were not detectable at the time of the survey, but which had the potential to occur at the site, an assessment was made of the suitability of the habitat for the species and its likelihood of occurrence. However, some fauna species are mobile and transient in their use of resources. Consequently, it is likely that not all species either resident or transitory at the site would have been recorded during the field surveys. The disadvantage of this limitation was reduced by database searches, and by assessing the habitat value of the study area for threatened and migratory species known to occur in the region, to determine their likelihood of occurrence.

Field surveys were not designed to enable all species, either resident or transitory in the study area, to be detected. Instead, they were aimed at identifying the ecological values of the study area, with particular emphasis on threatened and migratory species, to allow an assessment of the potential impacts of the proposal.

For those species of conservation significance that were not detected but likely to occur in the study area, an assessment of the likelihood of their occurrence was made based on known habitat requirements.

2.6 Likelihood of occurrence and assessment of impact significance

An assessment of the likelihood of occurrence was completed for listed species, populations and ecological communities with the potential to occur in the study area.

In assessing which of these species, populations and ecological communities are 'likely' to occur within the study area (as described in *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004) the following factors were taken into consideration:

- The presence of potential habitat within the study area
- Condition and approximate extent of potential habitat within the study area
- Species occurrence within the locality and region (including results of current and previous surveys and results of database searches and literature review).

The criteria used for the assessment of the likelihood of occurrence (Appendix B) are as follows:

- Recorded – the species was observed in the study area during the current survey
- High – it is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 kilometres) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration
- Moderate – potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. For breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded
- Low – it is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10 kilometres). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded
- None – suitable habitat is absent from the study area.

In addition, a BC Act assessment of significance and/or EPBC Act significance assessment was carried out for threatened biota assessed as having a moderate or high likelihood of occurrence, and those recorded during surveys and with the possibility to be impacted by the proposal (Appendix C).

2.7 Key threatening processes

A key threatening process is defined in the BC Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 key threatening processes listed under the BC Act, eight listed under the FM Act and 21 under the EPBC Act. A number of key threatening processes are listed under more than one Act.

Those key threatening processes potentially relevant to the proposal and specific mitigation measures to limit the impacts of these key threatening processes are discussed in section 4.3.

3 Existing environment

3.1 General description

3.1.1 Bioregion

The study area occurs in the South West Slopes Bioregion. This bioregion covers the lower inland slopes of the Great Dividing Range extending from north of Cowra, through southern NSW into western Victoria.

3.1.2 Vegetation connectivity and corridors

The study area occurs within the rural landscape north-east of Talbingo and is surrounded by the water storage facility of Jounama Pondage and Kosciuszko National Park. The proposal site covers an area of about 0.41 hectares, and is relatively linear in shape, including the access track.

The proposal site at the culvert itself is not located within a classified Mitchell Landscape, due to its location in a classified water area. The remainder of the study area occurs within two Mitchell Landscapes; the Minjary Hills and Ranges Mitchell Landscape and the Pinbeyan – Ravine Ranges Mitchell Landscape. The study area is in the major catchment area of the Murrumbidgee. Sixty-one percent of the Minjary Hills and Ranges landscape and six percent of the Pinbeyan – Ravine Ranges landscape has been cleared within the Murrumbidgee catchment area, therefore they are not considered to be over-cleared landscapes (ie greater than 70 per cent cleared) (DEC 2005).

Native canopy vegetation exists within the road reserve of the Snowy Mountains Highway and Kosciuszko National Park, which is located on the eastern side of the highway and as a small isolated patch to the west of the northern end of the proposal site. Remnant woodland in the national park is in good condition and connected to vegetation in the proposal site to the north, south and east. Kosciuszko National Park is about 6,900 square kilometres in size.

Terrestrial habitat connectivity in the study area has been reduced due to past clearing in the landscape for water storage and linear infrastructure. There is good connectivity along the roadside reserve to remnant vegetation in Kosciuszko National Park, although vegetation in the roadside reserve surrounding the proposal site has been heavily modified and largely cleared.

3.1.3 Surrounding landuse

The surrounding landuse is primarily dominated by woodland within Kosciuszko National Park and the water storage facility of Jounama Pondage. The township of Talbingo is located nearby to the south-west. There are three roads in the study area; the Snowy Mountains Highway where the proposal is located, Murray Jackson Drive which intersects the highway to the west, and the Jounama Creek Trail, which intersects the highway to the east.

3.1.4 Terrain, geology and drainage

The proposal site at the culvert itself is not located within a classified Mitchell Landscape, due to its location in a classified water area. The northern section and part of the southern section of the study area covering part of the compound site, is located in the Minjary Hills and Ranges Mitchell Landscape, which comprises steep hills and ranges on lower Silurian sandstone, greywacke, quartzite, dacite, tuff and phyllite, and Devonian ignimbrite and sandstone. The general elevation is 300 to 930 metres above sea level, with local relief 400 metres (Mitchell 2002).

The southernmost section of the proposal occurs within the Pinbeyan – Ravine Ranges, which comprises prominent bluffs to 120 metres and plateau top on a synclinal fold in Upper Devonian rhyolite, andesitic basalt, tuff, sandstone, conglomerate and siltstone. Extensive

rock outcrops with steep debris slope below cliffs. The general elevation is 500 to 1400 metres above sea level, with local relief 700 metres (Mitchell 2002).

The terrain of the study area is hilly to undulating, grading into mountainous to the east of the study area.

Jounama Creek is a permanent water course flowing from east to west through the study area, draining into Jounama Pondage via the culvert under the Snowy Mountains Highway (the proposal site). Dunns Gully, an ephemeral drainage line, flows north to south and drains into Jounama Pondage the west of the proposal site. Runoff from the study area drains into Jounama Creek and Dunns Gully, which drains into Jounama Pondage to the west of the site (see Figure 1-2).

3.1.5 Soils

The Minjary Hills and Ranges Mitchell Landscape contains rubbly scree with sandy loam matrix on steep slopes and thin red to yellow texture-contrast soils on lower slopes. The Pinbeyan - Ravine Ranges consists of rubbly brown sandy loam grading to red-brown texture-contrast soils on lower slopes (Mitchell 2002).

3.1.6 Climate

The area is classified as warm temperate with a mean annual rainfall of 977.9 millimetres (taken from the nearest weather station at Tumbarumba). Summers are generally warm to hot while winters are cold. The highest mean maximum monthly temperature is 28.9 degrees celsius, occurring in January, while the lowest mean minimum monthly temperature is -0.1 degrees celsius, occurring in July (BoM 2018a). Average rainfall is generally highest in August, with an average of 106.7 millimetres (BoM 2018b).

3.2 Flora

3.2.1 Flora survey results

Field surveys identified 63 flora species, of which 38 are native species and 25 are introduced species (see Appendix A).

Native tree species in the study area are dominated by Blue Gum (*Eucalyptus bicostata*) and Ribbon Gum (*E. viminalis*) along Jounama Creek and Blakely's Red Gum (*E. blakelyi*) and Red Stringybark (*E. macrorhyncha*) along the adjacent treed slopes.

Native shrubs that occur in the study area include Slender Tea-tree (*Leptospermum brevipes*), Burgan (*Kunzea ericoides*) and Blackthorn (*Bursaria spinosa*).

The groundcover vegetation in the study area is generally dominated by introduced flora species, such as Paspalum (*Paspalum dilatatum*), Purpletop (*Verbena bonariensis*) and Cocksfoot (*Dactylis glomerata*). A higher proportion of native species occurs within the woodland and forest patches of the national park, further away from previous disturbances. Commonly occurring native species include Kangaroo Grass (*Themeda triandra*), and Snowgrass (*Poa sieberiana*).

No threatened flora species listed under the BC Act or EPBC Act were recorded in the study area.

Priority weeds

One priority weed for the Snowy Valleys Council area was recorded during current surveys; Blackberry (*Rubus fruticosus*) (DPI 2018). The control duty for Blackberry is *prohibition on dealings*, which means the plant must not be imported into the state or sold.

Blackberry is also listed as a weed of national significance under the National Weeds Strategy.

3.2.2 Plant community types

Surveys of the vegetation in the study area identified two plant community types present. Forest dominated by Blue Gum and Ribbon Gum occurs along Jounama Creek in the wider study area and would not be impacted by proposal. This community is limited to the riparian area upstream of the proposal and classifies as the NSW plant community type (PCT) *Apple Box – Eurabbie grassy open forest on sheltered slopes and gullies in the Burrinjuck area, South Eastern Highlands Bioregion* (PCTID 652). As this community would not be impacted by the proposal, no further discussion of the community is required.

The majority of the forest community in the study area is dominated by Red Stringybark with Blakely's Red Gum and meets the classification criteria for the NSW PCT *Red Stringybark – Red Box – Long-Leaved Box – Inland Scribbly Gum tussock grass – shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion* (PCTID 290). Most of this community is in good condition, particularly where it occurs on the slopes away from direct disturbance such as the roads and camping ground. In the proposal site, however, the community occurs as a derived form and exists as regrowth shrubs and midstorey species due to disturbance from previous road construction (see Photo 1 and Figure 3-1). The shrub cover within the plot conducted in the community totalled about 70 percent foliage cover.

The derived patch of the community contains a mid to dense cover of shrubs, which is a common occurrence in the community when fire is absent. Shrub species present include Silver Wattle (*Acacia dealbata*), Slender Tea-tree, Burgan and Blackthorn, which are also known to colonise disturbed areas. Where native groundcover species are present, Snowgrass and Kangaroo Grass are common.

These plant community types do not classify for listing as a threatened ecological community under the BC Act or EPBC Act.

A summary of the vegetation and NSW plant community types present in the proposal site and nearby area is shown below in Table 3.1 with a description as per the PCT database following.

Table 3.1: NSW plant community types (PCT) and vegetation in the proposal area

Plant community type (PCT)	Condition class	Threatened ecological community?	Area (ha) in proposal site	Area (ha) in study area
PCTID 290 (derived shrubby regrowth)	Moderate	No	0.16	60 (total area of PCT)
Derived native grassland	N/A	No	(0.04)	-
Introduced grassland	N/A	No	(0.12)	-
Total			0.16	60

PCT ID 290 – *Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass – shrub low open forest on hills in the southern part of the NSW Southern Western Slopes Bioregion*

Vegetation formation: Dry Sclerophyll Forests (Shrub/grass sub-formation)

Vegetation class: Upper Riverina Dry Sclerophyll Forests

Conservation status: Not listed

Estimate of percent cleared: 67%

Condition: Moderate

Extent in the study area: 60 hectares

Plots completed in vegetation zone: 1

Description:

Mid to high open forest or woodland dominated by Red Stringybark with Red Box, Long-leaved Box (*E. gonicalyx*) and Scribbly Gum (*E. rossii*) sometimes present. Blakely's Red Gum is also sometimes present and in the study area Jounama Creek also features Blue Gum and Ribbon Gum. The shrub layer is usually sparse but may be mid to dense where fire has been less frequent. Shrub species include *Brachyloma daphnoides* subsp. *daphnoides*, *Hibbertia obtusifolia*, *Dillwynia phyllicoides*, *Phyllanthus hirtellus*, *Acacia dealbata*, *Daviesia leptophylla*, *Calytrix tetragona*, *Acacia paradoxa*, *Leucopogon ericoides* and *Melichrus urceolatus*. The grass tree *Xanthorrhoea glauca* subsp. *angustifolia* is common at some locations.

The ground cover is mid to dense to sparse. Grass species include *Rytidosperma eriantha*, *Joycea pallida*, *Poa sieberiana* var. *sieberiana* and *Dichelachne micrantha* with the mat-rush *Lomandra filiformis*. Forb species include *Gonocarpus tetragynus*, *Goodenia hederacea* subsp. *hederacea*, *Stypandra glauca*, *Dianella revoluta* var. *revoluta*, *Poranthera microphylla*, *Hydrocotyle laxiflora*, *Senecio prenanthoides*, *Thysanotus patersonii*, *Opercularia hispida*, *Pomax umbellata*, *Microseris lanceolata* and *Drosera auriculata*. The rock fern *Cheilanthes sieberi* subsp. *sieberi* may be abundant. The sedge *Lepidosperma laterale* may also be present.



Photo 1: PCTID 290 (derived shrubby regrowth) in the study area



LEGEND

— Road

— Waterway

▭ Culvert work/batter fill area

■ Kosciuszko National Park

Vegetation type

■ Derived native grassland

■ Introduced grassland

■ PCTID 290 (derived shrubby regrowth)

3.2.3 Threatened ecological communities

No threatened ecological communities were recorded during field surveys.

3.2.4 Groundwater dependent ecosystems

Jounama Creek within the proposal site is identified in the Atlas of Groundwater Dependent Ecosystems (GDE) (BoM 2018c) as having moderate potential at a national assessment level to contain an aquatic GDE. The Tumut River is identified as having high potential, however, has been highly modified by the Snowy Hydro Scheme and the creation of Jounama Pondage.

3.3 Fauna

3.3.1 Fauna habitat

Woodland/forest

Woodland and forest habitat for fauna in the study area is predominantly located within Kosciuszko National Park, which includes a large expanse of dry open eucalypt forest comprised of species including Red Stringybark and Broad-leaved Peppermint (*E. dives*) in the study area. More open woodland is located along Jounama Creek where previous clearing as occurred. These habitats provide foraging, movement and potential breeding habitat for a variety of bird species including threatened species that were recorded during current surveys, such as the Gang-gang Cockatoo (*Callocephalon fimbriatum*) (see Figure 2-1). It may also provide habitat for other threatened species not recorded in the study area, considered likely to occur, such as the Flame Robin (*Petroica phoenicea*) and Diamond Firetail (*Stagonopleura guttata*).

Mature eucalypt trees occur throughout the study area but do not occur within the proposal site. Regeneration of canopy species is occurring within existing woodland and forest habitat. Mature trees in the study area would be used for nesting and foraging by a range of woodland birds, arboreal mammals and microchiropteran bats. A wide variety of bird species were recorded during surveys in the study area (see Appendix A).

Although the species was not observed during surveys, it is considered likely that trees in the study area would provide habitat for the threatened Yellow-bellied Glider (*Petaurus australis*) due to the presence of hollows, the connectivity to known areas of habitat for the endangered population on the Bago Plateaux and recent records in the locality. Yellow-bellied Gliders would use trees in the study area to forage for sap and nectar. Other arboreal mammals such as the Common Brushtail Possum (*Trichosurus vulpecula*), which has previously been recorded in the study area, may also use trees in the study area for foraging.

Hollow-bearing trees occur throughout the study area and are likely to provide nesting and roosting habitat for microchiropteran bats and arboreal mammals such as the Yellow-bellied Glider and Brushtail Possum; and a range of woodland birds. Owls such as the threatened Masked Owl (*Tyto novaehollandiae*) and Southern Boobook (*Ninox novaeseelandiae*) may use hollow-bearing trees for nesting.

Woodland and forest areas with coarse woody debris and leaf litter would provide habitat for reptiles such as snakes and skinks, as well as foraging habitat for threatened woodland birds.

Derived native grassland

Native grassy areas in the study area are generally of a relatively small size and scattered distribution due to the high level of disturbance in areas outside of woodland and forest habitat and the dominance of these forested habitat types. Grassy areas provide foraging habitat for common mammals such as the Eastern Grey Kangaroo (*Macropus giganteus*) and Common Wombat (*Vombatus ursinus*). Grassy areas also provide foraging and nesting habitat for woodland birds, including threatened species such as the Diamond Firetail.

Aquatic habitat

The proposal site is located where Jounama Creek flows into Jounama Pondage. Jounama Creek and Jounama Pondage are both permanent waterways that provide habitat for a variety of aquatic fauna and flora. Both waterways are mapped as key fish habitat by the Department of Primary Industries (Fishing and Aquaculture), with Jounama Pondage providing known habitat for fish species and the Murray Crayfish (*Euastacus armatus*).

Aquatic habitat in Jounama Creek and Jounama Pondage are connected when higher pondage water levels are at or above the culvert base, removing the two to three metre drop from Jounama Creek flow travelling through the culvert to the bedrock of the pondage. During periods of low pondage levels, aquatic habitat in Jounama Creek and Jounama Pondage is not connected and imposes a barrier to aquatic species.

Vegetation lining the fringes of Jounama Creek is generally dominated by the introduced Blackberry (*Rubus fruticosus*), with native shrubs Burgan and Slender Tea-tree occurring along the banks of the creek. The canopy is comprised of native species including Ribbon Gum. Native aquatic groundcover species that occur include Water Primrose (*Ludwigia peploides*) and Slender Knotweed (*Persicaria decipiens*).

Jounama Creek also contains areas of cobble banks and large rocky habitat. Cobble banks with fringing vegetation cover provide habitat for the threatened Booroolong Frog (*Litoria booroolongensis*), which was recorded during current surveys, about 500 metres upstream of the proposals site. This species was known previously from Jounama Creek and current surveys confirm its presence. No potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site.

Large rocky habitat comprised of in-stream boulders and rocks, which also occur on the banks of the creek provide basking and shelter habitat for reptile species including the Australian Water Dragon (*Intellagama lesueurii*), which was recorded during the current survey period. Deep rocky habitat within the creek may also provide shelter habitat for fish species that may occur in the creek.

Vegetation on the fringes of Jounama Pondage is generally dominated by introduced species such as Paspalum (*Paspalum dilatatum*) and Phalaris (*Phalaris aquatica*), with native shrub species including Burgan, Slender Tea-tree and Silver Wattle (*Acacia dealbata*) present generally above the high water line. Jounama Pondage is a rockfill dam containing open water habitat, which provides known habitat for threatened species including the Murray Cod (*Maccullochella peelii*), Macquarie Perch (*Macquaria australasica*), Murray Crayfish and other native species including Golden Perch (*Macquaria ambigua*). Introduced species including Redfin Perch (*Perca fluviatilis*), which is listed as a Class 1 noxious fish under the FM Act, also occur in Jounama Pondage.

Jounama Creek and Jounama Pondage are known to provide habitat for recreational fish species such as Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*).

In addition to the Booroolong Frog, the creek and pondage are also likely to provide potential habitat for commonly occurring frogs such as the Eastern Sign-bearing Froglet (*Crinia parinsignifera*) and Peron's Tree Frog (*Litoria peronii*).

Aquatic habitat also provides foraging and breeding habitat for wetland birds, such as ducks and herons. A number of bird species that depend on wetland habitats were recorded during field surveys, including the Australian Wood Duck (*Chenonetta jubata*), White-faced Heron (*Egretta novaehollandiae*), Australasian Darter (*Anhinga novaehollandiae*) and White-necked Heron (*Ardea pacifica*).

3.3.2 Fauna recorded during current field surveys

Field surveys recorded 58 fauna species, five of which are introduced and 53 are native species (Appendix A).

The forest and woodland in the study area provides habitat for a number of bird species. Commonly occurring native bird species included the Australian Magpie (*Cracticus tibicen*), Laughing Kookaburra (*Dacelo novaeguineae*) and the Satin Bowerbird (*Ptilonorhynchus violaceus*). Introduced bird species recorded during surveys include the Common Startling (*Sturnus vulgaris*), European Goldfinch (*Carduelis carduelis*) and Common Blackbird (*Turdus merula*).

One threatened bird species was recorded during surveys; the Gang-gang Cockatoo, which is listed as vulnerable under the BC Act. The species was heard calling and observed flying over Jounama Creek at the Jounama camp ground and a male and female were observed perching in a juvenile eucalypt at the intersection of the Snowy Mountains Highway and Murray Jackson Drive.

Ten species of mammal were recorded during surveys, including the native Eastern Grey Kangaroo and seven bat species. Introduced mammals included the Feral Pig (*Sus scrofa*) and European Rabbit (*Oryctolagus cuniculus*). Ultrasonic Anabat recordings identified four bat species to a definite call confidence level including Gould's Wattled Bat (*Chalinolobus gouldii*), Large Forest Bat (*Vespadelus darlingtoni*) and White-striped Free-tailed Bat (*Tadarida australis*). Two bat species were recorded to a probable call confidence; Southern Forest Bat (*Vespadelus regulus*) and the threatened Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), which was recorded on one of two recording nights. As many as six other species may also have been recorded, but poor quality data and/or call similarity between species made it difficult to distinguish between certain species.

Two reptile species were recorded during surveys including the Australian Water Dragon and a species of skink (*Egernia* sp.). No threatened species of reptile are likely to occur in the study area.

One amphibian was recorded during current field surveys; the Booroolong Frog, which is listed as endangered under the BC Act and the EPBC Act. Three individuals of the species were observed along Jounama Creek; on cobbles within the creek and within grass on the creek bank, about 500 metres east of the proposal site.

No fish species or other aquatic fauna was observed during surveys, although these are known to occur (see section 3.3.1, above).

3.4 Threatened species and populations

This section describes the threatened biodiversity and other species of conservation concern present or likely to occur within the study area based on records within the locality and the nature of habitats within the existing environment.

3.4.1 Commonwealth listed matters

Matters of National Environmental Significance (NES) are listed and protected under the EPBC Act. The act identifies three Matters of National Environmental Significance relevant to this ecological assessment:

- Threatened species and ecological communities
- Migratory species
- Ramsar wetlands of international importance.

The literature review, database search and field surveys identified four ecological communities, seven flora species, seven bird species, eight mammal species, four amphibian species and three fish species listed under the EPBC Act that are known or likely to occur in the study area.

Table 3.2 provides a summary of the biota listed under the EPBC Act that have been recorded or are considered likely to occur in the study area and whether an impact is likely (see section 3.7 below and Appendix B).

The EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DEWHA 2009) was used to assist in determining the significance of the potential impacts of the proposal on one frog species recorded in the study area during current surveys. The assessment concluded that the proposal is unlikely to have a significant impact on the species (see Appendix C).

Migratory species

Migratory species are protected under the international agreements to which Australia is a signatory, including the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea-Australia Migratory Bird Agreement (RoKAMBA) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered matters of NES and are protected under the EPBC Act.

One bird species currently recognised under this provision of the EPBC Act is considered likely to occur within the study area; the Satin Flycatcher (*Myiagra cyanoleuca*) (Table 3.2).

Under the EPBC Act, an action is likely to have a significant effect on a migratory species if it substantially modifies, destroys or isolates and area of important habitat for the species (DEWHA 2009).

The study area is not considered to comprise important habitat for the Satin Flycatcher as it does not contain:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat used by a migratory species that is at the limit of the species' range
- Habitat within an area where the species is declining (DEWHA 2009).

As such, impacts of the proposal on migratory species are not considered further for this species.

Ramsar wetlands of international importance

No internationally important wetlands occur in the locality of the study area. As such, the proposal is not likely to have an adverse effect on any Ramsar Wetland either directly or indirectly.

3.4.2 State-listed species, communities and populations

The literature review, database search and field surveys identified two ecological communities, 10 flora species, 24 bird species, 11 mammal species, one reptile species, four amphibian species, three fish species, and one crustacean listed under the BC Act and/or FM Act that are known or likely to occur in the locality. Of these, one bird, one mammal and one amphibian species are known to occur within the study area and one crustacean is considered likely to occur in the study area with the potential to be impacted by the proposal.

Assessments of significance under section 1.7 of the EP&A Act were completed for one bird, one frog, one mammal and one crustacean species listed under the BC Act and/or FM Act identified as being likely to be impacted by the proposal and/or that were recorded in the study area during current surveys.

The assessments (see Appendix C), concluded that the proposal is unlikely to have a significant impact on these species known or likely to occur in the study area. It is unlikely to constrain the movement of the Gang-gang Cockatoo and Eastern Bentwing-bat due to their high mobility and the impacts of the proposal being limited to regrowth shrubs and disturbed groundcover unlikely to be favoured by these species. The impacts of the proposal would be limited to aquatic habitat that is unsuitable for the Booroolong Frog due to the very deep water habitats within the proposal site and lack of cobble banks. Suitable and known habitat occurs upstream of the proposal site and includes cobble banks and fringing aquatic vegetation. The Murray Crayfish is unlikely to be significantly impacted by the proposal due to the large additional areas of habitat available for them in the study area, the restricted area of aquatic impacts of the proposal, which are limited to low quality water habitats with no surrounding riparian vegetation preferred by the species and the rapidly fluctuating water levels. These attributes and the two to three metre drop from the culverts to the bedrock of the pondage at periods of low water levels are not optimal habitat conditions for the species.

Table 3.2: Listed species and their likelihood of occurrence in the study area and possibility of impact

Scientific name	Common Name	Status		Potential occurrence (Low, Moderate, High, Recorded)	Possibility of impact
		BC Act	EPBC Act		
Plants					
<i>Thelymitra atronitida</i>	Black-hooded Sun Orchid	CE	-	Moderate	Low
Birds					
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	Moderate	Low
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	Moderate	Low
<i>Petroica phoenicea</i>	Flame Robin	V	-	Moderate	Low
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Recorded	Low
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Moderate	Low
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Moderate	Low
<i>Petroica rodinogaster</i>	Pink Robin	V	-	Moderate	Low
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	Mi	Moderate	Low
<i>Petroica boodang</i>	Scarlet Robin	V	-	Moderate	Low
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	V	-	Moderate	Low
Mammals					
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Recorded	Low
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	Moderate	Low
<i>Macrotis lagotis</i>	Greater Glider	-	V	Moderate	Low
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Moderate	Low
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	Moderate	Low

Scientific name	Common Name	Status		Potential occurrence (Low, Moderate, High, Recorded)	Possibility of impact
		BC Act	EPBC Act		
Amphibians					
Litoria booroolongensis	Booroolong Frog	E	E	Recorded	Low
Fish					
Macquaria australasica	Macquarie Perch	E	E	High	Low
Maccullochella peelii	Murray Cod	-	V	High	Low
Euastacus armatus	Murray Crayfish	V (FM Act)	-	High	Moderate
Bidyanus bidyanus	Silver Perch	V	CE	High	Low

V – Vulnerable, E – Endangered, CE – Critically Endangered, Mi – Migratory

Bold – an EP&A Act assessment of significance and/or EPBC Act significance assessment has been completed for these species, which were recorded in the study area or those that have a high or moderate likelihood to occur in the study area and for which an impact is likely

3.5 Wildlife connectivity corridors

The proposal site occurs within the road reserve of the Snowy Mountains Highway, with Kosciuszko National Park predominantly occurring to the east, south and north and Jounama Pondage to the west. The road reserve of the Snowy Mountains Highway contains woodland that forms a vegetation corridor, which runs through the study area, and facilitates the movement of a range of fauna species through the study area. Parts of the road reserve have been previously cleared, particularly in the vicinity of the proposal site, however, this has not prevented fauna from traversing the study area. This corridor is directly connected to woodland in Kosciuszko National Park.

Kosciuszko National Park is about 6,900 square kilometres. Kosciuszko National Park shares a border with Maragle and Bago State Forests to the west and Bondo State Forest to the north-east. These three state forests have a total area of over 980 square kilometres. The extent and quality of the remnant vegetation in the study area and locality create high habitat connectivity throughout the study area and wider locality, which provides high quality wildlife connectivity enabling fauna species to traverse the study area and locality without difficulty.

The aquatic habitat in the study area is highly modified due to the Snowy Mountains hydroelectricity scheme. The proposal occurs within Jounama Creek, which drains into Jounama Pondage (formally Tumut River), however between 1949 and 1974 the Tumut River was impounded by six dams (Snowy Hydro 2011). This has resulted in a modified environment with reduced connectivity for aquatic species. Water entering Jounama Pondage from Jounama Creek has been diverted through the culvert at the proposal site. When the pondage water levels are low, water entering the pondage drops down about two to three metres from the culvert slab before it can enter the pondage. This does not; however, completely inhibit aquatic habitat connectivity between the two areas of Key Fish Habitat. Habitat in Jounama Creek and Jounama Pondage are connected when higher pondage water levels are at or above the culvert base, removing the drop from the culvert to the bedrock of the pondage.

3.6 State Environmental Planning Policy No 44 – Koala Habitat Protection

This policy applies to each LGA listed in Schedule 1 of the SEPP, which includes the Tumut LGA in which the proposal site is located, now a part of the Snowy Valleys LGA. Schedule 2 of

this policy lists preferred feed tree species of the Koala, including Ribbon Gum. Because Ribbon Gum constitutes at least 15 percent of the total number of trees in the upper or lower strata of the tree component, the habitat in the study area comprises *potential* koala habitat as defined under SEPP 44. However, the habitat assessment found that the Koala is unlikely to inhabit the study area due to a paucity of recent local sightings and due to the species not being recorded in the study area.

The study area is therefore unlikely to contain core Koala habitat, defined by SEPP 44 as ‘an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.’

While SEPP 44 does not apply to projects being assessed under Part 5 of the EP&A Act, the proposal recognises the intent of SEPP 44 and it has been considered in this assessment.

3.7 Matters of National Environmental Significance

A PMST database search was carried out to identify potential matters of NES within a 10 kilometre radius of the proposal site. Identified matters are shown in Table 3.3.

Table 3.3: Matters of NES identified by PMST search

Protected matter	Matter located within search radius	Comments	Potential impact
World heritage property	None	N/A	None
National heritage places	Two: Australian Alps National Parks and Reserves Snowy Mountains Scheme	The proposal would not impact on the Australian Alps National Parks and Reserve as work would be located within the designated road reserve. The specific boundary of the Snowy Mountains Scheme is unknown, however, the proposal is in keeping with the role and significance of the highway and its purpose within the scheme and therefore it is unlikely to be impacted.	None
Wetlands of international significance (Ramsar Wetlands)	Four: Banrock Station Hattah-kulkyne lakes Riverland The Coorong, and lakes Alexandrina and Albert Wetland	Proposal would not impact on these matters as works are downstream of the wetlands, the closest of which is 500 kilometres upstream.	None
Great Barrier Reef Marine Park	None	N/A	None

Protected matter	Matter located within search radius	Comments	Potential impact
Commonwealth Marine areas	None	N/A	None
Commonwealth land	One: Commonwealth Land – Telstra corporation	The project is not located on Commonwealth Land.	None
Threatened Ecological Communities	Four: Alpine sphagnum bogs and associated fens; Grey Box Grassy Woodland and derived native grasslands; Natural temperate grassland of the South Eastern Highlands; White Box Yellow Box Blakeley's Red Gum Woodland and derived native grassland.	None of these communities were identified in the study area during field surveys and would therefore not be impacted by the proposal.	None
Threatened species	35: Eight bird species Three fish species Four frog species Seven mammal species 10 plant species Two reptile species One insect species	The Booroolong Frog was recorded during current field surveys, upstream of the proposal site. Due to the proposal site being located downstream of all potential available habitat, in deep water lacking cobble banks, a significant impact on the species is unlikely.	None
Migratory Species	11: 1 migratory marine birds 4 migratory terrestrial species 6 migratory wetland species	Minimal impact considered, existing habitats modified and minor in comparison to available habitat and species likely to overfly project area.	None

4 Impact assessment

4.1 Construction impacts

4.1.1 Removal of native vegetation

The proposal would remove about 0.32 hectares of vegetation, of which 0.20 hectares is native vegetation (see Table 4.1). An additional 0.09 hectares of derived native grassland would be temporarily disturbed for the southern compound site.

Table 4.1: Impacts on vegetation

Plant community type (PCT)	Status		Proposal area ¹ (hectares/m ²)	Percent cleared in CMA ²
	BC Act	EPBC Act		
PCTID – 290 (derived shrubby regrowth)	-	-	0.16	67
Derived native grassland	-	-	0.04	N/A
Introduced grassland	-	-	0.12	N/A
Total			0.32	

1- Area to be cleared based on ground-truthed vegetation mapping within the study area.

2- Based on the VIS classification database.

The vegetation proposed to be removed is predominantly native shrub species that have regrown in the road reserve since previous clearing has occurred, and introduced grassland. A small area of derived grassland dominated by native species would also be removed for construction of the southern access track, with native grassland in the area of the compound site to be temporarily disturbed during the construction period via slashing. These areas would be allowed to naturally regenerate following completion of the proposal.

No mature trees or hollow-bearing trees would be removed by the proposal, or are located in the vicinity of the proposal.

4.1.2 Wildlife connectivity and habitat fragmentation

The woodland in the study area forms part of a vegetation corridor along the Snowy Mountains Highway that directly connects to Kosciuszko National Park and facilitates the movement of a range of fauna species through the study area and across the landscape. Kosciuszko National Park contains a vast area of native woodland habitat that also connects to other remnant patches including Bago and Maragle State Forests to the west and Bondo State Forest to the north-east. This woodland is vital habitat in the landscape with connectivity between patches important for maintaining fauna movement across the landscape.

Fragmentation of the vegetation in the locality has previously occurred through construction of the Snowy Mountains Highway and other local roads and access tracks, and for the development of the Snowy Mountains Scheme, which includes Jounama Pondage. These developments have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences, however the extent of native vegetation in the locality remains high.

Due to the limited amount of vegetation proposed to be removed in the already modified road reserve of the Snowy Mountains Highway, the removal of vegetation being limited to regrowth, and the extent of remaining native vegetation surrounding the proposal, it is unlikely that the proposal would fragment woodland habitat in the study area. Fauna would remain able to traverse the study area. It is unlikely that species limited in their dispersal abilities would be restrained by the proposed removal of vegetation.

The proposal would not remove any large areas or native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

4.1.3 Removal of threatened fauna habitat

The vegetation proposed to be removed is mostly regrowth shrubs, native grassland and introduced grassland. Some of this vegetation is likely to provide habitat for fauna species, including threatened species such as the Gang-gang Cockatoo and Eastern Bentwing-bat, which were recorded during surveys and may use the regrowth shrubs in the proposal site as marginal foraging habitat.

Table 4.2 includes the threatened fauna that have been recorded or have a high likelihood of occurrence in the study area and the potential for the proposal to impact on these species. Where relevant, the area of potential habitat of the species to be impacted has been included. It is unlikely to the proposal would have a substantial impact on these species due to the low quality of habitat to be removed and the limited area of habitat disturbance.

Table 4.2: Impacts on threatened fauna habitat

Species	Potential occurrence (Moderate, High, Recorded)	Impact by proposal likely?	Impact area of potential habitat (ha)
Booroolong Frog	Recorded	No	0
Eastern Bentwing-bat	Recorded	No	0.16
Gang-gang Cockatoo	Recorded	No	0.16
Murray Crayfish	High	Moderate	0.09

4.1.4 Aquatic impacts

Jounama Creek and Jounama Pondage are known to provide habitat to a number of fish species and the threatened Murray Crayfish. There is potential for the Murray Crayfish to burrow in the banks of the pondage in the vicinity of the proposal site and for fish to shelter under parts of existing apron slab and rock material. Due to the fluctuating water levels of the pondage, larger native fish are not expected to use the proposal site as primary habitat and are likely to be found in deeper water. There is no woody debris located in the area of the culvert, which is located on bedrock, and potential habitat for these species is entirely comprised of artificial concrete from the breakaway of the apron slab.

The existing apron slab would be removed during construction, with rock material also being removed and/or relocated. The banks of the pondage would be disturbed during construction of the new apron slab and modification to the existing culvert wingwalls and road embankment. The potential impacts may be minimised by removing only the necessary rocks and potential fish habitat and refugia during construction. This would be done so with minimal intrusion, particularly to the banks where possible, to allow any sheltering species to move away and re-establish in suitable habitat away from the proposal site. This habitat is likely to only provide marginal habitat and removal is unlikely to impact on any resident species due to the large area of alternative habitat in the pondage available.

Increased sedimentation may impact on spawning triggers for some fish species including the Macquarie Perch. Most of the proposal will occur within the areas of bedrock and the potential for sedimentation is less. In addition, mitigation measures including targeted sediment and erosion control plan would be implemented to minimise sedimentation. This would include the use of silt curtains or similar downstream of the culverts. Minimal sedimentation is also essential to ensure the efficient running of the hydroelectric scheme by Snowy Hydro and hence will be carefully managed during construction.

Removal of potential artificial habitat for the Murray Crayfish is unlikely to substantially impact on the species due to the placement of similar artificial habitat during construction of the proposal. In addition, this habitat is unlikely to provide preferred or substantial habitat for the species. The fluctuating water levels of the pondage would not be altered during the construction period and so would be unlikely to affect the species to any degree further than existing pondage operating conditions.

The existing drop from the culvert to the bedrock is currently two to three metres, which limits the movement of fish species through the culvert during periods of low flow. Although the proposal would be designed to limit this drop and potential obstruction of fish passage as much as possible in line with DPI policy, there would still be an almost one metre drop from the culvert to the bedrock.

There is no emergent or in-stream vegetation located in the pondage in the vicinity of the proposal site. Vegetation on the banks of the pondage would be disturbed during construction, however this vegetation is mostly terrestrial vegetation that is inundated by fluctuating pondage levels and is of low quality due to the dominance of introduced groundcover species. Aquatic habitat in the wider study area upstream in Jounama Creek is known to provide habitat for the endangered Booroolong Frog recorded during surveys, however vegetation to be removed by the proposal is unlikely to provide potential habitat for this species (see section 3.3.1). Habitat in the culvert area is mostly deep water habitat surrounded by introduced terrestrial vegetation and lacks favoured Booroolong Frog habitat including cobble banks with fringing aquatic vegetation. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

Removal of the existing apron slab may cause sedimentation of Jounama Pondage if the underlying alluvial material is disturbed during the removal process. Given that the proposal site is located mostly on bedrock, it is unlikely to generate significant amounts of sediment and safeguards would be implemented to prevent surrounding soil from the construction zone entering the pondage. This is discussed further below in section 4.2.1.

The proposal would require the blocking off of individual culvert cells at varying stages (at a minimum one culvert cell would remain open) of construction to divert water around the immediate work area. This has the potential to increase flows through the open culverts, however works would preferably be conducted during the low streamflow period when the increased flow rate would not be expected to be significant. The majority of the work would occur during periods when the proposal site would also be dry and is therefore unlikely to impact on aquatic habitat. Flowing water has the highest potential to result in water quality impacts during construction, which would mostly occur as a result of significant rainfall in the upstream catchment. Construction of the proposal would include close watch of weather conditions and the potential for high stream flows from Jounama Creek to occur, or rising high pondage levels due to pondage operation, in which case construction would cease and any blocking of culvert cells would be removed until water levels dropped.

The *Fisheries NSW policy and guidelines for fish habitat conservation and management* (DPI 2013) would be used to guide the management of impacts on aquatic biodiversity from the proposal.

Consultation with DPI – Fisheries has been undertaken during the preparation of this document to minimise the impact on the aquatic environment (see Appendix E).

4.1.5 Injury and mortality

Death or injury may occur to fauna present during clearing of vegetation during construction. If birds are present but not nesting during construction they will generally move away from the proposal site to escape the disturbance. No hollow-bearing trees would be removed by the proposal, therefore fauna would not be inhibited from moving away from the proposal site.

Injury and mortality of aquatic species is highly unlikely as most of the work would be completed during periods of low pondage levels and water flow through the culvert. In the

unlikely event that aquatic species are present they would generally move away from the proposal site to escape the disturbance.

4.2 Indirect/operational impacts

4.2.1 Sedimentation and bank erosion

The proposal may cause sedimentation of Jounama Pondage through removal of the existing apron slab, vegetation removal and machinery works adjacent to the pondage. There is the potential that works could cause destabilisation of the pondage banks, leading to erosion of the pondage and deposition of sediment, impacting water quality. Due to the low gradient of the banks it is unlikely this would be to a substantial degree to cause significant impacts, however, work on the road embankments and the original Jounama Creek alignment to contain water seepage, also has the potential to cause erosion and sedimentation.

Disturbance to the pondage bed during construction for machinery access and removal of the existing apron slab may result in localised increases in turbidity in Jounama Pondage if the underlying alluvial material is disturbed. Turbidity caused by these activities is expected to be low due to the proposal site being located predominantly on bedrock. There is potential for sediment to be generated during high flow conditions of Jounama Creek, however the construction site would be stabilised prior to predicted rises in flow levels to decrease potential for sediment impacts. Rises of pondage levels are unlikely to result in substantial sediment impacts as rises generally occur as a slow increase and are not rapid.

Construction of the access road and ramp would be out of road base material that is in accordance with Roads and Maritime specifications, containing no dispersive materials and compacted to be stable to reduce the potential for sediment to disperse through the pondage. In addition, larger rocks, to a minimum size of 100 millimetres, would be used for batter construction and as culvert backfill material.

Sedimentation has the potential to affect flora and fauna, including fish, frogs, turtles and macroinvertebrates. Fish normally move away from highly turbid water and potential sedimentation is unlikely to block fish passage due to the location of the proposal site on the edge of Jounama Pondage. More extreme impacts on fish species resulting from sedimentation and accompanying turbidity increases in the river can include:

- Smothering of gill surfaces with sediment leading to asphyxiation
- Swallowing of large amounts of sediment leading to illness
- Inhibition of light penetration into the water column which can affect predator-prey interactions
- Impacts on habitat diversity in the immediate area and downstream by smothering and filling of interstitial spaces inhabited by fish.

An erosion and sediment control plan would be prepared as part of the CEMP to manage potential erosion and sedimentation issues during construction. Potential impacts from sedimentation would also be managed by implementing safeguards identified in section 7 of the REF.

4.2.2 Changes to fish passage

Fish passage is important for several reasons, including:

- Access to habitat, food and shelter
- The avoidance of predators
- Seasonal movement associated with breeding cycles.

Fish passage may be blocked by sedimentation within Jounama Pondage, as described above. There is also potential for fish passage to be blocked during construction activities from closing off culvert cells and during intrusive stages of construction such as apron slab removal. This is unlikely to substantially block fish passage to any greater extent than the existing culvert already imposes, due to at least one of the four culvert cells being open at all times,

and the existing ability of fish to only navigate the migration from Jounama Creek to Jounama Pondage when pondage levels are higher, removing the current two to three metre drop from the culvert. The proposal would decrease the drop of the culvert to about one metre, which is likely to still impose a block to fish passage, although to a decreased extent.

Construction activities in the pondage have the potential to encounter and possibly injure or kill aquatic fauna and flora species, possibly by direct contact from machinery. However, this would be minimised by construction being mostly conducted during low pondage levels and low periods of creek flow when aquatic species would be away from the proposal site.

The potential deposition of debris from construction and demolition, including sediment, in the pondage could also impact on fish passage in the area by creating blockages. Construction activities have been designed to minimise any deposition of debris in the pondage by using larger size rocks for apron and batter construction and road base material for access roads that is in accordance with Roads and Maritime specifications.

Potential water quality impacts would also be managed by implementing safeguards identified in section 7 of the REF.

4.2.3 Disturbance of bats roosting in culvert

Culverts may be used as temporary roosting habitat by bat species such as the Eastern Bentwing-bat. Unmanaged construction works have the potential to result in stress, injury or mortality of microbats within a roosting colony. Disturbance of roosting individuals through noise, light or vibration, which may cause them to leave the roost during daylight hours, would increase energy expenditure and stress levels, and increase the risk of predation by diurnal birds. In addition, the culverts themselves are not being replaced for the proposal, which is limited to repairing the apron slab, existing wingwalls and batter. Surveys of the culverts indicated limited bat roosting habitat with any potential habitat not being removed by the proposal, which is therefore unlikely to impact any potential artificial habitat.

With the implementation of safeguards in section 5 including culvert inspections, if required, the proposal would be unlikely to substantially affect bats in the study area.

4.2.4 Invasion and spread of weeds

Groundcover vegetation in the study area is dominated by introduced species. The proposal has the potential to further introduce and spread weeds in the study area by movement of machinery and light vehicle traffic during construction of the proposal.

One priority weed species was identified during the surveys; Blackberry, which is present primarily along the banks of Jounama Creek in the study area with scattered occurrences around the edges of Jounama Pondage.

The spread of weeds is of particular concern in areas that are more dominated by native species, which are generally located in the tracts of forest and National Park and away from disturbance including the road and camping ground. It is unlikely the proposal would cause the further spread of weeds into these areas beyond that which already exists. The spread of weeds would be managed by implementing safeguards identified in section 5.2.

4.2.5 Water quality

The proposal has the potential to cause impacts to aquatic flora and fauna in Jounama Pondage through spills of contaminants such as fuels or chemicals. This may occur during refuelling operations or during preparation and use of chemicals for weed management. Spills could potentially contaminate habitat for species dependent on aquatic habitat such as frogs and fish.

The potential for wet concrete to cure when submerged in the pondage has the potential to cause an increase in the pH of the surrounding water and negatively impact on aquatic fauna within the pondage. The potential increase in pH of the water decreases as the concrete

cures, with spikes in pH levels highest within the first few hours and highly localised (CTC & Associates 2016). Flowing water has the highest potential for uncured concrete to result in water quality impacts. The proposal would mostly be constructed during periods of low flow and therefore the uncured concrete would not immediately be in contact with the surrounding water. In addition, any rises in water are generally as a result of rises in the pondage level from dam operation and not increases in stream flow from Jounama Creek. Construction of the proposal would include close watch of weather conditions and the potential for high stream flows from Jounama Creek to occur in which case construction would cease.

Potential water quality impacts from sedimentation are described above in section 4.2.1.

Potential water quality impacts would be minimised through the implementation of safeguards outlined in section 5.2.

4.2.6 Invasion and spread of pathogens and disease

The proposal has the potential to result in the spread of pathogens such as bacteria and fungi. This could occur through the spread of soils on vehicle tyres and operatives' footwear. Impacts of pathogens include spread of known diseases that are detrimental to fauna such as the amphibian chytrid fungus and psittacine circoviral disease. A known population of the endangered Booroolong Frog occurs upstream of the proposal in the unregulated portion of Jounama Creek. While the proposal would be limited to downstream, in deep water habitat unsuitable for the species, it is extremely important not to introduce the amphibian chytrid fungus into this population at the detriment to its continued persistence.

The potential spread of pathogens would be minimised through the implementation of safeguards outlined in section 5.2.

4.2.7 Noise and vibration

The proposal is likely to result in an increase of noise and vibration during construction. This would mostly result from construction machinery and vehicles accessing the proposal site. This has the potential to temporarily affect the use of the study area by fauna species, however, most will generally move away from the source to an alternative area of nearby habitat. Increased noise and vibration activity would be likely to be short in duration and only during the construction period.

4.2.8 Groundwater dependent ecosystems

The proposal is located in the catchment of the groundwater dependent ecosystems identified in section 3.2.4. The proposal would require the removal of regrowth shrubs and native grassland, which are not a part of a groundwater dependent ecosystem. The proposal would not involve any major earth works or other activities which are likely to impact the groundwater dependent ecosystems and is unlikely to substantially alter the local groundwater system in the study area.

4.3 Key threatening processes

The proposal would result in the following key threatening processes listed under the BC Act, FM Act and/or EPBC Act:

- Clearing of native vegetation (BC Act and EPBC Act) – the proposal would remove about 0.2 hectares of native vegetation from the proposal site
- Invasion of native plant communities by exotic perennial grasses – the study area is already dominated by exotic perennial grasses; however, the proposal could lead to the further spread of exotic perennial grasses such as *Paspalum*.

The proposal has the potential to result in the FM Act listed key threatening process; installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams. However, due to the existing culvert having previously altered the natural flow regime of Jounama Creek, it is unlikely the proposal would have a negative

impact. In addition, the proposal would decrease the current drop from the culvert to the bedrock of the pondage, which would create a more natural flow.

The impacts of key threatening processes would be minimised through the implementation of safeguards detailed in section 5.2.

4.4 Cumulative impacts

There are no currently known projects being undertaken in Talbingo, however, Roads and Maritime are proposing to conduct routine maintenance and repair work on bridges and bridge sized culvers and repair and reinstatement of slips that may occur in mountainous areas. A constraints analysis was conducted for these works along a section of the Snowy Mountains Highway, between the Hume Highway junctions to the Yarrangobilly Caves Road south-east of Talbingo. Three of these bridges and/or culverts occur in the locality of the proposal, including the proposal itself.

The proposal would have cumulative impacts with the proposed maintenance work in other locations within the locality, including a minor removal of native vegetation, although of low diversity and condition, and potential erosion and sedimentation impacts during construction. Potential cumulative impacts are considered to be low.

4.5 Assessments of significance

The assessment of likelihood of occurrence found that the proposal may potentially impact on one bird, one mammal, one amphibian and one crustacean species listed under the BC Act and/or FM Act that are known or likely to occur in the study area. Assessments of significance under section 1.7 of the EP&A Act were completed for these species to determine if a significant impact is likely to result from the proposal.

Assessments of significance (Appendix C) concluded that the proposal is unlikely to have a significant impact on these biota, primarily due to the minor removal of potential habitat and the significant high quality habitat remaining in the study area and locality (see Table 4.3). The preparation of a species impact statement is not required.

The assessment of likelihood of occurrence found that the proposal may potentially impact upon one amphibian species listed as threatened under the EPBC Act (Appendix B). The EPBC Act Policy Statement *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DotE 2013) was reviewed when determining if a significant impact is likely on a matter of NES (Appendix C).

The significance assessment concluded that the proposal would be unlikely to have a significant impact on the amphibian species primarily due to areas of potential habitat for the species being restricted to upstream of the proposal site (see Table 4.3).

Table 4.3: Summary of assessment of significance results

EP&A Act assessments of significance						
Threatened species, or communities	Significance assessment question ¹					Likely significant impact?
	a	b	c	d	e	
Booroolong Frog	N	X	N	N	Y	No
Eastern Bentwing-bat	N	X	N	N	Y	No
Gang-gang Cockatoo	N	X	N	N	Y	No
Murray Crayfish	N	X	N	N	Y	No
EPBC Act assessments						

Threatened species, or communities	Important population / habitat critical to the survival of species	Likely significant impact?
Booroolong Frog	No	No

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

1. Significance Assessment Questions as set out in the *Biodiversity Conservation Act 2016*
 - 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,
 - b 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,
 - c 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,
 - 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)
 - e 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.
2. A 'population of a species' as determined by the *Environment Protection and Biodiversity Conservation Act 1999* is an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
 - a a geographically distinct regional population, or collection of local populations, or
 - a population, or collection of local populations, that occurs within a particular bioregion.

Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:

- a is likely to be key source populations either for breeding or dispersal
- b is likely to be necessary for maintaining genetic diversity
- c is at or near the limit of the species range.

4.6 Impact summary

A summary of the impacts of the proposal is provided in Table 4.4.

Table 4.4: Summary of impacts

Impact	Biodiversity values	Nature of impact (Direct, indirect, cumulative)	Extent of impact (Site based, local, regional, state, national)	Duration (Short term, long term)	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment (Known, unknown, unpredictable or irreversible)
Removal of native vegetation	Native vegetation	Direct	Site based	Long term	• Clearing of native vegetation	Known
Removal of threatened fauna habitat	Gang-gang Cockatoo Eastern Bentwing-bat Murray Crayfish	Direct	Site based	Long term	• Clearing of native vegetation	Known
Aquatic impacts	Water quality, removal of artificial habitat	Direct	Site based/local	Short term	N/A	Known
Injury and mortality of fauna	Fauna	Direct	Site based	Short term	N/A	Known
Wildlife connectivity and habitat fragmentation	Native vegetation connectivity	Cumulative	Unlikely	N/A	N/A	Known
Disturbance of bats roosting in culvert	Bats	Indirect	Site based	Short term	N/A	Known
Sedimentation and bank erosion	Water quality	Indirect	Site based/local	Short term	N/A	Unpredictable
Changes to fish passage	Fish	Indirect	Site based/local	Short term	N/A	Unpredictable
Invasion and spread of weeds	Native vegetation	Cumulative	Site based/local	Long term	• Invasion of native plant communities by exotic perennial grasses	Known

Impact	Biodiversity values	Nature of impact (Direct, indirect, cumulative)	Extent of impact (Site based, local, regional, state, national)	Duration (Short term, long term)	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment (Known, unknown, unpredictable or irreversible)
Water quality	Water quality	Indirect	Site based/local	Short term	N/A	Unpredictable
Invasion and spread of pathogens and disease	Vegetation and frogs	Indirect	Unlikely	N/A	N/A	Known
Groundwater dependent ecosystems	Groundwater dependent ecosystems	Indirect	Unlikely	N/A	N/A	Known
Noise and vibration	Fauna	Indirect	Local	Short term	N/A	Known

5 Avoid, minimise and mitigate impacts

Development of the proposal has incorporated a hierarchy of avoiding, minimising and mitigating impacts wherever possible.

5.1 Avoidance and minimisation

The “avoid, minimise, mitigate and offset” hierarchy has been followed in relation to impacts on threatened species, ecological communities and migratory species listed under the BC Act, FM Act and the EPBC Act.

To minimise impacts on native vegetation the compound site and access track have been designed to occur within previously disturbed corridors with low quality native vegetation. Areas of vegetation removal have been kept to a minimum to reduce impact. Stockpile sites have been located within existing stockpile site areas to avoid impacts to native vegetation.

Rehabilitation works within Jounama Creek have been designed to minimise impacts on aquatic habitat through sedimentation controls and use of some precast concrete and large infill rocks to reduce use of wet concrete. Most of the construction would be completed during periods of low pondage levels and low flow of Jounama Creek to minimise the potential for sediment impacts on the pondage. In addition, a crane would be used from outside of the pondage to transport materials to the work site to limit the required construction plant and machinery within the pondage and associated impacts these may cause, including sediment impacts and potential fuel spills.

The proposal has also been designed to avoid the complete blocking of Jounama Creek, with at least one of the four culvert cells being open at all times. This would avoid potential blocking of fish passage.

Biodiversity offsetting is not required for the proposal due to the limited removal of native vegetation.

5.2 Mitigation measures

The safeguards and management measures detailed in Table 5.1 would be implemented to minimise the impacts of the proposal on the ecology of the study area. These safeguards and management measures would be incorporated into a construction environmental management plan (CEMP) to be implemented during construction.

Table 5.1: Mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Residual impacts anticipated
Removal of native vegetation	<p>Flora and fauna management measures will prepared as part of the Construction Environmental Management Plan (CEMP) to minimise the ecological impacts of the proposal. It will address terrestrial and aquatic matters and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> Plans for the construction site and adjoining area showing native vegetation, including the boundaries of Kosciuszko National Park (particularly the portion located on the western side of the highway), flora and fauna habitat and threatened species Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features and areas for rehabilitation or re-establishment of native vegetation Procedures addressing relevant matters specified in the <i>Biodiversity guidelines – Protecting and Managing biodiversity on Roads and Maritime projects</i> including but not limited to: <ul style="list-style-type: none"> Pre-clearing including establishment of exclusion zones and on-ground identification of specific habitat features to be retained Vegetation clearing and bushrock removal Fauna handling and unexpected threatened species finds Rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions <p>Monitoring during construction and post-construction adaptive management measures to be applied if monitoring indicates unexpected adverse impact.</p>	Project manager	Detailed design / pre-construction	Loss of 0.2 hectares of native vegetation
Impacts to fauna	Clearing of vegetation will be undertaken as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 4: Clearing of vegetation and removal of bushrock</i> .	Contractor / Roads and Maritime project manager	Construction	Unlikely
	If required, fauna handling during vegetation removal will be undertaken by a licensed fauna ecologist or wildlife carer, as detailed in RTA (2011) - <i>Biodiversity Guidelines Guide 9: Fauna handling</i> .	Contractor / Roads and	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Residual impacts anticipated
		Maritime project manager		
	All staff working on site will undertake a site-specific environmental induction. This will include the limits of vegetation clearing and the areas of vegetation to be retained.	Project manager/contractor	Construction	
	All vehicles and equipment used for construction will adhere to the access tracks, existing roads and exclusion areas outlined in the traffic management plan (TMP).	Project manager/contractor	Construction	
General	All staff working on site will undertake a site-specific environmental induction. This will include the limits of vegetation clearing and the areas of vegetation to be retained.	Project manager/contractor	Construction	Unlikely
	All vehicles and equipment used for construction will adhere to the access tracks, existing roads and exclusion areas outlined in the traffic management plan (TMP).	Project manager/contractor	Construction	
	Revegetate or replant disturbed areas with native vegetation following construction in accordance with the Roads and Maritime <i>Biodiversity Guidelines</i> (RTA 2011).	Project manager/contractor	Construction	
Aquatic impacts	Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures</i> of the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI 2013).	Project manager/contractor	Construction	Unlikely
	A maximum of half the culverts will be blocked off at any one time during construction, to maintain flow from Jounama Creek to Jounama Pondage.	Project manager/contractor	Construction	
	Any herbicides used for weed control will be applied to the manufacturers Material Safety Data Sheet.	Project manager/contractor	Construction	Unlikely

Impact	Environmental safeguards	Responsibility	Timing	Residual impacts anticipated
Chemical impacts on flora and fauna	Broad spectrum non-selective herbicides (residual herbicides) will not be used. Herbicides selected for use will be appropriate for the species being treated.	Project manager/contractor	Construction	
	Spraying of herbicides will not be undertaken in windy weather or within such distance of a watercourse as would cause any of the herbicide to enter the water.	Project manager/contractor	Construction	
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor / Roads and Maritime project manager	Construction	Unlikely
Invasion and spread of pathogens and disease	Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011) – <i>Biodiversity Guidelines Guide 7: Pathogen management</i> .	Contractor / Roads and Maritime project manager	Construction	Unlikely

6 Conclusion

The study area has generally been modified by the construction of the Snowy Mountains Highway and other local roads and access tracks, and for the development of the Snowy Mountains Scheme, which includes Jounama Pondage. The proposal site occurs within the road reserve of the Snowy Mountains Highway, with Kosciuszko National Park predominantly occurring to the east, south and north and Jounama Pondage to the west. Vegetation in the road reserve is directly connected to remnant vegetation in Kosciuszko National Park and is known to provide habitat for a range of fauna species listed under the BC Act and/or the EPBC Act. Aquatic habitats in the study area are also known to provide habitat for a range of fauna species listed under the BC Act, FM Act and/or the EPBC Act.

The proposal has the potential to affect one bird species, one amphibian species, one bat species and one crustacean listed under the BC Act, FM Act and/or EPBC Act.

The proposal would remove 0.32 hectares of vegetation, of which 0.2 hectares is native. The area of native vegetation to be removed mostly consists of regrowth shrubs. About 0.09 hectares of aquatic habitat would also be impacted by the proposal, either directly or indirectly.

A number of safeguards and mitigation measures are proposed to minimise the impacts of the proposal on native flora and fauna, particularly biota listed under the BC Act, FM Act and EPBC Act. Assessments of significance were completed with reference to section 1.7 of the EP&A Act and EPBC Act 'Significant Impact Guidelines 1.1 Matters of National Environmental Significance'. The assessments concluded the proposal is unlikely to have a significant impact on any biota listed under the BC Act or FM Act and therefore a species impact statement is not required. The proposal is also unlikely to have a significant impact on any biota listed under the EPBC Act and a referral to the Australian Government Minister for the Environment is not required.

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Appendix A – Species recorded

Recorded flora

Family	Scientific Name	Common name	Status		Abundance in each plot*		Incidental
			BC Act	EPBC Act	1	2	
Fabaceae	<i>Acacia dealbata</i>	Silver Wattle					✓
Fabaceae	<i>Acacia melanoxylon</i>	Blackwood				0.5	✓
Fabaceae	<i>Acacia rubida</i>	Red-stemmed Wattle					✓
Rosaceae	<i>Acaena novae-zelandiae</i>	Bidgee-widgee			0.1	0.1	
Sapindaceae	<i>Acer</i> sp.*	Maple species			5		
Poaceae	<i>Avena fatua</i> *	Wild Oats			0.5		
Poaceae	<i>Bothriochloa macra</i>	Red-leg Grass			0.5		
Poaceae	<i>Briza maxima</i> *	Quaking Grass			0.1	0.1	
Poaceae	<i>Briza minor</i> *	Shivery Grass			0.1		
Myrtaceae	<i>Callistemon sieberi</i>	River Bottlebrush					
Gentianaceae	<i>Centaurium erythraea</i> *	Common Centaury			0.2		
Pteridaceae	<i>Cheilanthes sieberi</i>	Rock Fern			0.1		
Poaceae	<i>Chloris truncata</i>	Windmill Grass			0.1		
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane				0.1	✓
Asteraceae	<i>Conyza sumatrensis</i> *	Tall Fleabane			0.1	0.1	
Rosaceae	<i>Cotoneaster</i> sp.*						✓
Rosaceae	<i>Crataegus monogyna</i>	Hawthorn					✓
Poaceae	<i>Cynodon dactylon</i>	Couch			0.2	0.5	
Cyperaceae	<i>Cyperus eragrostis</i> *	Umbrella Sedge					
Poaceae	<i>Dactylis glomerata</i> *	Cocksfoot			2	0.5	✓
Poaceae	<i>Dichelachne</i> sp.	Plumegrass				0.1	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed					
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush				2	
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Narrow-leaved Hopbush					✓
Boraginaceae	<i>Echium plantagineum</i>	Paterson's Curse					✓
Boraginaceae	<i>Echium vulgare</i> *	Vipers Bugloss			0.1	0.1	
Poaceae	<i>Eleusine tristachya</i> *	Goose Grass			0.1		
Onagraceae	<i>Epilobium hirtigerum</i>					0.1	

Family	Scientific Name	Common name	Status		Abundance in each plot*		Incidental
			BC Act	EPBC Act	1	2	
Poaceae	<i>Eragrostis cilianensis</i> *	Stinkgrass					✓
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass				0.2	
Asteraceae	<i>Euchiton</i> sp.	Cudweed species			0.1		
Euphorbiaceae	<i>Euphorbia drummondii</i>	Caustic Weed				0.1	
Santalaceae	<i>Exocarpos cupressiformis</i>	Native Cherry				0.1	✓
Poaceae	<i>Holcus lanatus</i> *	Yorkshire Fog					
Hypericaceae	<i>Hypericum perforatum</i> *	St. John's Wort			0.1	0.1	
Asteraceae	<i>Hypochaeris radicata</i> *	Catsear			0.2	0.2	
Juncaceae	<i>Juncus</i> sp.				0.1		
Myrtaceae	<i>Kunzea parvifolia</i>	Violet Kunzea			0.1	2	
Myrtaceae	<i>Leptospermum brevipes</i>	Slender Tea-tree				60	
Oleaceae	<i>Ligustrum</i> sp.*	Privet			0.1		
Onagraceae	<i>Ludwigia peploides</i>	Water Primrose					✓
Fabaceae	<i>Medicago</i> sp.*	Medic species			0.1		
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass				0.5	
Orobanchaceae	<i>Orobanche minor</i> *				0.1		
Oxalidaceae	<i>Oxalis corniculata</i> *				0.1		
Poaceae	<i>Panicum</i> sp.				0.1	0.5	
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum			2	1	✓
Poaceae	<i>Phalaris aquatica</i> *	Phalaris			10		✓
Plantaginaceae	<i>Plantago lanceolata</i> *	Lamb's Tongues			0.1		✓
Poaceae	<i>Poa sieberiana</i>	Snowgrass			0.1	0.3	
Poaceae	<i>Poa</i> sp.				0.1		
Polygonaceae	<i>Polygonum</i> sp.*						✓
Ranunculaceae	<i>Ranunculus sessiliflorus</i>	Small-flowered Buttercup					✓
Polygonaceae	<i>Rumex crispus</i> *	Curled Dock					✓
Rosaceae	<i>Rubus fruticosus</i> *	Blackberry				2	✓
Poaceae	<i>Setaria verticillata</i> *	Whorled Pigeon Grass				0.3	✓
Asteraceae	<i>Solenogyne dominii</i>				0.1	0.1	
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass			60		✓
Fabaceae	<i>Trifolium angustifolium</i> *	Narrow-leaved Clover			0.1		

Family	Scientific Name	Common name	Status		Abundance in each plot*		Incidental
			BC Act	EPBC Act	1	2	
Fabaceae	<i>Trifolium arvense</i> *	Haresfoot Clover				0.1	
Scrophulariaceae	<i>Verbascum virgatum</i> *	Twiggy Mullein					✓
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop				0.1	✓
Poaceae	<i>Vulpia bromoides</i> *	Squirrel Tail Fescue			0.1		

Recorded fauna

Scientific Name	Common name	Status		Observation type			
		BC Act	EPB C Act	Bird survey	Incidental	Spot-lighting	Anabat
BIRDS							
Anhinga novaehollandiae	Australasian Darter	-	-		O		
Alisterus scapularis	Australian King Parrot	-	-		O, W		
Cracticus tibicen	Australian Magpie	-	-	O, W	O, W		
Corvus coronoides	Australian Raven	-	-		O		
Chenonetta jubata	Australian Wood Duck	-	-		O		
Turdus merula*	Blackbird	-	-		O, W		
Phaps chalcoptera	Common Bronzewing	-	-		O		
Platycercus elegans	Crimson Rosella	-	-		O, W		
Acanthorhynchus tenuirostris	Eastern Spinebill	-	-		O, W		
Psophodes olivaceus	Eastern Whipbird	-	-		O, W		
Eopsaltria australis	Eastern Yellow Robin	-	-	O, W	O, W		
Carduelis carduelis*	European Goldfinch	-	-		O		
Eolophus roseicapilla	Galah	-	-		O, W		
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	O, W	O, W		
Pachycephala pectoralis	Golden Whistler	-	-	O, W	O, W		
Rhipidura albiscapa	Grey Fantail	-	-	O, W	O, W		
Dacelo novaeguineae	Laughing Kookaburra	-	-	O, W	O, W		
Grallina cyanoleuca	Magpie Lark	-	-		O, W		
Vanellus miles	Masked Lapwing	-	-		O, W		
Phylidonyris novaehollandiae	New Holland Honeyeater	-	-		O, W		
Oriolus sagittatus	Olive-backed Oriole	-	-		O, W		
Anas superciliosa	Pacific Black Duck	-	-		O		
Strepera graculina	Pied Currawong	-	-	O, W	O, W		
Neochmia temporalis	Red-browed Finch	-	-		O, W		
Todiramphus sanctus	Sacred Kingfisher	-	-		O		
Ptilonorhynchus violaceus	Satin Bowerbird	-	-	O, W	O, W		
Zosterops lateralis	Silvereye	-	-	W			
Pardalotus punctatus	Spotted Pardalote	-	-	W			
Sturnus vulgaris*	Starling	-	-		O		

Scientific Name	Common name	Status		Observation type			
		BC Act	EPB C Act	Bird survey	Incidental	Spot-lighting	Anabat
<i>Pardalotus striatus</i>	Striated Pardalote	-	-	W			
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	-	-	O, W	O, W		
<i>Malurus cyaneus</i>	Superb Fairy-wren	-	-	O, W	O, W		
<i>Aquila audax</i>	Wedge-tailed Eagle	-	-		O		
<i>Gerygone fusca</i>	Western Gerygone	-	-	O, W	O, W		
<i>Sericornis frontalis</i>	White-browed Scrubwren	-	-	O, W	O, W		
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	-	-	O, W	O, W		
<i>Egretta novaehollandiae</i>	White-faced Heron	-	-		O		
<i>Ardea pacifica</i>	White-necked Heron	-	-		O		
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	-	-	O, W	O, W		
<i>Cormobates leucophaea</i>	White-throated Treecreeper	-	-	O, W	O, W		
<i>Rhipidura leucophrys</i>	Willie Wagtail	-	-	O, W	O, W		
<i>Acanthiza nana</i>	Yellow Thornbill	-	-	O, W	O, W		
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	-	-	O, W	O, W		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	-	-	O, W	O, W		
<i>Calyptrorhynchus funereus</i>	Yellow-tailed Black Cockatoo	-	-	O, W	O, W		
MAMMALS							
<i>Chalinolobus morio</i>	Chocolate Wattled Bat						Pr
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat						Pr
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	-	-		O		
<i>Sus scrofa</i> *	Feral Pig	-	-		O		
<i>Nyctophilus gouldii/geoffroyi</i>	Gould's Long-eared Bat / Lesser Long-eared Bat						D
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat						D
<i>Vespadelus darlingtoni</i>	Large Forest Bat						D
<i>Oryctolagus cuniculus</i> *	Rabbit	-	-		O		
<i>Vespadelus regulus</i>	Southern Forest Bat						Pr
<i>Austronomus australis</i>	White-striped Freetail Bat	-	-			W	D
AMPHIBIANS							
<i>Litoria booroolongensis</i>	Booroolong Frog	E	E			O	

Scientific Name	Common name	Status		Observation type			
		BC Act	EPB C Act	Bird survey	Incidental	Spot-lighting	Anabat
REPTILES							
<i>Intellagama lesueurii</i>	Australian Water Dragon	-	-		O		
<i>Egernia sp.</i>		-	-		O		

*Bold denotes native species, * denotes introduced*

Appendix B – Habitat assessment table

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Habitat assessment table

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Threatened ecological communities					
Alpine Sphagnum Bogs and associated Fens	-	E	Boggy soils in hollows and drainage lines above 1500 m elevation. The bog soils are generally more acidic and have less phosphorus, nitrogen and potassium than those of the fens, although the two types of wetland are often juxtaposed. Restricted to Kosciuszko plateau and north to the Brindabella range. Also in the Victorian alps.	Predicted likely to occur from PMST.	Low – Community unlikely to occur within the study area due to elevation below 1500 metres. Low – Unlikely to be impacted by the proposal.
Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	E	E	Grey box woodlands includes those woodlands in which the most characteristic tree species, <i>Eucalyptus microcarpa</i> (Inland Grey Box), is often found in association with <i>E. populnea subsp. bimbil</i> (Bimble or Poplar Box), <i>Callitris glaucophylla</i> (White Cypress Pine), <i>Brachychiton populneus</i> (Kurrajong), <i>Allocasuarina luehmannii</i>	May occur from PMST search.	Low - This community is unlikely to occur within the study area and wasn't recorded during current surveys.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			(Bullock) or <i>E. melliodora</i> (Yellow Box), and sometimes with <i>E. albens</i> (White Box). The community occurs on fertile soils of the western slopes and plains of NSW. The community generally occurs where average rainfall is 375- 800 mm pa and the mean maximum annual temperature is 22- 26°C.		Low – Unlikely to be impacted by the proposal.
Natural Temperate Grassland of the South Eastern Highlands	-	CE	Natural Temperate Grassland is confined to the Southern Tablelands, a region bounded by the ACT, Yass, Boorowa, the Abercrombie River, Goulburn, the Great Eastern Escarpment, the Victorian border and the eastern boundary of Kosciusko National Park. The community occurs in a number of distinct plant associations (see Armstrong et al., 2013). According to the association present, the community is found in various topographical positions and on a variety of substrates. The altitudinal range of the community is between 500 m and 1200 m asl. The community is found on broad sweeping plains with poor drainage and cold air inversions that promote frosts which inhibit tree growth; on all topographical locations, including upper-slopes, crests and plateaux on basalt landscapes; and in frost hollows in areas otherwise dominated by woodlands or forests. The community may also occur in a landscape mosaic with several woodland communities.	Predicted likely to occur from PMST.	Low - This community is unlikely to occur within the study area and wasn't recorded during current surveys. Low – Unlikely to be impacted by the proposal.
White Box Yellow Box Blakely's Red Gum Woodland	E	CE	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (<i>E. bridgesiana</i>), Red Box (<i>E. polyanthemus</i>), Candlebark (<i>E. rubida</i>), Snow Gum (<i>E. pauciflora</i>), Argyle Apple (<i>E. cinerea</i>), Brittle Gum (<i>E. mannifera</i>), Red Stringybark (<i>E. macrorhyncha</i>), Grey Box (<i>E. microcarpa</i>), Cabbage Gum (<i>E. amplifolia</i>) and others.	May occur from PMST search.	Low - This community is unlikely to occur within the study area and wasn't recorded during current surveys. Low – Unlikely to be impacted by the proposal.
Flora					
Bago Leek Orchid <i>Prasophyllum bagoensis</i>	CE	CE	Currently known from a single population on land covered by a Crown Lease on State Forest near Tumbarumba on the Southern Tablelands of NSW. The species occurs over about 12 ha of sub-alpine grassy plain and wetland at an elevation of about 1100 m. Its distribution may extend into adjacent woodlands. Found in grassy, low heathland	Predicted likely to occur from PMST.	Low – Unlikely to occur due to lack of suitable potential habitat occurring within the study area. Low – Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			dominated by <i>Poa clivicola</i> , <i>Epacris gunnii</i> and <i>E. celata</i> on a subalpine plain bordered by Snow Gum and Mountain Gum.		
Black-hooded Sun Orchid <i>Thelymitra atronitida</i>	CE	-	In New South Wales, The Black-hooded Sun Orchid is known from two localities, Cape Solander in Botany Bay National Park in southern Sydney, and Bago State Forest south of Tumut. The known occurrences in NSW fall in parts of the Sutherland and either or both of the Tumut and Tumbarumba Local Government Areas. In the Bago area it is recorded as occurring in open forest with a heathy understorey on well-drained sand or clay-loam soils.	Predicted from OEH habitat distribution.	Moderate – Potential habitat may occur within open forest in study area. Low – Unlikely to be impacted by the proposal due to work being outside of potential forest habitat.
Blue-tongued Greenhood <i>Pterostylis oreophila</i>	CE	CE	In New South Wales, the Blue-tongued Greenhood is known from a few small populations within Kosciuszko National Park and a population of about 40 plants (possibly now extinct) in Bago State Forest and adjoining Crown Leases south of Tumut. The known distribution includes parts of the Snowy River, Tumbarumba and possibly Tumut Local Government Areas. The Blue-tongued Greenhood is also known from the Australian Capital Territory (Brindabella Range) and in montane areas of far north-eastern Victoria. Grows along sub-alpine watercourses under more open thickets of Mountain Tea-tree in muddy ground very close to water.	Predicted likely to occur from PMST.	Low – Unlikely to occur due to lack of suitable potential habitat occurring within the study area. Low – Unlikely to be impacted by the proposal.
Brandys Marys leek- orchid <i>Prasophyllum innubum</i>	CE	CE	In New South Wales, <i>Prasophyllum innubum</i> is known from a single population comprising about seven small colonies, totalling about 400 individuals, from a small area about 30 kilometres north-west of Cabramurra and about 17 kilometres south of Talbingo, in the Tumbarumba Local Government Area. The species occurs in Bago State Forest and apparently also on adjacent Crown forestry lease and private freehold. The species is not known to occur in any conservation reserves. The species is known only from a highly restricted streamside habitat and sphagnum hummocks, and rarely on adjacent grassy flats, at altitudes of 1150-1180 metres.	Predicted from OEH habitat distribution.	Low - Unlikely to occur within the study area due to the lower elevation than required for species and highly disturbed streamside habitat available. Low – Unlikely to be impacted by the proposal.
Cotoneaster Pomaderris <i>Pomaderris cotoneaster</i>	E	E	Cotoneaster Pomaderris has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, Bungonia State Conservation Area, the Yerranderie area, Kanangra-Boyd National Park, the Canyonleigh area and Ettrema Gorge in	Predicted from OEH habitat distribution.	Low – Unlikely to occur within the study area due to highly disturbed streamside habitat available and not observed during current surveys.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			Morton National Park. The species has also been recorded along the Genoa River in Victoria. Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.		Low – Unlikely to be impacted by the proposal.
Curtis Colobanth <i>Colobanthus curtisiae</i>	-	V	In Victoria and NSW, the species occurs in treeless vegetation in the Australian Alps (but may extend for a short distance into adjoining snow gum woodland) (McDougall and Walsh 2007). Based on herbarium records, Doherty and colleagues (2015) note that in New South Wales, the species is endemic to Kosciusko National Park where it occurs in subalpine / montane treeless zone below 1800 metres altitude. Curtis' Colobanth is found in grassland and grassy woodland. The species can also be found in areas subject to a variety of environmental conditions. It is commonly found on gentle slopes with elevations between 160 metres in lowland areas and 1300 metres in alpine areas. The species is found in areas of annual rainfall between 530 mm in the Midlands and 1400 millimetres on Ben Lomond. Curtis' Colobanth is commonly found on soils derived from sandstone as well as clay loams derived from dolerite and basalt. It can persist in remnant grasslands grazed by stock.	Predicted likely to occur from PMST.	Low – Unlikely to occur due to preferential natural treeless habitat not occurring within the study area. Low – Unlikely to be impacted by the proposal.
Kelton's Leek Orchid <i>Prasophyllum keltonii</i>	CE	CE	Kelton's Leek Orchid is known from a single population that occurs in a small area known as McPhersons Plain, about 30 kilometres north-west of Cabramurra and about 17 kilometres south of Talbingo, in the Tumbarumba Local Government Area. The known population, which is intermingled with the Bago Leek Orchid, is recorded as comprising approximately 400 plants, of which about 380 occur on the Brandy Marys State Forest Crown Leases, and about 20 on an adjacent private property. Surveys over six years up to 2005 have found no plants in the adjoining Bago State Forest. The species is not known to occur in any conservation reserves. The species is known only from a highly restricted habitat on the treeless McPhersons Plain, an area that includes sub-alpine grassland, sphagnum bogs, and open heathland, at an elevation of 1,100 metres. The species has a preference for grassland.	Predicted from OEH habitat distribution.	Low - Unlikely to occur within the study area due to the lower elevation than required for species and lack of natural grassland habitat. Low – Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Leafy Anchor Plant <i>Discaria nitida</i>	V	-	The Leafy Anchor Plant is confined to the far south of the Southern Tablelands of NSW and the north-east highlands of Victoria. In NSW the Leafy Anchor Plant grows mostly within Kosciuszko National Park, south from the Blue Water Holes – Yarrangobilly Caves area to south-west of Jindabyne, at altitudes above 900 metres. In NSW 18 sites are known with a total population of about 2,800 plants. Generally occurs on or close to stream banks and on rocky areas near small waterfalls. The species occurs in both woodland with heathy riparian vegetation and on treeless grassy sub-alpine plains. Most population survive in sites that appear to be rarely burnt "fire refugia". The species is known to be highly fire sensitive and most plants that have been observed to have been burnt, even lightly, have died and there has been very little post fire recruitment.	Predicted from OEH habitat distribution.	Low – Unlikely to occur within the study area due to lack of suitable potential habitat and lower elevation than required for species. Low – Unlikely to be impacted by the proposal.
Pine Donkey Orchid <i>Diuris tricolor</i>	V	-	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. Localities in the south include Red Hill north of Narrandera, Coolamon, and several sites west of Wagga Wagga. Condobolin-Nymagee road, Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal, in the Central West. Pilliga SCA, Pilliga National Park and Bibblewindi State Forest in the north and Muswellbrook in the east. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include <i>Callitris glaucophylla</i> , <i>Eucalyptus populnea</i> , <i>Eucalyptus intertexta</i> , Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species.	Predicted from OEH habitat distribution.	Low – Unlikely to occur within the study area due to lack of suitable shrubland and woodland habitat. Low – Unlikely to be impacted by the proposal.
Raleigh Sedge <i>Carex raleighii</i>	E	-	In NSW Raleigh Sedge is found only in areas above about 1000 metres on the Southern Tablelands. Most populations are in Kosciuszko National Park (eg. Charlottes Pass area, Muellers Pass, Tantangara area and the upper Tooma and Tumut valleys). Also occurs in vicinity of Snowy Plain (private land and travelling stock reserve) and on the coastal escarpment at the headwaters of Tantawangalo Creek within South East Forests National Park. Grows in sphagnum bogs and high mountain wetlands, as well as damp grasslands and stream-edges of sub-alpine plains.	PMST/OEH Historical record exists seven kilometres south west of proposal site.	Low – Unlikely to occur due to lack of suitable sphagnum bog habitat within the study area and the lower elevation than required for species. Low – Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Tumut Grevillea <i>Grevillea wilkinsonii</i>	E	E	The Tumut Grevillea has a highly restricted distribution in the NSW South-west Slopes region. Its main occurrence is along a 6 kilometre stretch of the Goobarragandra River approximately 20 kilometres east of Tumut where about 1,000 plants are known. The other occurrence is a small population that straddles the boundary of two private properties at Gundagai where only eight mature plants survive. The associated native vegetation in the Goobarragandra sites are typically remnant riverine shrub communities adjacent to open-forest, with the most common tree species being Blakely's Red Gum (<i>E. blakelyi</i>), Apple Box (<i>E. bridgesiana</i>), Yellow Box (<i>E. melliodora</i>), and Red Stringybark (<i>E. macrorhyncha</i>) and with Kurrajongs (<i>Brachychiton populneus</i>) sometimes growing in nearby paddocks. The population at Gundagai is growing on the upper slope of a steep hill on Serpentine rock. The associated native vegetation at this site is a grassy White Box (<i>E. albens</i>) woodland with scattered shrubs of Pink Wedding Bush (<i>Ricinocarpos bowmanii</i>) and Hop Bush (<i>Dodonaea viscosa</i>). The groundcover is dominated by Kangaroo Grass (<i>Themeda triandra</i>) and Snow Grass (<i>Poa sieberiana</i>).	Predicted from OEH habitat distribution.	Low – Unlikely to occur within the study area due to lack of suitable woodland habitat and the species was not during current surveys in riparian habitat in the study area. Low – Unlikely to be impacted by the proposal.
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Black-chinned Honeyeater <i>Meliphreptus gularis gularis</i>	V	-	Extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>E. sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>).	Predicted from OEH habitat distribution.	Low – Species may be a vagrant to the study area, however, is likely to use preferred box and ironbark habitat outside the study area. Low – Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	-	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Sedentary, considered to be resident in many locations throughout its range; present in all seasons or year-round at many sites; territorial year-round. Up to 80% of the diet is comprised of ants; other invertebrates (including spiders, insects larvae, moths, beetles, flies, hemipteran bugs, cockroaches, termites and lacewings) make up the remaining percentage; nectar from Mugga Ironbark (<i>Eucalyptus sideroxylon</i>) and paperbarks, and sap from an unidentified eucalypt are also eaten. Hollows in standing dead or live trees and tree stumps are essential for nesting. Breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha).	Predicted from OEH habitat distribution.	Low – Species may occur within the study area, however, is likely to use preferred woodland habitat dominated by rough-barked eucalypt species outside the locality. Low – Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover.
Bush Stone-curlew <i>Burhinus grallarius</i>	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Nest on the ground in a scrape or small bare patch.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable woodland habitat with sparse grassy groundlayer. Low – Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Diamond Firetail <i>Stagonopleura guttata</i>	V	-	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (<i>Eucalyptus pauciflora</i>) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	BioNet (OEH) – Recorded 2.7 kilometres south west of the proposal site during 1999.	Moderate – Species may occur within the study area as suitable open forest habitat is available. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Dusky Woodswallow <i>Artamus cyanopterus</i>	V	-	Dusky Woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland.	BioNet (OEH) – Recorded four kilometres north west of the proposal site during 2017.	Moderate – Species may occur within the study area as suitable open forest habitat is available. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Eastern Osprey <i>Pandion cristatus</i>	V	-	Found around the Australian coastline, except Victoria and Tasmania. They are common around the northern coast, especially on rocky shores. Favour areas along the coast like river mouths, lagoons and lakes. Feed on fish in clear, open water. Nests in crowns of dead trees a kilometre from the ocean.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur in the study area due to lack of records and likely to use preferred habitat outside the locality. Low - Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Flame Robin <i>Petroica phoenicea</i>	V	-	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense.	BioNet (OEH) – Recorded about three kilometres south west of the proposal site during 1999.	Moderate – Species may occur within the study area as suitable forest habitat is available. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	V	-	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. 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. May also occur in sub-alpine Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	Recorded during current surveys within the study area.	Recorded – Species recorded during current surveys. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great	Predicted from OEH habitat distribution.	Low – Species is unlikely to occur due to lack of suitable preferred Sheoak habitat in the study area. Low – Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnanthera</i> . Belah is also utilised and may be a critical food source for some populations.		
Grey-crowned Babbler (eastern subspecies) <i>Pomatostomus temporalis temporalis</i>	V	-	The eastern subspecies (<i>temporalis</i>) occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable woodland habitat. Low – Unlikely to be impacted by the proposal.
Hooded Robin <i>Melanodryas cucullata cucullata</i>	V	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies <i>cucullata</i>) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies <i>picata</i> . Two other subspecies occur outside NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable open woodland habitat. Low – Unlikely to be impacted by the proposal.
Little Eagle <i>Hieraaetus morphnoides</i>	V	-	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak	BioNet (OEH) – Recorded four kilometres north east of	Moderate – Species may occur within the study area due to presence of suitable open forest habitat.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			or Acacia woodlands and riparian woodlands of interior NSW are also used.	the proposal site in 2017.	Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
Major Mitchell's Cockatoo <i>Cacatua leadbeateri</i>	V	-	Found across the arid and semi-arid inland, from south-western Queensland south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that. Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur in the study area due to lack of records in the locality. The species is known to occur in the western arid and semi-arid part of NSW. Low – Unlikely to be impacted by the proposal.
Masked Owl <i>Tyto novaehollandiae</i>	V	-	Ranges from east coast of NSW to the western plains. Its range makes up 90 per cent of NSW. The species lives in dry eucalypt forests and woodlands. Hunts along the edge of forests and roadsides. Lives in dry eucalypt forests and woodlands from sea level to 1100 metres.	BioNet (OEH) – Recorded about six kilometres south west of the proposal site during 2011.	Moderate – Species may occur within the study area due to presence of suitable forest habitat. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
Olive Whistler <i>Pachycephala olivacea</i>	V	-	The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly inhabit wet forests above about 500 metres. During the winter months they may move to lower altitudes. Forage in trees and shrubs and on the ground, feeding on berries and insects.	BioNet (OEH) – Recorded about 5.5 kilometres east of the proposal site during 2016.	Low – Species may be a vagrant to the study area, however, is likely to use preferred habitat outside the locality to the east. Low - Unlikely to be impacted by the proposal.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Painted Honeyeater <i>Grantiella picta</i>	V	V	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the <i>Amyema</i> genus. Nests in outer tree canopy. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable woodland habitat containing required mistletoes. Low - Unlikely to be impacted by the proposal.
Pink Robin <i>Petroica rodinogaster</i>	V	-	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Predicted from OEH habitat distribution.	Moderate – Species may occur within the study area due to presence of suitable open forest habitat Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Regent Honeyeater <i>Anthochaera phrygia</i>	CE	CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.	Predicted from OEH habitat distribution.	Low – Species has a limited distribution and is unlikely to occur within the study area due to a lack of preferred habitat containing mistletoes and recent or historical records. Low - Unlikely to be impacted by the proposal.
Satin Flycatcher <i>Myiagra cyanoleuca</i>	-	Mi	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and	Predicted to occur from PMST.	Moderate – Species may be an occasional visitor to the study area due to presence of suitable forest habitat.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests. Prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksia. Where they breed at elevations of more than 600 m above sea level in south-eastern Australia, they breed from November to early January (Frith 1969). Mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and sub canopy of trees.		Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Scarlet Robin <i>Petroica boodang</i>	V	-	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps.	Bionet (OEH) – Recorded about four kilometres north west of the proposal site during 2017.	Moderate – Species may occur due to presence of suitable forest habitat in study area. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species.
Speckled Warbler <i>Chthonicola sagittata</i>	V	-	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable woodland habitat and the lack of records in the locality and Kosciuszko National Park. The species is more likely to utilise open habitat away from the mountains. Low - Unlikely to be impacted by the proposal.
Superb Parrot <i>Polytelis swainsonii</i>	V	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of suitable woodland habitat and the lack of records in the locality.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.		Low - Unlikely to be impacted by the proposal.
Swift Parrot <i>Lathamus discolor</i>	E	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Inland Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> .	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of favoured eucalypt habitat and the lack of records in the locality. Low - Unlikely to be impacted by the proposal.
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	V	-	Distributed along the Australian coastline and well inland along rivers and wetlands, it's widespread in eastern NSW. Foraging habitat consists of coastal seas, rivers, fresh and saline lakes, lagoons, reservoirs and terrestrial habitats such as grasslands. Diet consists of waterbirds, turtles and fish. Resident pairs are territorial and occupy nesting territories of hundreds of hectares. Breeding habitat consists of large trees within mature open forest, gallery forest or woodland and reported that they avoid nesting near urban areas. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.	Bionet (OEH) – Recorded four kilometres north west of the proposal site during 2017.	Moderate – Species may occur within the study area due to the presence of large water bodies with surrounding eucalypt habitat. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
White-fronted Chat <i>Epthianura albifrons</i>	V	-	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of records in the locality and

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. 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.		Kosciuszko National Park. The species is more likely to utilise open habitat in the western part of the state or along the coast. Low - Unlikely to be impacted by the proposal.
White-throated Needletail <i>Hirundapus caudacutus</i>	-	Mi	The White-throated Needletail is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. A large proportion of the White-throated Needletails of the nominate subspecies would occur in Australia as non-breeding visitors. Most White-throated Needletails spend the non-breeding season in Australasia, mainly in Australia, and occasionally in New Guinea and New Zealand, though it has been suggested that some may overwinter in parts of South-East Asia. As the Needletails that occur in Australia migrate from breeding areas in the Northern Hemisphere, they would be affected by global threats.	Bionet (OEH) – Recorded 7.5 kilometres north east of the proposal site during 2016.	Low – Species may occur as an occasional visitor within the study area, however is more commonly recorded along the coast. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
Mammals					
Broad-toothed Rat <i>Mastacomys fuscus</i>	V	V	In NSW the Broad-toothed Rat occurs in two widely separated areas: the wet alpine and subalpine heaths and woodlands in Kosciuszko National Park, adjacent Nature Reserves (Bimberi and Scabby NR) and State Forest (Buccleuch SF) in the south of the State, and on the Barrington Tops, north-west of Newcastle. In Victoria - South Gippsland and the Otways - and western Tasmania, it can be found in wet sedge and grasslands at lower elevations. The Broad-toothed Rat lives in a complex of runways through the dense vegetation of its wet grass, sedge or heath environment, and under the snow in winter. This relatively warm under-snow space enables it to be active throughout winter.	Bionet (OEH) – Recorded 7.5 kilometres north east of the proposal site during 2016.	Low – Species unlikely to inhabit the study area due to a lack of suitable alpine and subalpine heath and woodland habitat. Low - Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V	-	Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only four known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony. Hunts in forested areas for insects like moths and flying insects. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Predicted from OEH habitat distribution.	Recorded – Species was recorded to a probable call confidence level during current Anabat surveys. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. The small amount of habitat to be removed in relation to available habitat in the study area is unlikely to impact the species. Potential roosting habitat inside the culvert would not be directly impacted by the proposal.
Eastern Pygmy-possum <i>Cercartetus nanus</i>	V	-	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	Bionet (OEH) – Recorded about 7 kilometres south east of the proposal site during 2010.	Moderate – Species may occur due to presence of suitable forest habitat in study area. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
Greater Glider <i>Macrotis lagotis</i>	-	V	The species is restricted to eastern Australia, from north QLD to central Victoria. This nocturnal marsupial lives in a variety of eucalypt-dominated habitats, ranging from low open forests on the coast to tall forests in the ranges and low woodland westwards of the Dividing Range. It feeds on eucalypt leaves and flowers. It uses large tree hollows in old, large trees.	Bionet (OEH) - Historical record 2.6 kilometres north of the proposal site.	Moderate – Species may occur due to presence of suitable open forest habitat in study area. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Predicted likely to occur from PMST.	Low – Species may be a vagrant to the study area, however is more commonly recorded along the coast. Low - Unlikely to be impacted by the proposal.
Koala <i>Phascolarctos cinereus</i>	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	PMST/OEH – Recent record from 2016 north of the proposal site.	Low – Species unlikely to occur within the study area due to lack of records in the locality and Kosciuszko National Park. The species was recorded recently in the national park, north of the proposal site, however, no evidence of the species has since been recorded or was recorded during current surveys. Low - Unlikely to be impacted by the proposal.
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Found in well-timbered areas containing gullies.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to lack of records in the locality and Kosciuszko National Park. The species is known to occur further to the north and east along the coast. Low - Unlikely to be impacted by the proposal.
Smoky Mouse <i>Pseudomys fumeus</i>	CE	E	The Smoky Mouse is currently limited to a small number of sites in western, southern and eastern Victoria, south-east NSW and the ACT. In NSW there are three records from Kosciuszko National Park and two records adjacent to the park in Bondo and Ingbyra State Forests; the remainder are centred around Mt Poole, Nullica State Forest and the adjoining South East Forests National Park. The Smoky Mouse appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open-forest from the coast (in Victoria) to sub-alpine regions of up to 1800 metres, but	Predicted likely to occur from PMST.	Low – Species unlikely to occur within the study area due to lack of suitable and preferred heath habitat. Low - Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			sometimes occurs in ferny gullies. Nesting burrows have been found in rocky localities among tree roots and under the skirts of Grass Trees <i>Xanthorrhoea</i> spp.		
South-eastern Long-eared Bat <i>Nyctophilus corbeni</i>	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, buloke <i>Allocasuarina leuhmanni</i> and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.	Predicted to occur from PMST.	Low – Species unlikely to occur within the study area due to lack of favoured eucalypt and/or buloke habitat and the lack of records in the locality. The species is known to occur along the western slopes and plains, west of the proposal site Low - Unlikely to be impacted by the proposal.
Southern Myotis <i>Myotis macropus</i>	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 kilometres inland, except along major rivers. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water.	Predicted from OEH habitat distribution.	Low – Species unlikely to occur within the study area due to the mountainous terrain. The species is likely to occur at lower elevations outside the locality. Low - Unlikely to be impacted by the proposal.
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	V	E	It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along immensely vegetated creek lines.	Bionet (OEH) - Recorded five kilometres south west of the proposal site during 2011.	Moderate – Species may occur due to presence of suitable open forest habitat in study area with hollow-bearing trees available for denning requirements. Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Yellow-bellied Glider <i>Petaurus australis</i>	V	-	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	Bionet (OEH) - Recorded 7.5 kilometres south east of the proposal site during 2016.	Moderate – Species may occur within the study area due to suitable forest habitat, connectivity to known areas of habitat for the endangered population on the Bago Plateaux and recent records in the locality Low - Unlikely to be impacted by the proposal due to the limited vegetation removal restricted to regrowth shrubs and disturbed groundcover. Habitat to be removed is unlikely to be important to the species.
Reptiles					
Rosenberg's Goanna <i>Varanus rosenbergi</i>	V	-	Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component.	Bionet (OEH) - Recorded about five kilometres south east of the proposal site during 2016.	Low – Species unlikely to occur within the study area due to absence of termite mounds, a critical habitat component. The species is likely to utilise preferred habitat outside of the study area. Low - Unlikely to be impacted by the proposal.
Amphibians					
Alpine Tree Frog <i>Litoria verreauxii alpina</i>	E	V	The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1100 m asl. Most locations are within National Park and some are close to alpine resorts. Found in a wide variety of habitats including woodland, heath, grassland and herb fields. Breed in natural and artificial wetlands including ponds, bogs, fens, streamside pools, stock dams and drainage channels that are still or slow flowing.	Predicted to occur from PMST.	Low – Species is unlikely to occur within the study area due to the lack of alpine and subalpine habitat and lower elevation than required for the species. Low - Unlikely to be impacted by the proposal.

Common Name (Scientific Name)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Booroolong Frog <i>Litoria booroolongensis</i>	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi catchment. The species is rare throughout most of the remainder of its range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	Recorded during current surveys	Recorded – Four adults and two juveniles recorded upstream of project site in known habitat of Jounama Creek. Low – The proposal impacts would be limited to work within Jounama Pondage, a deep water body with previously disturbed banks, which does not provide suitable habitat for this species. No work would be conducted in Jounama Creek proper or within potential cobble bank habitat for the species.
Northern Corroboree Frog <i>Pseudophryne pengilleyi</i>	CE	CE	The Northern Corroboree Frog occurs in forests, sub-alpine woodlands and tall heath in the Brindabella Ranges from Mt Bimberi to north of Mt Coree, and the Fiery Range from the Snowy Mountains Highway to Wee Jasper. Populations also occur in the pine plantations near Tumut. The distribution is within National Park, State Forest and other public land. Summer breeding habitat is pools and seepages in sphagnum bogs, wet heath, wet tussock grasslands and herbfelds in low-lying depressions. Tadpoles overwinter in the pools, feed and grow slowly through spring as the water warms and metamorphose in early summer.	Predicted to occur from PMST.	Low – Species is unlikely to occur within the study area due to the lack of suitable preferred aquatic habitat, including bogs and wet heath. Low - Unlikely to be impacted by the proposal.
Southern Bell Frog <i>Litoria raniformis</i>	E	V	In NSW the species was once distributed along the Murray and Murrumbidgee Rivers and their tributaries, the southern slopes of the Monaro district and the central southern tablelands as far north as Tarana, near Bathurst. Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few yet unconfirmed records have also been made in the Murray Irrigation Area in recent years. The species is also found in Victoria, Tasmania and South Australia, where it has also become endangered. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river	Predicted to occur from PMST.	Low – Species is unlikely to occur within the study area due to the lack of suitable preferred aquatic habitat, and is generally restricted to the area west of the locality. Low - Unlikely to be impacted by the proposal.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
			valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat.		
Fish					
Macquarie Perch <i>Macquaria australasica</i>	E	E	The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). Populations may survive in impoundments if able to access suitable spawning sites.	DPI habitat distribution map.	High - Translocated population known to occur within Talbingo Reservoir. Low – Although the proposal would involve work within Jounama Pondage where the species may occur, it is unlikely to impact on this species due to potential impacts being confined to a restricted area of the large pondage. The majority of works would be completed when the water level is below the works area.
Murray Cod <i>Maccullochella peelii</i>	-	V	The species was once abundant throughout the Murray-Darling river system. They generally prefer slow flowing, turbid water in streams and rivers, favouring deeper water around boulders, undercut banks, overhanging vegetation and logs.	DPI fishing guide.	High - Species has previously been stocked within Talbingo Reservoir Low – Although the proposal would involve work within Jounama Pondage where the species may occur, it is unlikely to impact on this species due to potential impacts being confined to a restricted area of the large pondage. The majority of works would be completed when the water level is below the works area, limiting potential for sedimentation.

Common Name (<i>Scientific Name</i>)	BC Act	EPBC Act	Habitat requirements	Number of records (source)	Likelihood of occurrence and possibility of impact
Murray Crayfish <i>Euastacus armatus</i>	V	-	The Murray Crayfish is the most widely distributed <i>Euastacus</i> species in Australia; originally occurring in the Murrumbidgee River system in NSW and the ACT, and parts of the Murray river system in NSW, Victoria and South Australia. The species has also been recorded from the Lachlan and Macquarie catchments in NSW, although the origin of these populations is currently unknown, and may be translocated. Murray Crayfish have an upper altitudinal range of approximately 750 – 800 metres ASL. Adult Murray Crayfish have very low dispersal abilities and occupy small home-ranges	DPI habitat distribution map.	High – Population known to occur within the area. Moderate – The proposal would involve work within Jounama Pondage where the species is known to occur and has the potential to impact on the species if it is inhabiting the banks in the vicinity of the proposal site. The proposal has the potential to disturb habitat through machinery and vehicle movement, and potential sedimentation within the vicinity of the proposal site.
Silver Perch <i>Bidyanus bidyanus</i>	V	CE	The species was once abundant throughout the Murray-Darling river system. Silver perch generally prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds.	DPI fishing guide.	High – Species has previously been stocked within Talbingo Reservoir and Blowering Dam. Low – Although the proposal would involve work within Jounama Pondage where the species may occur, it is unlikely to impact on this species due to potential impacts being confined to a restricted area of the large pondage. The majority of works would be completed when the water level is below the works area.

Environmental Protection and Biodiversity Conservation Act – Significance assessments

1) Are there any matters of national environmental significance located in the area of the proposed action?

The following matters of national environmental significance are known or likely to occur in the area of the proposed action:

- Booroolong Frog (endangered).

2) Considering the proposed action at its broadest scope, is there potential for impacts on matters of national environmental significance?

The proposal would remove about 0.2 hectares of native vegetation and have potential impacts on water quality in the immediate downstream vicinity of the proposal site, including potential sediment impacts and increases in pH of the immediate area. No hollow-bearing trees would be removed from the proposal site and native vegetation to be removed consists of regrowth shrubs with some derived native grassland.

The endangered Booroolong Frog was recorded during current surveys in the study area, upstream of the proposal site in the unregulated portion of Jounama Creek. This species is known from Jounama Creek and these are not new records. The species was recorded along cobble bank habitat and its fringing vegetation.

Due to the species being recorded in the study area during surveys, the proposal may impact on the matter of NES.

3) Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance?

Safeguards and mitigation measures have been prepared with the aim of minimising impacts of the proposal on the ecology of the study area and on matters of NES. These are detailed in section 5.2 of this report.

4) Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts?

Important populations

In accordance with the Significant Impact Guidelines (DoE 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range.*

In the absence of specific information on whether an important population of the endangered species below is likely to occur in the study area, it is assumed that an important population of the species is likely to occur.

Endangered and Critically endangered species – Booroolong Frog

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 an important population of a species;**

Aquatic habitat within the study area upstream of the proposal site in Jounama Creek is known to provide habitat for the Booroolong Frog, which was recorded during surveys. The species was recorded within cobble bank habitat and the fringing grassland about 500 metres upstream of the proposal site.

No potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site. Fringing aquatic vegetation is also absent from the proposal site and nearby area. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

Due to potential habitat for the species being limited to upstream areas of Jounama Creek, potential impacts on water quality and sediment are unlikely to impact on the species.

The proposal is unlikely to remove any potential habitat of the Booroolong Frog or alter conditions of its known habitat in the study area and is therefore unlikely to lead to a decrease in the size of the population.

- **reduce the area of occupancy of the species**

The proposal would remove a small area of native vegetation and have potential impacts on water quality in the immediate vicinity of the proposal site, including potential sediment impacts and small, temporary increases in pH of the immediate area. However, as habitat for the Booroolong Frog is limited to upstream of the proposal site, potential impacts are unlikely to affect the species.

The proposal would be unlikely to reduce the area of occupancy for the species as no suitable aquatic fringing vegetation or cobble bank habitat, which may provide potential habitat for the Booroolong Frog is present in the proposal site. Suitable habitat for the species is limited to upstream of the culvert in the unregulated portion of Jounama Creek.

- **fragment an existing important population into two or more populations;**

Habitat in the culvert area is mostly deep water habitat surrounded by introduced terrestrial vegetation and lacks favoured Booroolong Frog habitat including cobble banks with fringing aquatic vegetation. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

The proposal would disturb terrestrial vegetation on the banks of the pondage during construction, however this vegetation is unlikely to provide potential habitat for this species. Potential water quality impacts in the immediate vicinity of the proposal site, including potential sediment impacts and increases in pH of the immediate area are unlikely to affect the species due to potential habitat being limited to upstream of the proposal site.

The proposal is therefore unlikely to cause a lack of connectivity for the Booroolong Frog.

- **adversely affect habitat critical to the survival of a species**

Cobble banks with fringing vegetation cover provide habitat for the Booroolong Frog in the study area and are critical to the survival of the species, however no potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site.

Habitat for this species is limited to cobble banks with fringing vegetation in the unregulated portion of Jounama Creek about 300 metres upstream of the culvert.

The potential vegetation and water quality impacts of the proposal are unlikely to impact the species as habitat is limited to upstream of the proposal site. The proposal is therefore unlikely to adversely affect habitat critical to the survival of the Booroolong Frog.

- **disrupt the breeding cycle of a population**

The Booroolong Frog breeds during spring and early summer, with tadpoles metamorphosing in late summer to early autumn within slow-flowing connected or isolated pools.

Preferred breeding habitat for this species doesn't occur within the proposal site due to the lack of connected, slow-flowing pools and fringing aquatic vegetation. In addition, the deep and rapidly fluctuating water level in the vicinity of the proposal site is unpredictable and may rise or fall within a matter of hours making the area unfavourable for frog breeding.

High quality breeding habitat for this species occurs upstream along the unregulated portion of Jounama Creek, which would not be impacted by the proposal. Therefore, the proposal would be unlikely to disrupt the breeding cycle of a population.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Cobble banks with fringing vegetation cover provide habitat for the Booroolong Frog in the study area. However no potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site.

Habitat for this species is limited to cobble banks with fringing vegetation in the unregulated portion of Jounama Creek about 300 metres upstream of the culvert. Therefore, the proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent this species would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The project has the potential to introduce and spread invasive weed species to the habitat. Due to the existing presence of weed species in the study area, and with the

implementation of safeguards, the proposal is unlikely to further spread weed species that could harm the species.

- **introduce disease that may cause the species to decline, or**

The project has the potential to introduce and spread amphibian Chytrid fungus within or between populations. Under Commonwealth legislation Chytridiomycosis due to the amphibian chytrid fungus is listed as a key threatening process. If mitigation measures outlined in section 5.2 of this report are followed, it is unlikely the Booroolong Frog would be exposed to chytrid fungus causing the species to decline.

- **interfere with the recovery of the species.**

The proposal would be unlikely to significantly interfere with the recovery of the species due to the relatively small impacts of the proposal being limited to an area outside known and potential habitat of the species.

Conclusion

The proposal would be unlikely to have a significant effect on the endangered Booroolong Frog as:

- *Habitat of the species is limited to upstream of the proposal site in the unregulated portion of Jounama Creek*
- *Potential construction impacts are limited to downstream of all known and potential habitat of the species.*

Environmental Planning & Assessment Act – Significance assessments

Section 1.7 of the EP&A Act lists five factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species', populations or ecological communities (or their habitats) listed under the BC Act.

The '5-part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Should the 5-part test conclude that a significant effect is likely an SIS must be prepared.

Five part tests have been provided for threatened biota which were recorded or have a high or moderate likelihood of occurrence and could potentially be impacted by the project. Where possible, threatened fauna have been grouped based on similar habitat requirements. The following threatened biota are included in these assessments:

- Threatened fauna species:
 - Booroolong Frog (endangered)
 - Gang-gang Cockatoo (vulnerable)
 - Eastern Bentwing-bat (vulnerable)
 - Murray crayfish (vulnerable – FM Act).

Section 1.7 assessments (Booroolong Frog – endangered)

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,

Booroolong Frogs live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.

Aquatic habitat within the study area upstream of the proposal site in Jounama Creek is known to provide habitat for the Booroolong Frog, which was recorded during surveys. The species was recorded within cobble bank habitat and the fringing grassland about 500 metres upstream of the proposal site.

No potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site. Fringing aquatic vegetation is also limited within the proposal site and nearby area. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

Due to potential habitat for the species being limited to upstream areas of Jounama Creek, potential impacts on water quality and sediment are unlikely to impact on the species.

The proposal is unlikely to remove any potential habitat of the Booroolong Frog or alter conditions of its known habitat in the study area and is therefore unlikely to have an adverse effect on the life cycle of the Booroolong Frog such that a viable population of the species is likely to 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

N/A

(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,

N/A

**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**

The proposal would remove 0.2 hectares of native vegetation and have potential impacts on water quality in the immediate vicinity of the proposal site, including potential sediment impacts and potential temporary increases in pH of the immediate area. However, as habitat for the Booroolong Frog is limited to upstream of the proposal site, potential impacts are unlikely to affect the species.

No suitable aquatic fringing vegetation or cobble bank habitat, which may provide potential habitat for the Booroolong Frog is present in the proposal site, nearby area or would be impacted by the proposal. Suitable habitat for the species is limited to upstream of the culvert in the unregulated portion of Jounama Creek that would not be directly or indirectly impacted by the proposal.

(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

Habitat in the culvert area is mostly deep water habitat with a two to three metre drop from the culvert and surrounded by introduced terrestrial vegetation, which lacks favoured Booroolong Frog habitat including cobble banks with fringing aquatic vegetation. The nearest suitable habitat for the species is located about 300 metres upstream of the culvert in the unregulated portion of Jounama Creek.

The habitat in the proposal site would remain as deep water habitat, although the drop from the culvert to the bedrock of the pondage would be reduced. The creek and pondage would remain connected during the construction period and at completion of the proposal, maintaining habitat connectivity. Nonetheless, potential impacts of the proposal, including water quality impacts, are unlikely to affect the species due to potential habitat for the species being limited to upstream of the proposal site.

The proposal is therefore unlikely to fragment or isolate habitat important to the Booroolong Frog.

(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,

Cobble banks with fringing vegetation cover provide habitat for the Booroolong Frog in the study area, however no potential habitat for the species is present within the proposal site due to the deep water habitat of Jounama Pondage, fast flowing culverts with no rocky habitat bottom and the lack of cobble bank habitat within 50 metres upstream or downstream of the proposal site.

Habitat for this species is limited to cobble banks with fringing vegetation in the unregulated portion of Jounama Creek about 300 metres upstream of the culvert.

The potential vegetation and water quality impacts of the proposal are unlikely to impact the species as habitat is limited to upstream of the proposal site. The habitat is unlikely to be important habitat for the species for the reasons outlined above.

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 proposal would not affect any habitat of outstanding biodiversity value.

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.

The proposal would not result in any key threatening processes that are relevant to the Booroolong Frog.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Booroolong Frog due to:

- *Habitat of the species being limited to upstream of the proposal site in the unregulated portion of Jounama Creek*
- *Potential construction impacts being limited to downstream of all known and potential habitat of the species.*

Section 7.3 assessments (Gang-gang Cockatoo – vulnerable)

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,

The Gang-gang Cockatoo favours old growth forest and woodland attributes for nesting and roosting. Nests are generally located in hollows that are 10 centimetres in diameter or larger and at least nine metres above the ground in eucalypts.

The woodland and forest in the study area is known to provide habitat for the threatened Gang-gang Cockatoo, which was recorded during current surveys in eucalypt trees and flying overhead. The fruits and seeds of trees and shrubs provide foraging resources for the species, with hollow-bearing trees potentially used for breeding.

The proposal would remove about 0.2 hectares of native vegetation, including regrowth shrubs and grassland, which may be used by the species for foraging. This is a very small proportion of the potential habitat resources of the species in the study area and locality.

No hollow-bearing trees would be removed by the proposal, therefore potential breeding habitat would not be impacted.

The very small amount of vegetation to be removed in relation to that available in the study area and locality is unlikely to have an adverse impact on the life cycle of this species.

High quality habitat within Koscuizsko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site. Koscuizsko National Park is directly connected to Bago, Bondo and Maragle State Forests.

The Gang-gang Cockatoo is a highly mobile species and it is unlikely the removal of a small amount of vegetation connected to high quality suitable habitat would 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.

- 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

N/A

- (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,**

N/A

- 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

The proposal would remove 0.2 hectares of native vegetation, including regrowth shrubs and grassland, which may be used by the species for foraging. This is a very small proportion of the potential habitat resources of the species in the study area and locality. No hollow-bearing trees would be removed by the proposal, therefore potential breeding habitat would not be impacted.

The Gang-gang Cockatoo is a highly mobile species and it is unlikely that the proposal would remove a significant amount of habitat for the species. High quality habitat within Koscuizsko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site.

- (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**

The woodland in the study area forms part of a vegetation corridor along the Snowy Mountains Highway that directly connects to Kosciuszko National Park and facilitates the movement of a range of fauna species through the study area and across the landscape. Kosciuszko National Park contains a vast area of native woodland habitat that also connects to other remnant patches including Bago and Maragle State Forests to the west and Bondo State Forest to the north-east.

Fragmentation of the vegetation in the locality has previously occurred through construction of the Snowy Mountains Highway and other local roads and access tracks, and for the development of the Snowy Mountains Scheme, which includes Jounama Pondage.

Due to the limited amount of vegetation proposed to be removed in the already modified road reserve of the Snowy Mountains Highway, the removal of vegetation being limited

to regrowth, and the extent of remaining native vegetation surrounding the proposal, it is unlikely that the proposal would fragment woodland habitat in the study area.

The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of the Gang-gang Cockatoo, the proposal is unlikely to create any substantial barriers to movement for the species or isolate it from other areas of habitat.

(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,

The proposal would remove 0.2 hectares of native vegetation, including regrowth shrubs and grassland, which may be used by the species for foraging. No hollow-bearing trees would be removed by the proposal, therefore potential breeding habitat would not be impacted.

The area of habitat proposed to be removed is a very small proportion of the potential habitat resources of the species in the study area and locality. High quality habitat within Kosciuszko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site.

The proposed removal of vegetation does not represent habitat critical to the Gang-gang Cockatoo and it is unlikely that the very small area of habitat to be removed would be of significant importance to the species.

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 proposal would not affect any habitat of outstanding biodiversity value.

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.

The proposal constitutes one threatening process relevant to the Gang-gang Cockatoo; clearing of native vegetation – the proposal would remove about 0.2 hectares of native vegetation, including regrowth shrubs and grassland, which may be used by the species for foraging. This is unlikely to represent a significant loss of habitat, as described above.

Conclusion of Assessment of Significance

The proposal would be unlikely to have a significant impact on the Gang-gang Cockatoo as:

- *Only a small area of habitat would be removed compared to the extent of habitat available within the study area and locality, which is connected to Kosciuszko National Park, about 6,900 square kilometres in size*
- *No hollow-bearing trees would be removed by the proposal*
- *The small amount of vegetation removal is unlikely to result in significant additional fragmentation to that which has already occurred. The species is highly mobile and capable of traversing the study area to other areas of habitat.*

**Section 7.3 assessments
(Eastern Bentwing-bat – vulnerable)**

- 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,**

The Eastern Bentwing-bat occurs primarily in caves, storm water tunnels, buildings and other man-made structures. The woodland and forest in the study area may provide habitat for the Eastern Bentwing-bat, which was recorded to a probable call confidence on one of two recording nights during current Anabat surveys.

The proposal would remove 0.16 of native regrowth shrubs, which may be used by the species for foraging. This is a very small proportion of the potential habitat resources of the species in the study area and locality.

The culvert itself may provide potential roosting habitat for the species, which is known to use man-made structures as preferential roosting habitat. However, current surveys of the culvert indicated limited bat roosting habitat and the culverts themselves are not being impacted by the proposal. Impacts to the culvert would be limited to temporary disturbance primarily from noise during the construction period. In addition, the culverts would be inspected for bats before the start of works to minimise impacts on the species if present.

The very small amount of vegetation to be removed in relation to that available in the study area and locality is unlikely to have an adverse impact on the life cycle of this species.

High quality habitat within Koscuizsko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site. Koscuizsko National Park is directly connected to Bago, Bondo and Maragle State Forests. There is likely to be preferred roosting habitat within these areas.

The Eastern Bentwing-bat is a highly mobile species and it is unlikely the removal of a small amount of vegetation connected to high quality suitable habitat would 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.

- 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

N/A

- (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,**

N/A

- 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

The proposal would remove 0.16 hectares of native regrowth shrubs, which may be used by the species for foraging. This is a very small proportion of the potential habitat resources of the species in the study area and locality. Preferred roosting habitat for the

species is in man-made structures, which would include the culverts in the proposal site. The culverts would not be directly impacted by the proposal and provide limited potential bat roosting habitat.

The Eastern Bentwing-bat is a highly mobile species and it is unlikely that the proposal would remove a significant amount of habitat for the species. High quality habitat within Kosciuszko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site. There is likely to be preferred roosting habitat within the national park.

(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

The woodland in the study area forms part of a vegetation corridor along the Snowy Mountains Highway that directly connects to Kosciuszko National Park and facilitates the movement of a range of fauna species through the study area and across the landscape. Kosciuszko National Park contains a vast area of native woodland habitat that also connects to other remnant patches including Bago and Maragle State Forests to the west and Bondo State Forest to the north-east.

Fragmentation of the vegetation in the locality has previously occurred through construction of the Snowy Mountains Highway and other local roads and access tracks, and for the development of the Snowy Mountains Scheme, which includes Jounama Pondage.

Due to the limited amount of vegetation proposed to be removed in the already modified road reserve of the Snowy Mountains Highway, the removal of vegetation being limited to regrowth, and the extent of remaining native vegetation surrounding the proposal, it is unlikely that the proposal would fragment woodland habitat in the study area.

The proposal would not remove any large areas of native vegetation, sever any important corridors or otherwise isolate any areas of habitat.

Due to the mobility of the Eastern Bentwing-bat, the proposal is unlikely to create any substantial barriers to movement for the species or isolate it from other areas of habitat.

(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,

The proposal would remove 0.16 hectares of native regrowth shrubs, which may be used by the species for foraging. Preferred roosting habitat for the species is in man-made structures, which would include the culverts in the proposal site. The culverts would not be directly impacted by the proposal and provide limited potential bat roosting habitat.

The area of habitat proposed to be removed is a very small proportion of the potential habitat resources of the species in the study area and locality. High quality habitat within Kosciuszko National Park, which is about 6,900 square kilometres in size, surrounds the proposal site.

The proposed removal of vegetation does not represent habitat critical to the Eastern Bentwing-bat and it is unlikely that the very small area of habitat to be removed would be of significant importance to the species.

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 proposal would not affect any habitat of outstanding biodiversity value.

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.

The proposal constitutes one threatening process relevant to the Eastern Bentwing-bat; clearing of native vegetation – the proposal would remove about 0.16 hectares of native regrowth shrubs, which may be used by the species for roosting, movement and foraging. This is unlikely to represent a significant loss of habitat, as described above.

Conclusion of Assessment of Significance

The proposal would be unlikely to have a significant impact on the Eastern Bentwing-bat as:

- *Only a small area of habitat would be removed compared to the extent of habitat available within the study area and locality, which is connected to Kosciuszko National Park, about 6,900 square kilometres in size*
- *Potential preferred roosting habitat within the Jounama Creek culvert would not be directly impacted and only temporarily disturbed, although limited potential bat roosting habitat exists within the culvert*
- *The small amount of vegetation removal is unlikely to result in significant additional fragmentation to that which has already occurred. The species is highly mobile and capable of traversing the study area to other areas of habitat.*

Section 7.3 assessments (The Murray Crayfish – vulnerable)

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,

The Murray Crayfish is often found in the Murray and Murrumbidgee rivers, and many of their tributaries. The species is known to occur in Jounama Pondage.

There is potential for the Murray Crayfish to burrow in the banks of the pondage in the vicinity of the proposal site. However, the proposal site is unlikely to provide optimal habitat for the species due to the absence of surrounding riparian vegetation preferred by the species and the rapidly fluctuating water levels. In addition, most of the area to be disturbed where construction will occur is on existing bedrock or artificial rock embankments.

The proposal would result in impacts to potential aquatic habitat of the species during the construction period, including water quality impacts such as potential sediment impacts, potential temporary increases in pH of the immediate area and potential contamination by chemicals. These impacts are likely to be localised, temporary, limited to the construction period and due to construction occurring mostly during periods of low pondage levels, unlikely to substantially impact the species which would likely move away from the site if present.

The proposal would remove potential artificial habitat for the Murray Crayfish, in the form of rock from the existing apron, however, this is unlikely to substantially impact on the

species due to the placement of similar artificial habitat during construction of the proposal. In addition, this habitat is unlikely to provide preferred or substantial habitat for the species as it mostly occurs on bedrock. The fluctuating water levels of the pondage would not be altered during the construction period and so would be unlikely to affect the species to any degree further than existing pondage operating conditions.

Closure of the culverts during the construction period is unlikely to affect the species due to this occurring mostly at periods of low pondage levels when the species is unlikely to inhabit the area due to the two to three metre drop from the culverts to the bedrock of the pondage, when the species is likely to utilise deeper habitat.

Good quality habitat is present in other areas of Jounama Pondage with a strong hold for the species occurring in the Murrumbidgee River downstream of the study area. Due to the localised and limited impacts the proposal would have on potential aquatic habitat of the species, the proposal is unlikely to have an adverse effect on the life cycle of the Murray Crayfish such that a viable population of the species is likely to 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

N/A

- (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,**

N/A

- 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

The proposal would result in impacts, both direct and indirect, on about 0.09 hectares of potential aquatic habitat of the Murray Crayfish, including the removal of potential artificial habitat in the form of rock and concrete from the existing apron. However, this is unlikely to substantially impact on the species due to the placement of similar artificial habitat during construction of the proposal.

The proposal would also impact on the banks of the pondage in the vicinity of the proposal site due to machinery movement, which the species has the potential to burrow into. However, the proposal site is unlikely to provide optimal habitat for the species due to the absence of surrounding riparian vegetation preferred by the species and the rapidly fluctuating water levels.

The proposal would also result in impacts to potential aquatic habitat of the species during the construction period, including water quality impacts such as potential sediment impacts, potential temporary increases in pH of the immediate area and contamination by chemicals.

- (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**

The aquatic habitat in the study area is highly modified due to the operation of Jounama Pondage as part of the Snowy Mountains Hydroelectric Scheme. This has resulted in a modified environment with reduced connectivity for aquatic species. Water entering Jounama Pondage from Jounama Creek has been diverted through the culvert at the proposal site. When the pondage water levels are low, water entering the pondage drops down about two to three metres from the culvert slab before it can enter the pondage. Habitat in Jounama Creek and Jounama Pondage are connected when higher pondage water levels are at or above the culvert base, removing the drop from the culvert to the bedrock of the pondage, which the Murray Crayfish would be capable of traversing.

Culvert cells would be blocked during the construction period, however at least one of the four culvert cells would be open at all times and this would generally occur during periods of low pondage levels when the species is likely to utilise habitat away from the site. Therefore, the proposal is unlikely to fragment aquatic habitat to any greater extent than that which already exists.

(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,

The proposal would result in impacts, both direct and indirect, on about 0.09 hectares of potential aquatic habitat of the Murray Crayfish, including the removal of potential artificial habitat in the form of rock from the existing apron. However, this is unlikely to substantially impact on the species due to the placement of similar artificial habitat during construction of the proposal.

The proposal would also impact on the banks of the pondage in the vicinity of the proposal site due to machinery movement, which the species has the potential to burrow into. However, the proposal site is unlikely to provide optimal habitat for the species due to the absence of surrounding riparian vegetation preferred by the species and the rapidly fluctuating water levels.

Good quality habitat is present in other areas of Jounama Pondage with a strong hold for the species occurring in the Murrumbidgee River downstream of the study area. It is unlikely that the small area of potential habitat to be impacted would be of significant importance to the long-term survival of the species.

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 proposal would not affect any habitat of outstanding biodiversity value.

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.

The proposal would not result in any key threatening processes that are relevant to the Murray Crayfish.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Murray Crayfish due to:

- The small area of aquatic habitat disturbance when compared to the extent of available habitat in the study area and locality*

-
- *Removal of potential artificial habitat by the proposal would be replaced with additional artificial habitat*
 - *Potential water quality impacts would be localised and temporary in duration*
 - *The low quality of the aquatic habitat to be impacted which lacks surrounding riparian vegetation preferred by the species.*
-

B72 - SNOWY MOUNTAINS HIGHWAY

SNOWY VALLEYS COUNCIL

JOUNAMA CREEK CULVERT REPAIRS

AT 3.5 km NORTH - EAST OF TALBINGO

SCHEDULE OF DRAWINGS

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CONSTRUCTION STAGING DIAGRAM - SHEET 2
- 6

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- 8

ACCESS ROAD PLAN AND LONG SECTION
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EXCAVATOR ACCESS PLAN AND LONG SECTION
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ACCESS ROAD - CROSS SECTIONS - SHEET 1
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ACCESS ROAD - CROSS SECTIONS - SHEET 2
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WORK AREA - CROSS SECTIONS - SHEET 1

THE WORKS SHALL BE COMPLETED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS WHERE RELEVANT:

- B30

-

EXCAVATION AND BACKFILL FOR BRIDGEWORKS
- B80

-

CONCRETE WORK FOR BRIDGES
- B82

-

SHOTCRETE WORK
- B115

-

PRECAST CONCRETE MEMBERS (NOT PRETENSIONED)
- B153

-

ERECTION OF PRECAST CONCRETE MEMBERS (NOT PRETENSIONED)
- B201

-

STEELWORK FOR BRIDGES
- B203

-

WELDING OF REINFORCING STEEL
- B220

-

PROTECTIVE TREATMENT OF BRIDGE STEELWORK
- B240

-

SUPPLY OF BOLTS, NUTS, SCREWS AND WASHERS
- B264

-

ERECTION OF BARRIER RAILINGS AND MINOR COMPONENTS
- B341

-

DEMOLITION OF EXISTING STRUCTURE
- B350

-

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- G1

-

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- G7

-

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- G10

-

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- G22

-

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- G36

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ENVIRONMENTAL PROTECTION
- G38

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- G40

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CLEARING AND GRUBBING
- G71

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CONSTRUCTION SURVEYS
- G73

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- 3051

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- 3071

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- 3222

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- 3552

-

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- 3556

-

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- 3557

-

FLEXIBLE STRIP FILTER DRAINS
- 3580

-

AGGREGATE FILTER MATERIALS FOR SUBSURFACE DRAINAGE
- R44

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- R63

-

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- R81

-

NO FINES CONCRETE SUBBASE
- R178

-

VEGETATION
- R179

-

LANDSCAPE PLANTING
- R201

-

FENCING



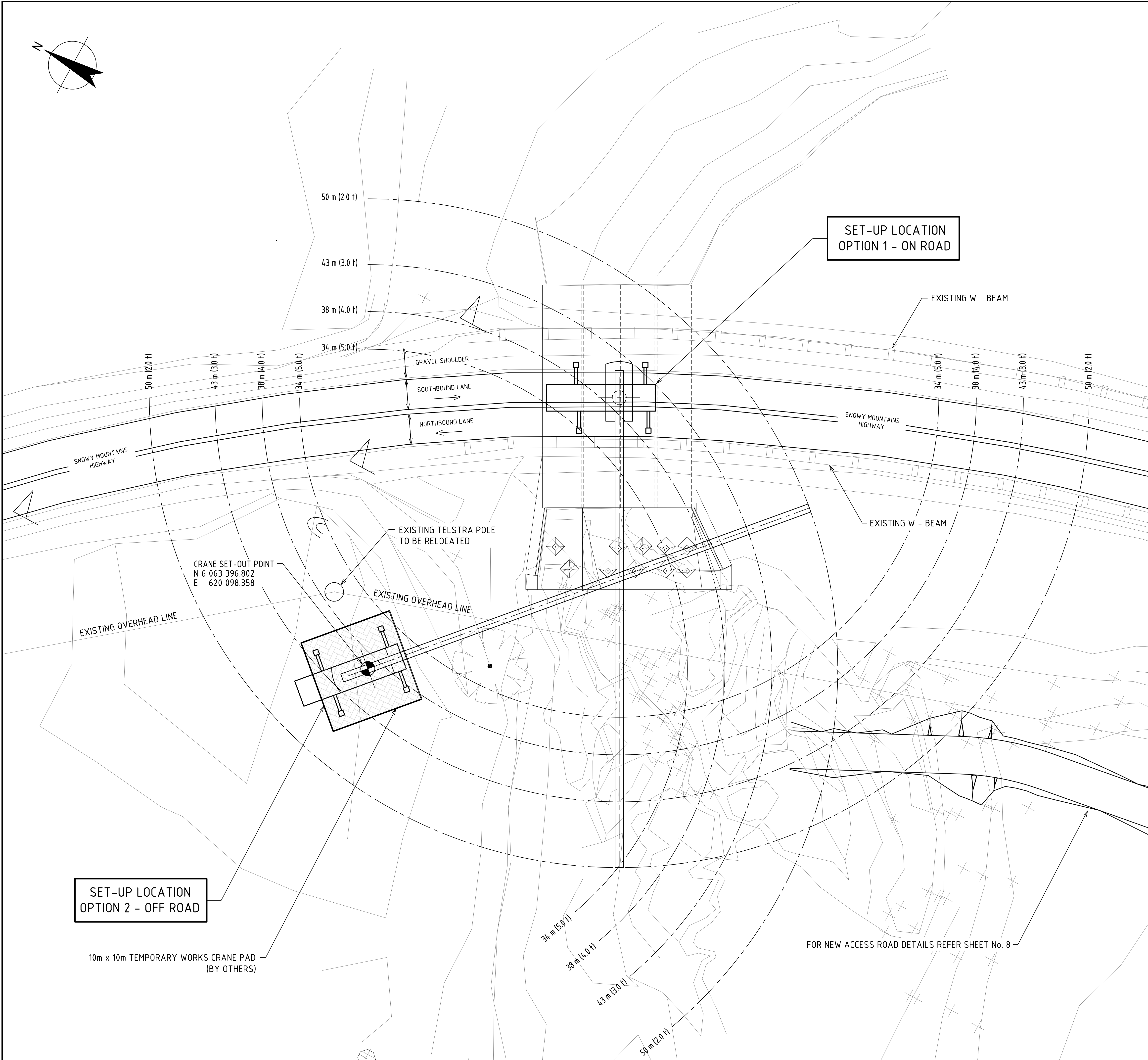
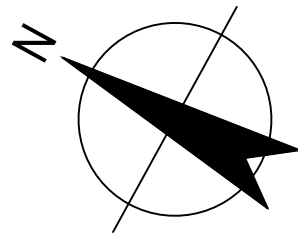
LOCALITY PLAN
THE CULVERT SITE IS APPROXIMATELY
3.5 km BY ROAD FROM TALBINGO

NOT TO SCALE



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REGISTRATION No OF PLANS		DS2018 / 001306	
ISSUE STATUS: 100% DETAIL DESIGN			
SHEET No	1	No OF SHEETS	12
ISSUE		B	



CRANE SPECIFICATIONS:

MODEL No. 100t LIEBHERR LTM 1100-5.2

BASIC CAPACITY ESTIMATES SHOWN IN THE TABLE ARE BASED ON FULL COUNTERWEIGHT ASSEMBLY AND WORKING WITH MAIN JIB ONLY. (NO FLY JIB).

OUTREACH (m)	CAPACITY (t)
34	5.0
38	4.0
43	3.0
50	2.0

NOTE:

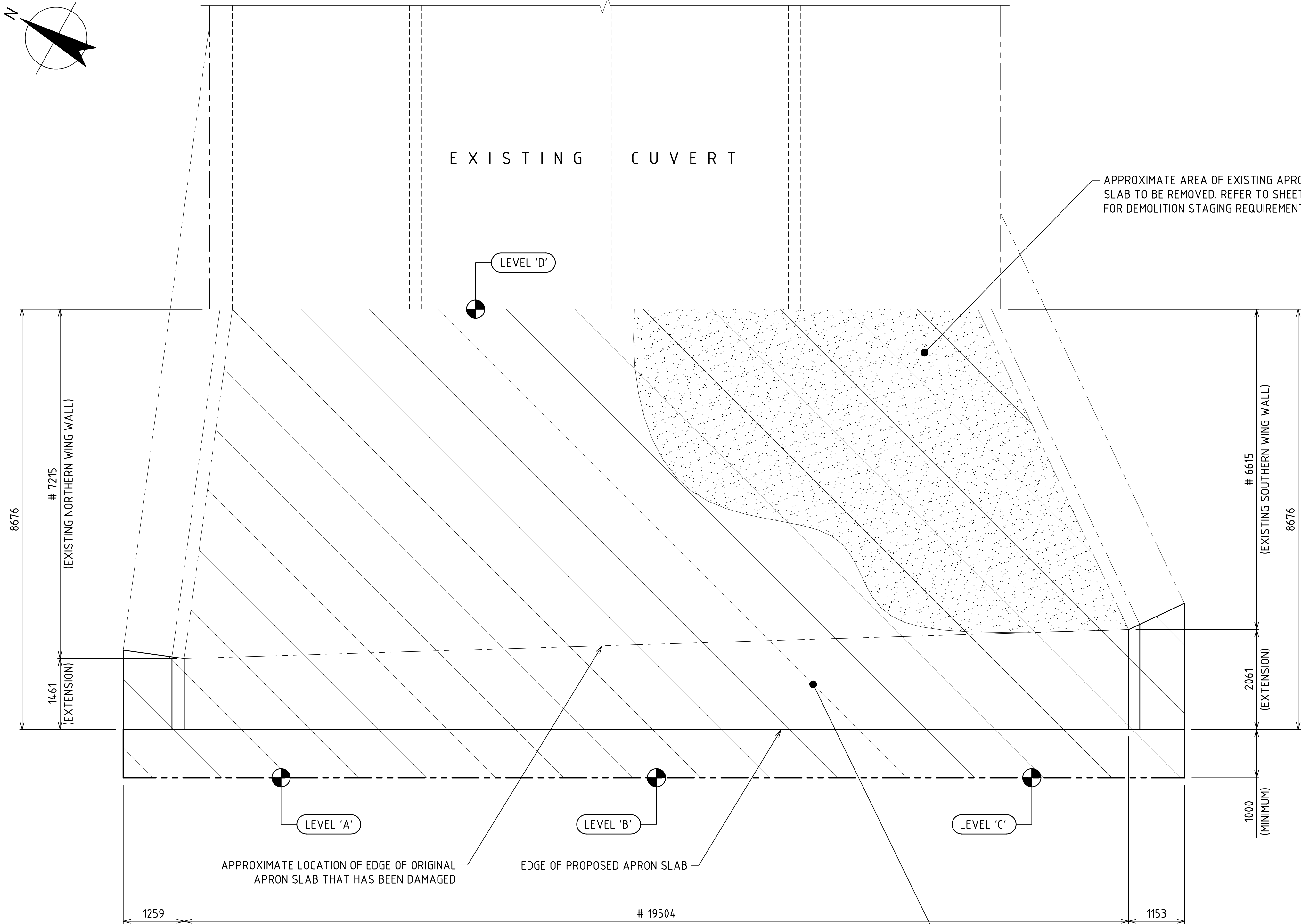
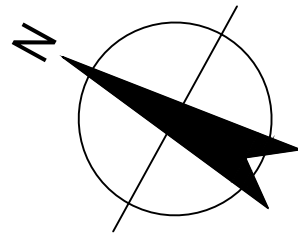
- THE LIFTING CAPACITIES AND RADIUSES SHOWN ON THIS DRAWING FOR THE CRANE MODEL NOTED ARE PROVIDED FOR INFORMATION ONLY AND HAVE NOT BEEN VERIFIED OR CHECKED FOR USE.
- CRANE LIFT STUDY MUST BE COMPLETED BY CRANE SUPPLIER PRIOR TO CONSTRUCTION.

GENERAL NOTES:

SCALE 0 2 4 6 8 10m OR AS SHOWN

- ALL DIMENSIONS ARE IN MILLIMETRES.
- CHAINAGES AND REDUCED LEVELS ARE IN METRES.
- REDUCED LEVELS ARE TO AHD.
- LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

B			17.08.18	100% DETAIL DESIGN			C.R.	T.F.	S.F.
A			13.07.18	80% DETAIL DESIGN			C.R.	T.F.	
Rev.	Date	Description				By	Ch'd	App'd	
ROADS AND MARITIME SERVICES									
B72 - SNOWY MOUNTAINS HIGHWAY					SNOWY VALLEYS COUNCIL				
JOUNAMA CREEK CULVERT									
CULVERT REPAIRS									
CRANE REACH DIAGRAM - 100t LIEBHERR LTM 1100-5.2									
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com							NSW GOVERNMENT Transport Roads & Maritime Services		
PREPARED			CHECKED		REGISTRATION No OF PLANS				
DESIGN T.F.					DS2018 / 001306				
DRAWING C.RYE					RMS BRIDGE NUMBER		5460		
APPROVED DESIGN QA RECORDS					ISSUE STATUS: 100% DETAIL DESIGN				
DIRECTOR					SHEET No.		2		ISSUE B



SITE PREPARATION PLAN

NOTE: PREPARATION WORK CAN BE COMPLETED IN STAGES TO SUIT CONSTRUCTION SEQUENCE IF REQUIRED.

DENOTES APPROXIMATE DIMENSION AS DETERMINED FROM EXISTING SURVEY.

GENERAL NOTES:

- SCALE 0 1 000 2 000 3 000mm OR AS SHOWN
- ALL DIMENSIONS ARE IN MILLIMETRES.
 - CHAINAGES AND REDUCED LEVELS ARE IN METRES.
 - REDUCED LEVELS ARE TO AHD.
 - LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

SCHEDULE OF SURVEYED LEVELS

LOCATION	AHD R.L.	SHD R.L.
NATURAL ROCK LEVEL 'A'	386.550	387.727
NATURAL ROCK LEVEL 'B'	384.600	385.777
NATURAL ROCK LEVEL 'C'	385.325	386.502
DOWNSTREAM CULVERT INVERT LEVEL 'D'	387.448	388.625

FLOW DEPTH TABLE

FLOW RATE (m ³ /s)	WATER LEVEL ABOVE INVERT (m)
0	0.0
2	0.2
5	0.4
10	0.6
15	0.7
20	0.9

B	17.08.18	100% DETAIL DESIGN		T.F.	S.F.
A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd

ROADS AND MARITIME SERVICES

B72 - SNOWY MOUNTAINS HIGHWAY SNOWY VALLEYS COUNCIL

JOUNAMA CREEK CULVERT
CULVERT REPAIRS

SITE PREPARATION PLAN

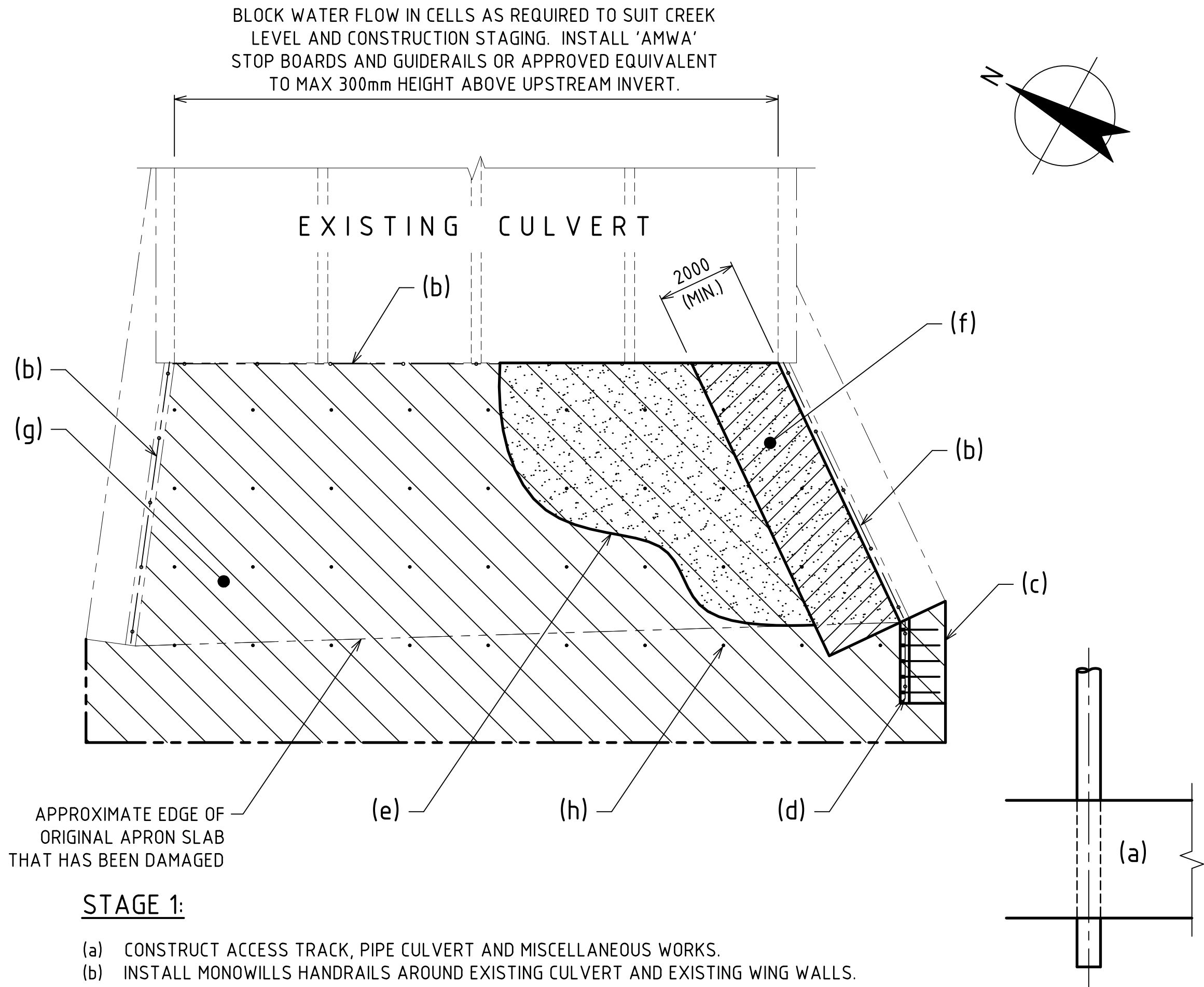
GHD

GHD Tower, Level 3
24 Honeysuckle Drive, Newcastle NSW 2300 Australia
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T 61 2 4979 9999 F 61 2 4979 9988
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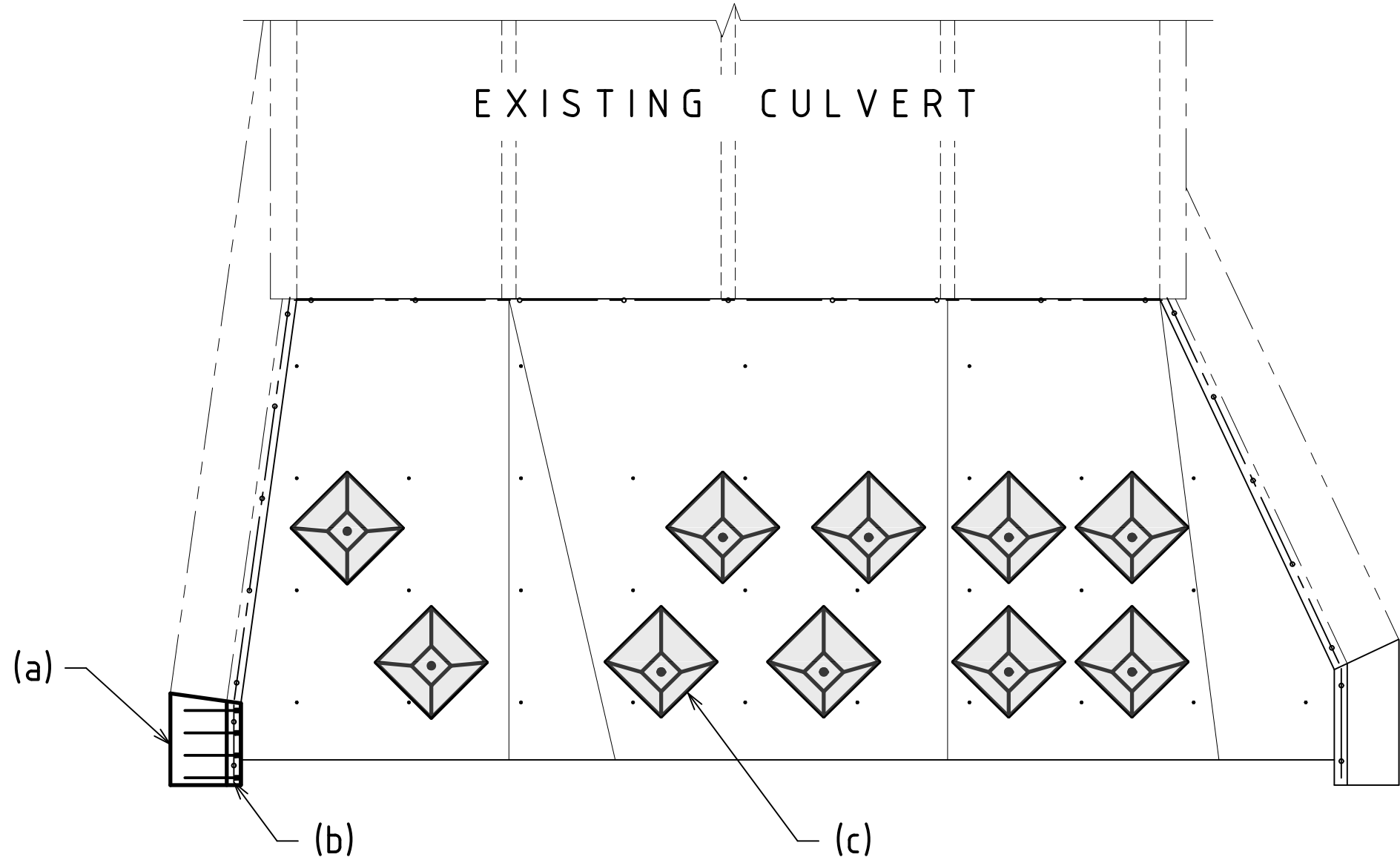
Transport
Roads & Maritime
Services

PREPARED	CHECKED	REGISTRATION No OF PLANS
DESIGN T.F.		DS2018 / 001306
DRAWING C.RYE		RMS BRIDGE NUMBER 5460
APPROVED DESIGN QA RECORDS	ISSUE STATUS: 100% DETAIL DESIGN	
DIRECTOR	SHEET No. 3	ISSUE B



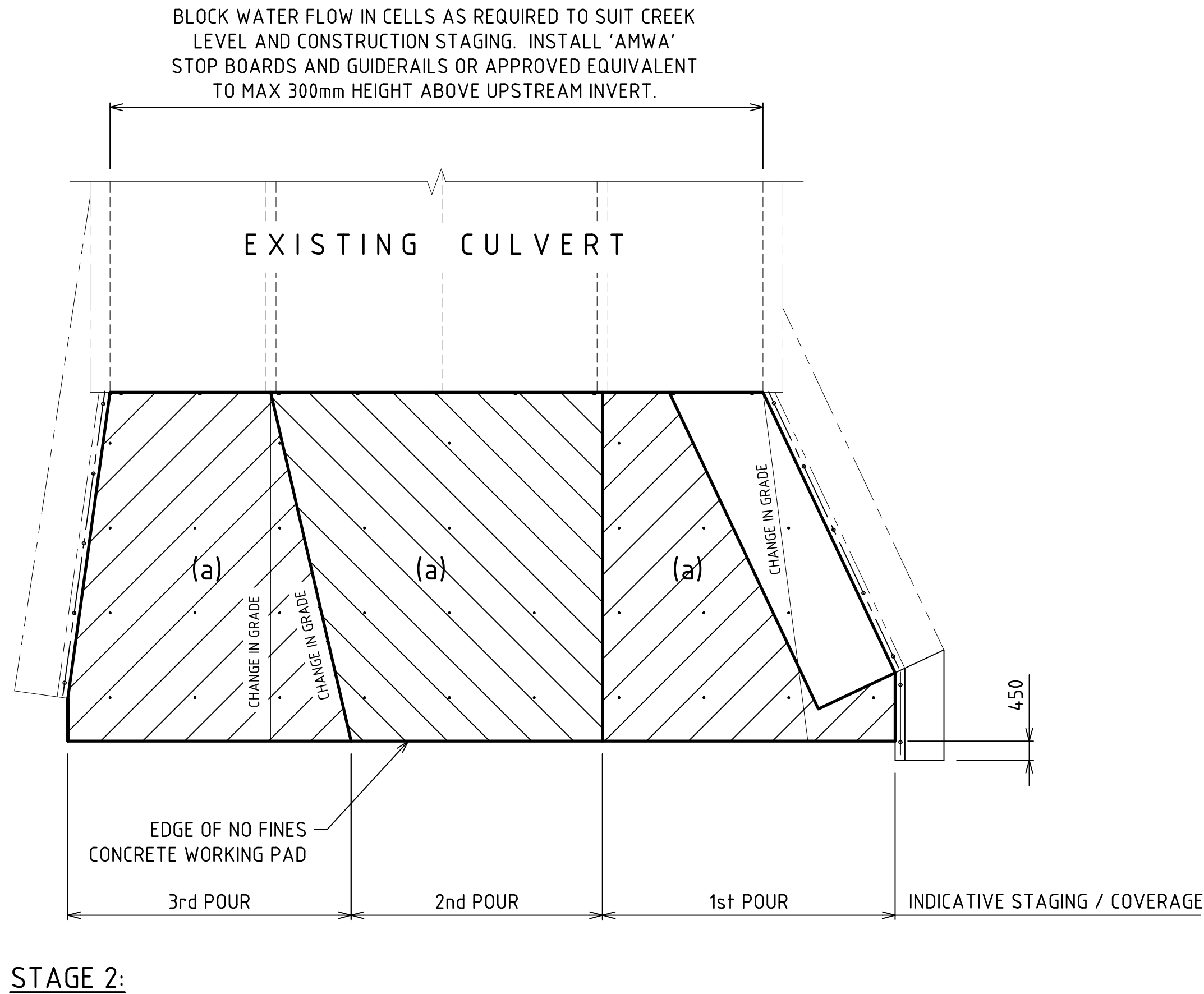
STAGE 1:

- CONSTRUCT ACCESS TRACK, PIPE CULVERT AND MISCELLANEOUS WORKS.
- INSTALL MONOWILLS HANDRAILS AROUND EXISTING CULVERT AND EXISTING WING WALLS.
- CONSTRUCT WING WALL EXTENSION TO SOUTHERN WING WALL AND INSTALL CAST IN REID BAR COUPLERS. REFER SECTION 'G' & 'H' ON SHEET No. 7 FOR DETAILS.
- INSTALL MONOWILLS HANDRAILS IN TOP OF NEW SOUTHERN WING WALL.
- AFTER WING WALL EXTENSION HAS ACHIEVED $f'c = 32 \text{ MPa}$, REMOVE EXISTING APRON SLAB AREA.
- IMMEDIATELY FOLLOWING STEP (e) REMOVE ALL EXISTING LOOSE ROCK AND ALLUVIAL MATERIAL FROM 2m WIDE AREA SHOWN HATCHED. DRILL AND FIX N20 (HOT DIP GALVANISED) AT 2000 CENTRES EACH WAY. MINIMUM 250 EMBEDMENT INTO EXISTING BEDROCK WITH HILTI HIT-RE500 OR APPROVED EQUIVALENT. REFER SECTION 'F' ON SHEET No. 7 DO NOT INSTALL IN LOCATIONS THAT ARE UNDER NEW PRECAST CONCRETE BLOCKS. CAST NO FINES CONCRETE IN THIS AREA TO REINSTATE SUPPORT TO SOUTHERN WINGWALL.
- REMOVE ALL EXISTING LOOSE ROCK AND ALLUVIAL MATERIAL FROM REMAINING AREA SHOWN HATCHED. DRILL AND FIX N20 (HOT DIP GALVANISED) AT 2000 CENTRES EACH WAY. MINIMUM 250 EMBEDMENT INTO EXISTING BEDROCK WITH HILTI HIT-RE500 OR APPROVED EQUIVALENT. REFER SECTION 'F' ON SHEET No. 7 DO NOT INSTALL IN LOCATIONS THAT ARE UNDER NEW PRECAST CONCRETE BLOCKS.



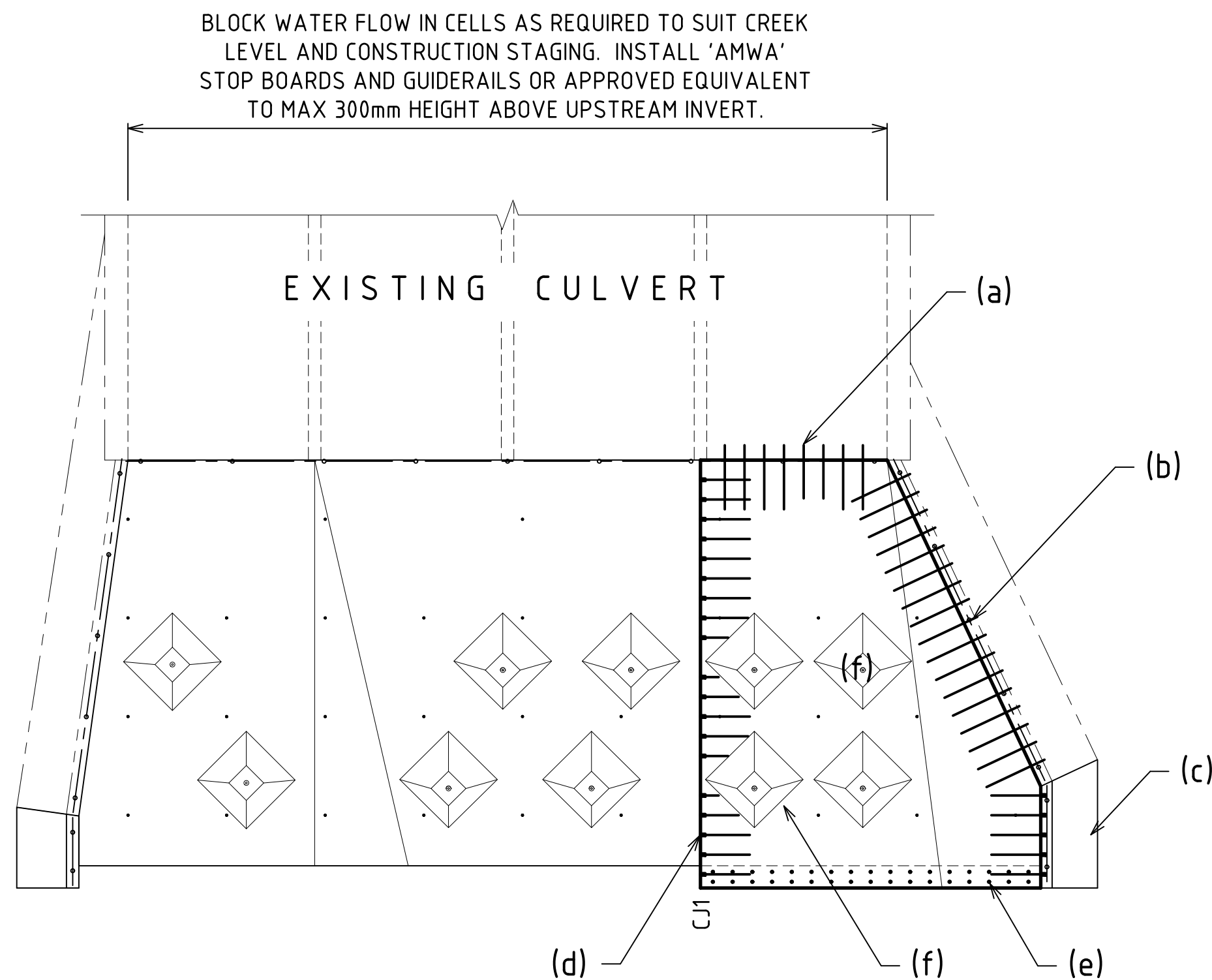
STAGE 3:

- CONSTRUCT WING WALL EXTENSION TO NORTHERN WING WALL AND INSTALL CAST IN REID BAR COUPLERS. REFER SECTION 'G' & 'H' (SIMILAR) ON SHEET No. 7 FOR DETAILS. NOTE: THIS STAGE CAN BE CONSTRUCTED IN STAGE 1 IF ACCESS AND WATER LEVELS PERMIT.
- INSTALL MONOWILLS HANDRAILS ON TOP OF NEW NORTHERN WING WALL.
- PLACE MASS CONCRETE PRECAST BLOCKS ON TOP OF NO-FINES CONCRETE IN APPROXIMATE LOCATION / SPACING SHOWN. REFER DETAIL 'A' ON SHEET No. 6



STAGE 2:

- CONSTRUCT NO FINES CONCRETE WORKING PAD TO ACHIEVE PLANAR INCLINED WORKING PLATFORM IN STAGES AS REQUIRED, STARTING AT SOUTHERN END.
- COMPLETE NO FINES CONCRETE PLACEMENT UNTIL FULL APRON AREA IS COVERED. CONCRETE LEVEL TO BE 250mm MINIMUM LOWER THAN FINISHED TOP OF APRON SLAB CONCRETE LEVEL. NOTE: FINISHED CONCRETE LEVELS ARE SHOWN ON SHEET No. 6



STAGE 4:

- DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE OF EXISTING CULVERT.
- DRILL AND FIX REINFORCEMENT BARS INTO EXISTING SOUTHERN WING WALL CONCRETE.
- INSTALL RBA16 REID BARS INTO SOUTHERN WING WALL EXTENSION.
- INSTALL CAST IN REID BAR COUPLER RBA16CG AT 400 CENTRES MAX. WITH MIN 1000 LONG RBA16 REID BAR AT SOUTH SIDE OF CJ1 JOINT.
- DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
- PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
- POUR NEW APRON SLAB PORTION (250mm THICK MINIMUM).

GENERAL NOTES:

- SCALE 0 1 2 3 4 5m OR AS SHOWN
1 0.5
- ALL DIMENSIONS ARE IN MILLIMETRES.
 - CHAINAGES AND REDUCED LEVELS ARE IN METRES.
 - REDUCED LEVELS ARE TO AHD.
 - LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

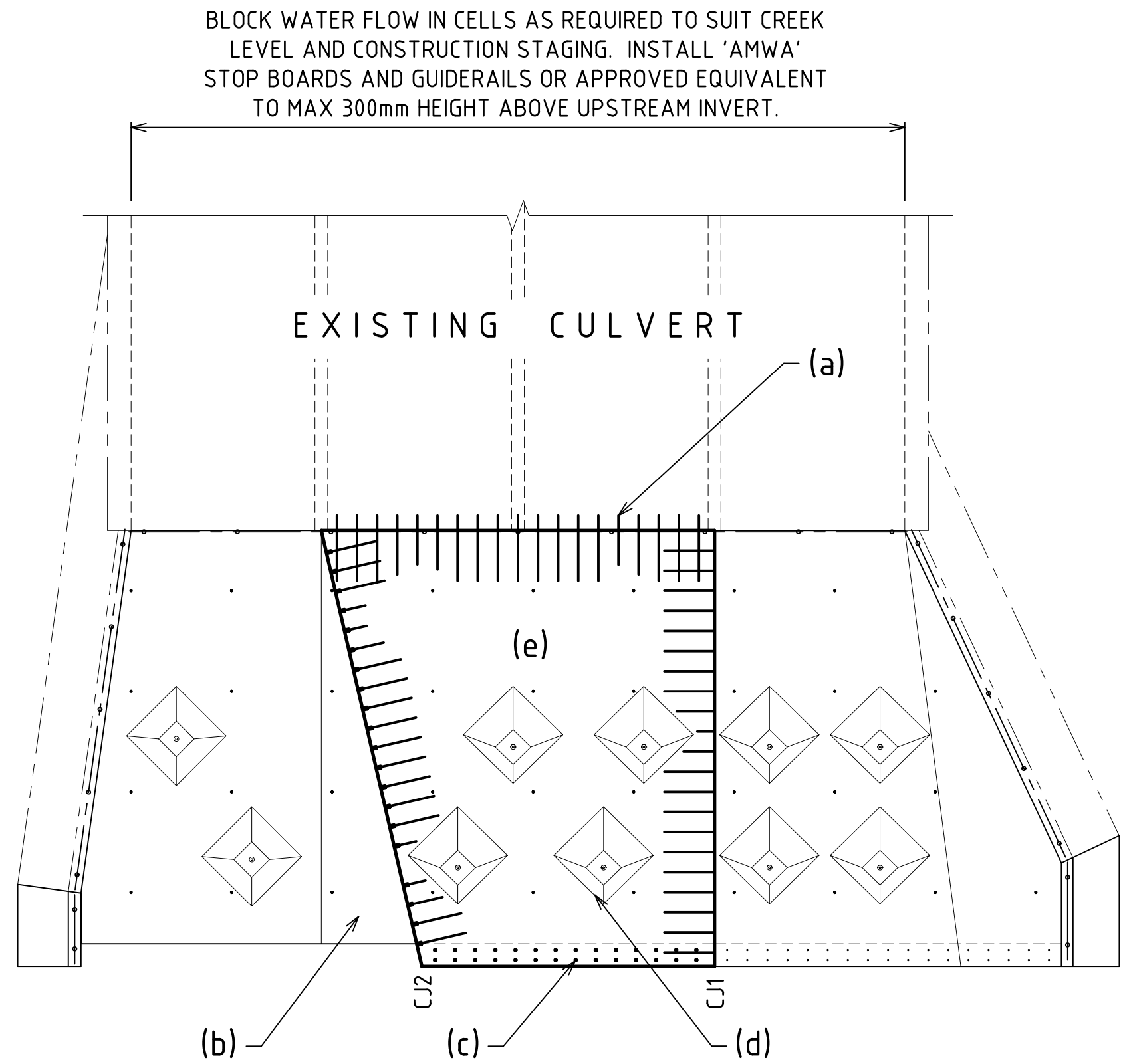
CONCRETE NOTES:

- CONCRETE EXPOSURE CLASSIFICATION B1.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF CAST INSITU REINFORCED CONCRETE WALLS SHALL BE 40 MPa FOR PRECAST CONCRETE AND 40 MPa FOR APRON SLAB AND WINGWALL EXTENSIONS.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF MASS CONCRETE AND NO FINES CONCRETE SHALL BE 25 MPa .
- EDGES SHALL BE CHAMFERED 20×20 AND RE-ENTRANT ANGLES FILLETED 20×20 UNLESS NOTED OTHERWISE.
- CJ DENOTES CONSTRUCTION JOINT.
- NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 45MM IF CAST AGAINST FORMWORK, 55MM IF CAST AGAINST NO FINES CONCRETE OR MEMBRANE AND 75MM IF CAST AGAINST THE GROUND.
- UNLESS SHOWN OTHERWISE ON THE DRAWINGS LAPS ON ADJACENT BARS ON ANY FACE SHALL BE STAGGERED (OFFSET) BY NO LESS THAN THE LAP LENGTH.
- UNLESS OTHERWISE SPECIFIED, THE MINIMUM DEVELOPMENT LENGTHS AND LENGTHS OF LAPS SHALL BE AS FOLLOWS:

BAR SIZE: mm	N12	N16	N20	N24	N28	N32	N36
a) HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW THE BAR:	460	650	940	1250	1580	.....	.....
b) OTHER BARS:	350	500	720	960	1210	.....	.....

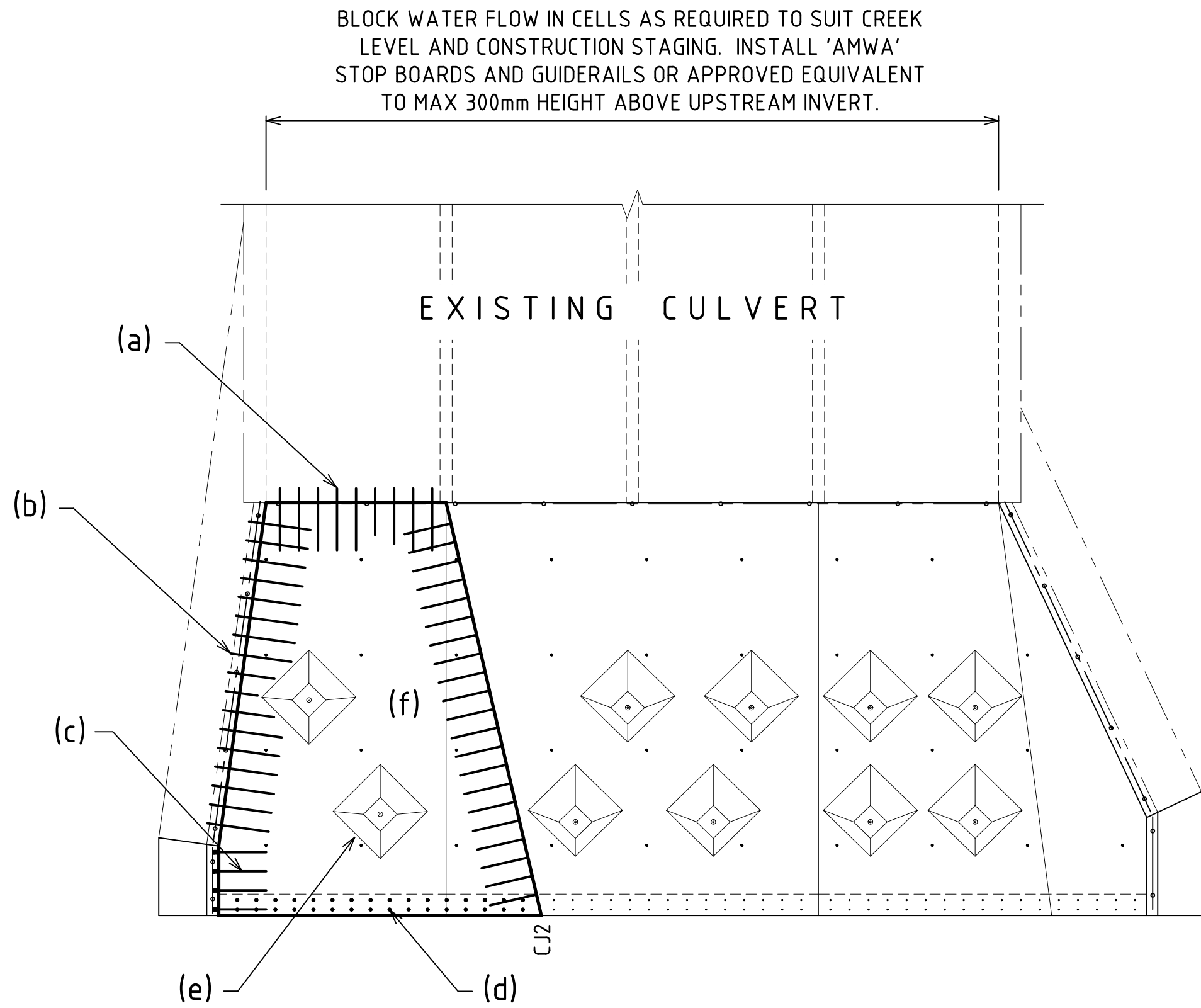
- REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR DOWELS, TIE BARS AND PRECAST BLOCKS.

B	17.08.18	100% DETAIL DESIGN	C.R.	T.F.	S.F.		
A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.			
Rev.	Date	Description	By	Ch'd	App'd		
ROADS AND MARITIME SERVICES							
B72 - SNOWY MOUNTAINS HIGHWAY				SNOWY VALLEYS COUNCIL			
JOUNAMA CREEK CULVERT							
CULVERT REPAIRS							
CONSTRUCTION STAGING DIAGRAM - SHEET 1							
<div>GHD</div> <div>GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com</div>				<div><div>Transport Roads & Maritime Services</div></div>			
PREPARED		CHECKED		REGISTRATION No OF PLANS			
DESIGN T.F.				DS2018 / 001306			
DRAWING C.RYE				RMS BRIDGE NUMBER		5460	
APPROVED DESIGN QA RECORDS				ISSUE STATUS: 100% DETAIL DESIGN			
				SHEET No.		4	
DIRECTOR				ISSUE		B	



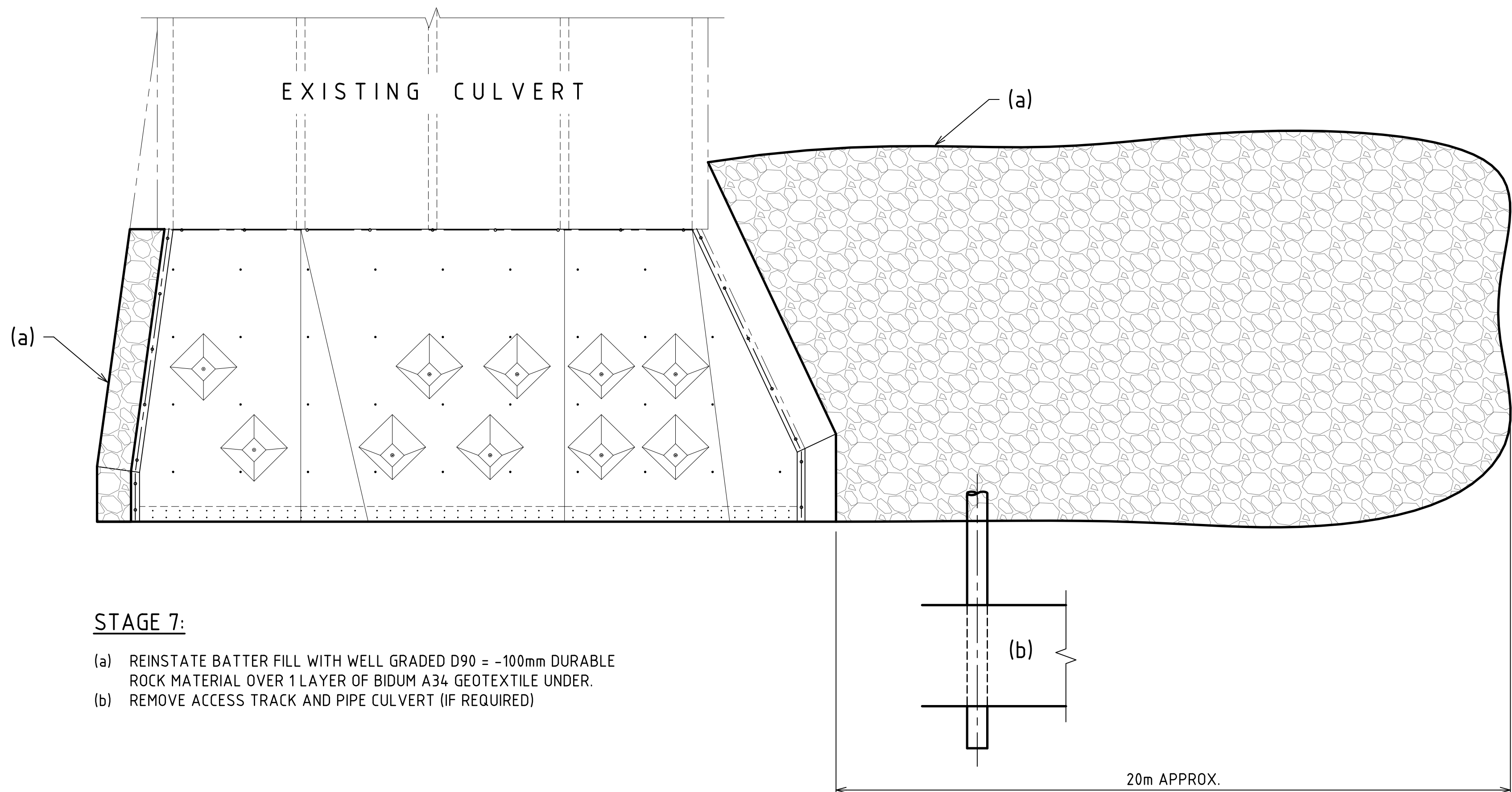
STAGE 5:

- (a) DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE.
- (b) INSTALL CAST IN REID BAR COUPLER RBA16CG AT 400 CENTRES MAX. WITH MIN 1000 LONG RBA16 REID BAR AS SOUTH SIDE OF CJ2 JOINT AND INSTALL RBA16 BARS ALONG 'CJ1'
- (c) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
- (d) PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
- (e) POUR NEW APRON SLAB PORTION (250mm THICK MINIMUM).



STAGE 6:

- (a) DRILL AND FIX REINFORCEMENT BARS INTO CONCRETE ON DOWNTURN EDGE BEAM AT DOWNSTREAM SIDE.
- (b) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING NORTHERN WING WALL.
- (c) INSTALL RBA16 REID BARS INTO NORTHERN WING WALL EXTENSION AND ALONG 'CJ2'
- (d) DRILL AND FIX REINFORCEMENT BARS INTO EXISTING BEDROCK. REFER SECTION 'D' & 'F' ON SHEET No. 7
- (e) PLACE REINFORCING MESH (CUT AROUND PRECAST BLOCKS).
- (f) POUR NEW APRON SLAB PORTION (250mm MINIMUM THICKNESS).



STAGE 7:

- (a) REINSTATE BATTER FILL WITH WELL GRADED D90 = -100mm DURABLE ROCK MATERIAL OVER 1 LAYER OF BIDUM A34 GEOTEXTILE UNDER.
- (b) REMOVE ACCESS TRACK AND PIPE CULVERT (IF REQUIRED)

GENERAL NOTES:

SCALE 0 1 2 3 4 5m
1 0.5 OR AS SHOWN


- ALL DIMENSIONS ARE IN MILLIMETRES.
- CHAINAGES AND REDUCED LEVELS ARE IN METRES.
- REDUCED LEVELS ARE TO AHD.
- LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.

CONCRETE NOTES:

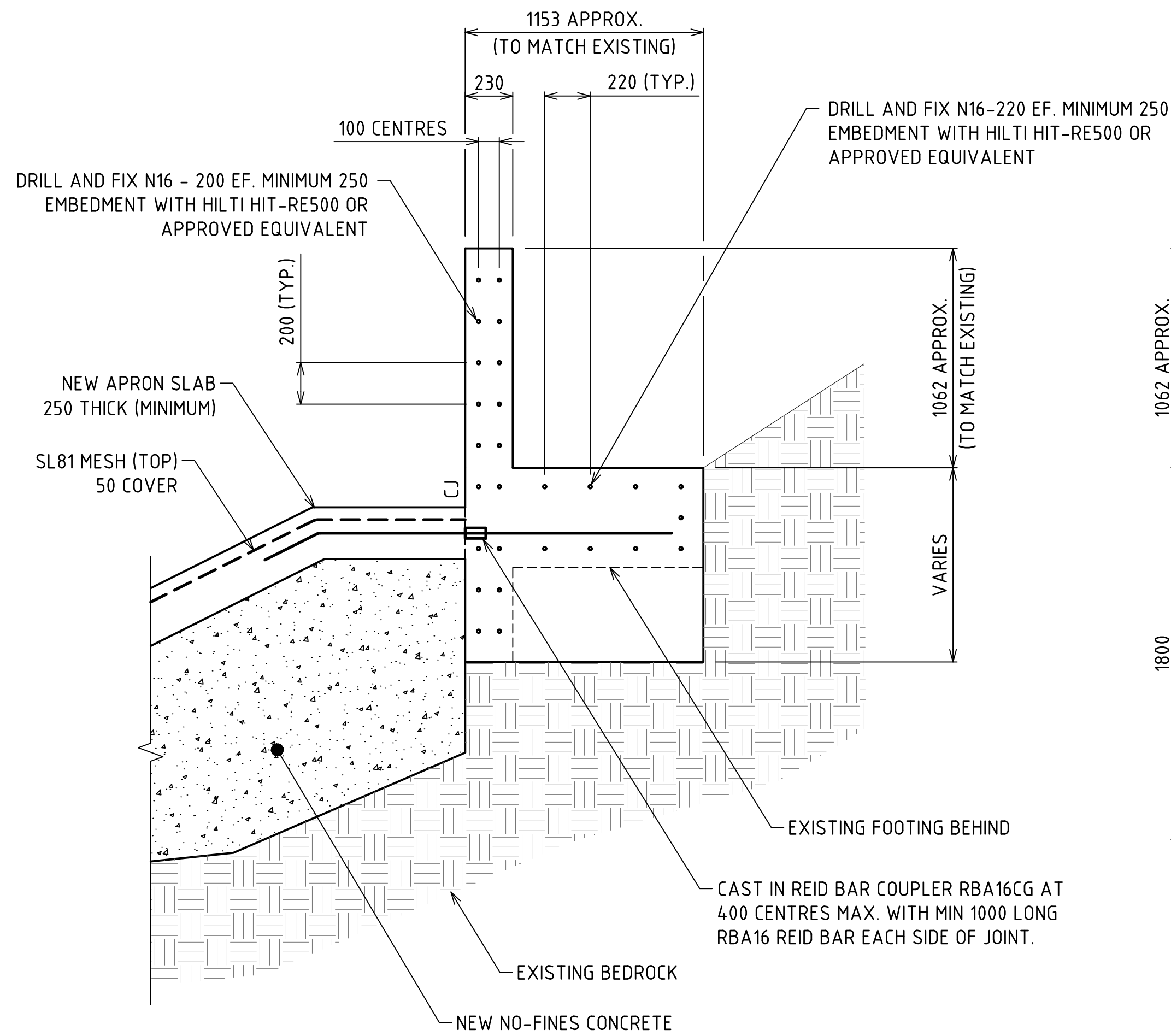
- CONCRETE EXPOSURE CLASSIFICATION B1.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF CAST INSITU REINFORCED CONCRETE WALLS SHALL BE 40MPa FOR PRECAST CONCRETE AND 40MPa FOR APRON SLAB AND WINGWALL EXTENSIONS.
- MIN. 28 DAY COMPRESSIVE STRENGTH OF MASS CONCRETE AND NO FINES CONCRETE SHALL BE 25MPa.
- EDGES SHALL BE CHAMFERED 20 x 20 AND RE-ENTRANT ANGLES FILLETED 20 x 20 UNLESS NOTED OTHERWISE.
- CJ DENOTES CONSTRUCTION JOINT.
- NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 45MM IF CAST AGAINST FORMWORK, 55MM IF CAST AGAINST NO FINES CONCRETE OR MEMBRANE AND 75MM IF CAST AGAINST THE GROUND.
- UNLESS SHOWN OTHERWISE ON THE DRAWINGS LAPS ON ADJACENT BARS ON ANY FACE SHALL BE STAGGERED (OFFSET) BY NO LESS THAN THE LAP LENGTH.
- UNLESS OTHERWISE SPECIFIED, THE MINIMUM DEVELOPMENT LENGTHS AND LENGTHS OF LAPS SHALL BE AS FOLLOWS:

BAR SIZE: mm	N12	N16	N20	N24	N28	N32	N36
a) HORIZONTAL BARS WITH>300mm OF CONCRETE CAST BELOW THE BAR:	460	650	940	1250	1580	.....	.....
b) OTHER BARS:	350	500	720	960	1210	.....	.....

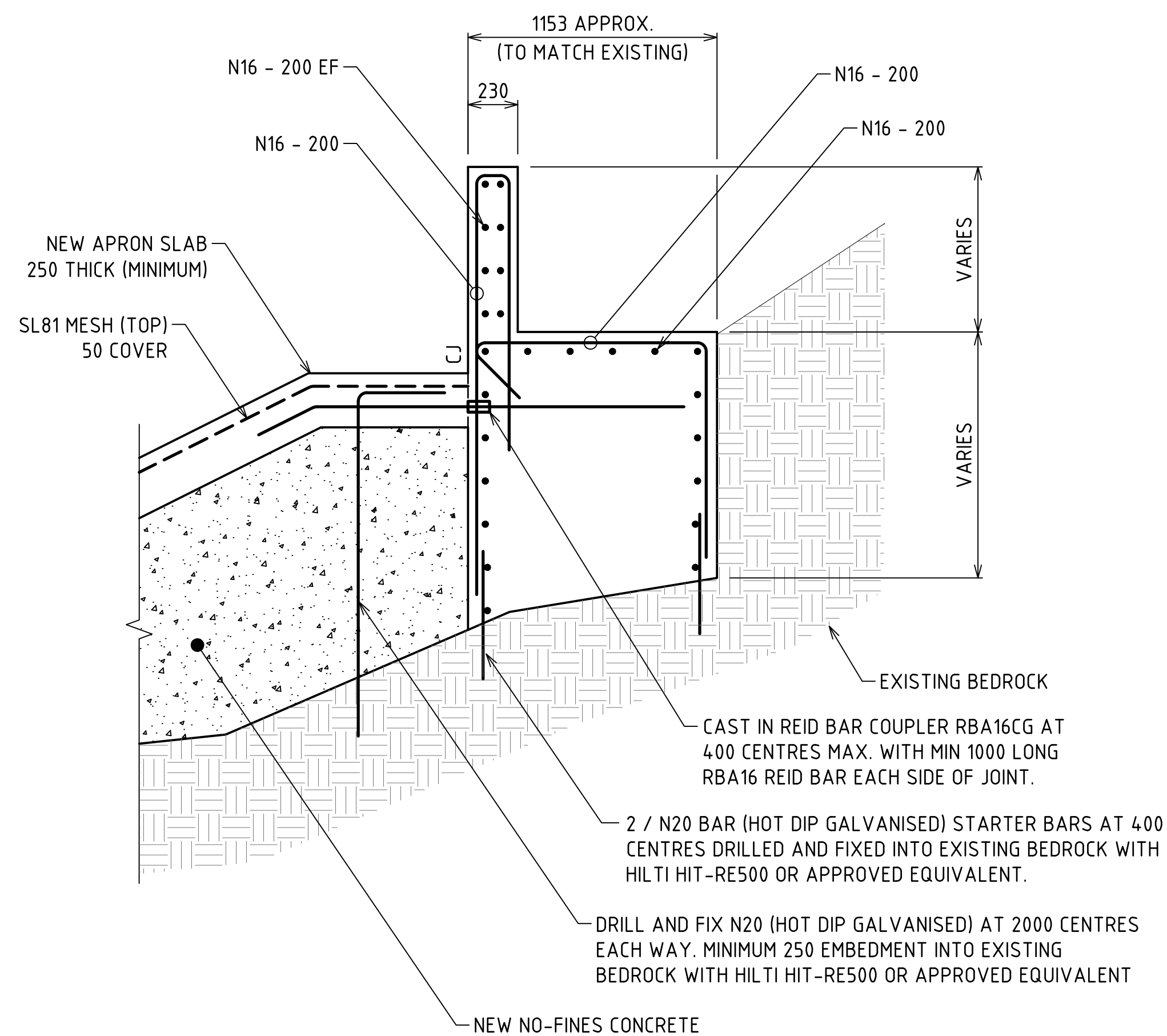
- REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR DOWELS, TIE BARS AND PRECAST BLOCKS.

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A	13.07.18	80% DETAIL DESIGN	C.R.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
CONSTRUCTION STAGING DIAGRAM - SHEET 2					
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
PREPARED		CHECKED	REGISTRATION No OF PLANS		
DESIGN T.F.			DS2018 / 001306		
DRAWING C.R.YE			RMS BRIDGE NUMBER		5460
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
DIRECTOR			SHEET No. 5		ISSUE B

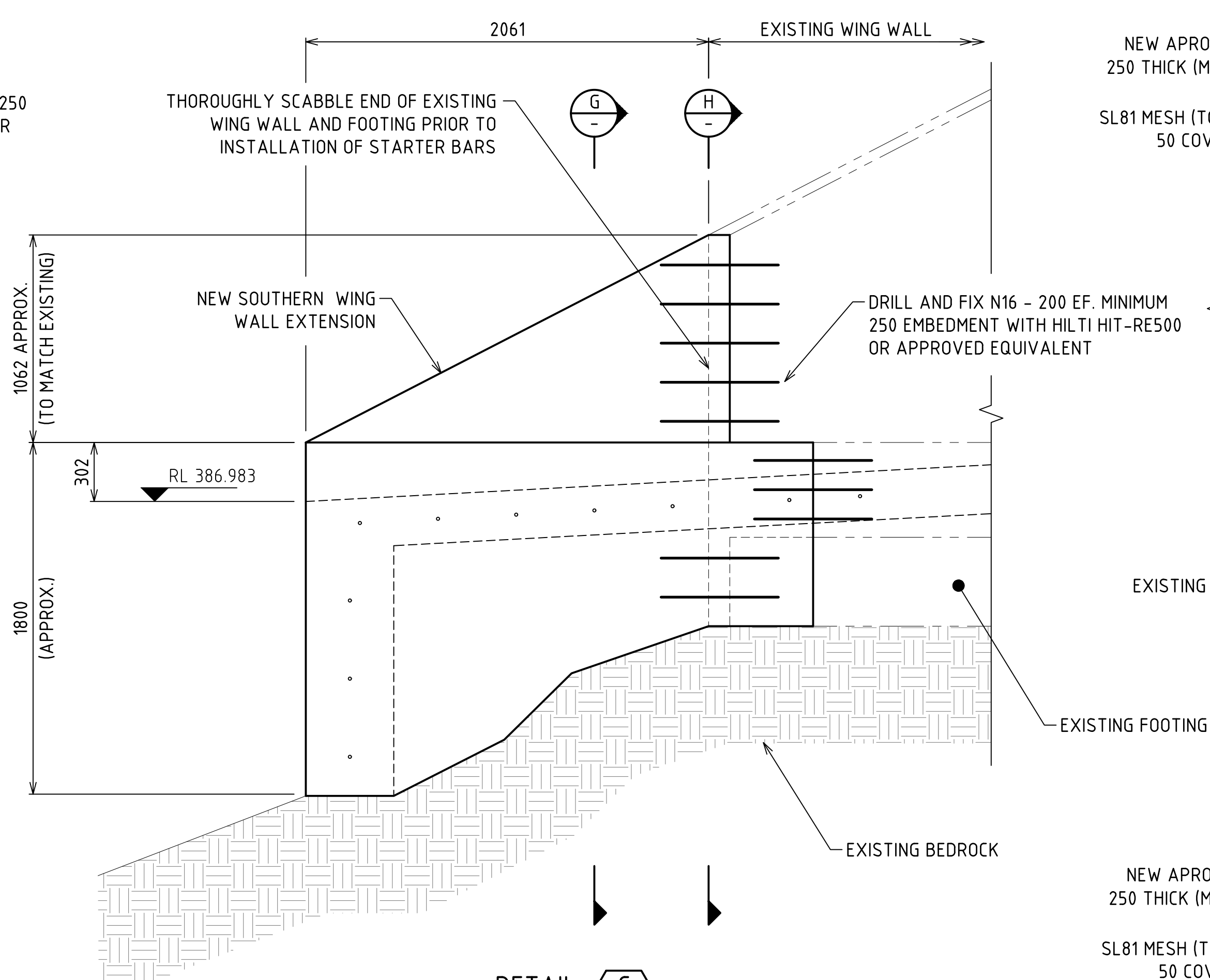
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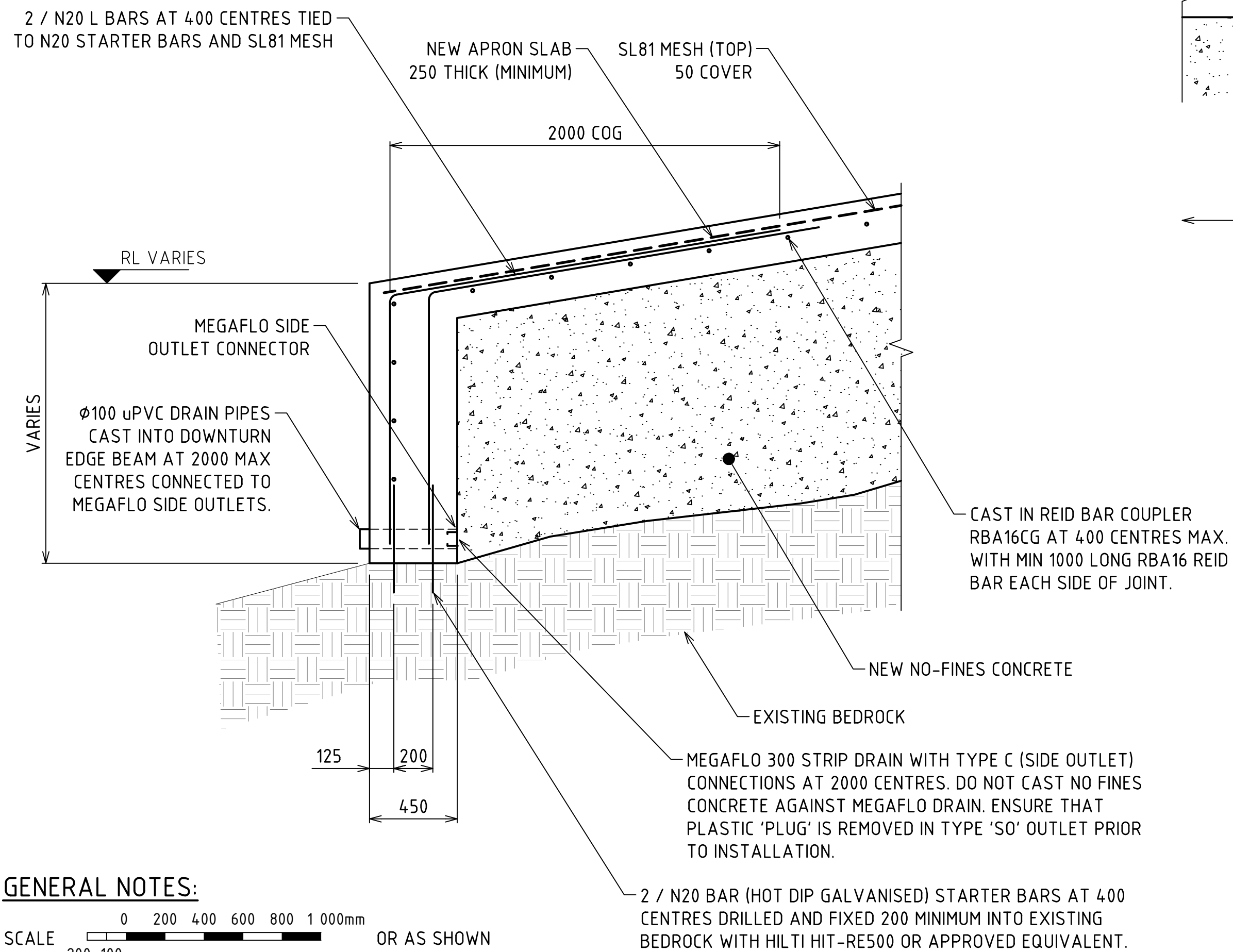
SECTION H
SCALE 1:20



SECTION G
SCALE 1:20



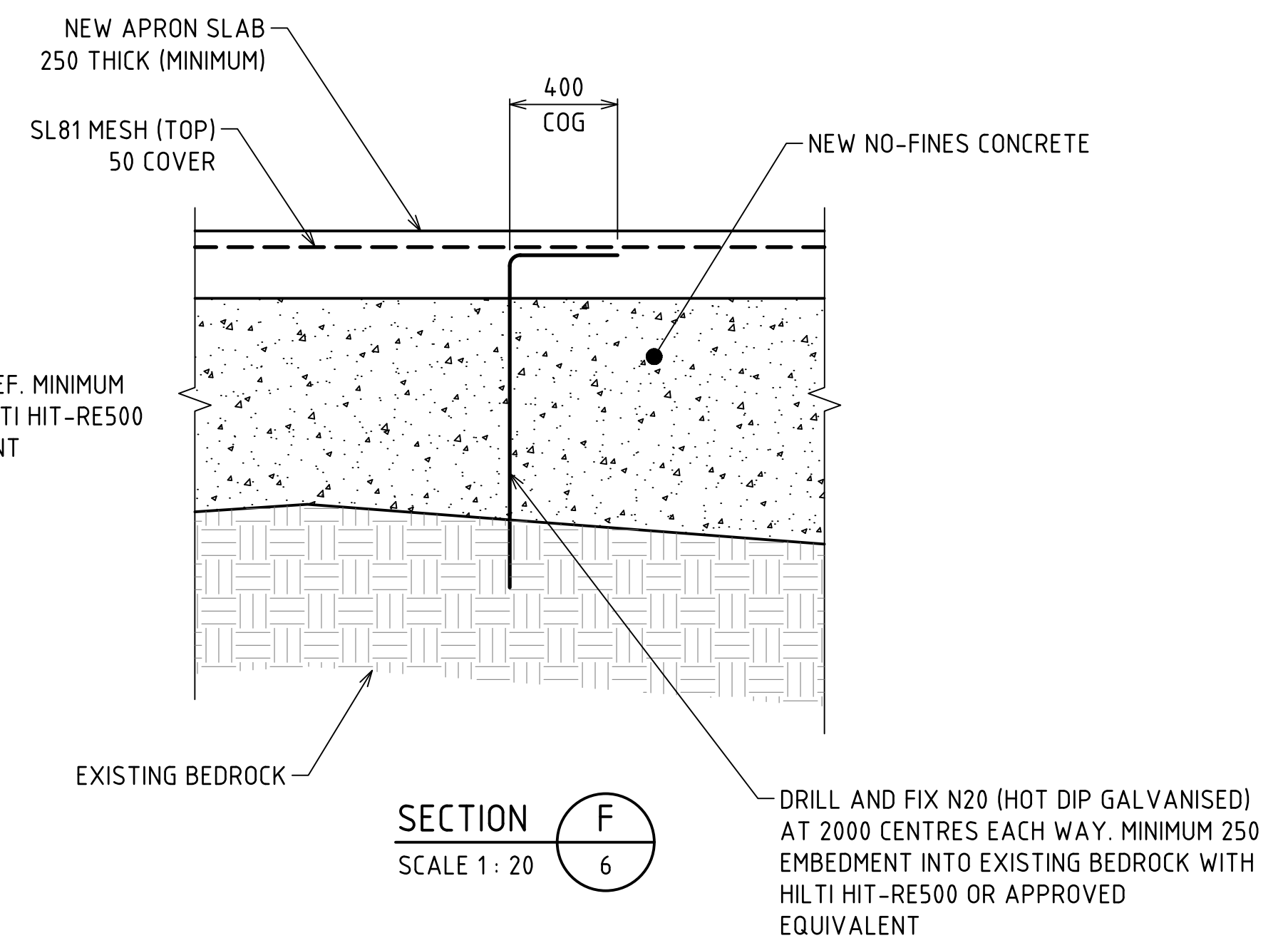
DETAIL C
SCALE 1:20



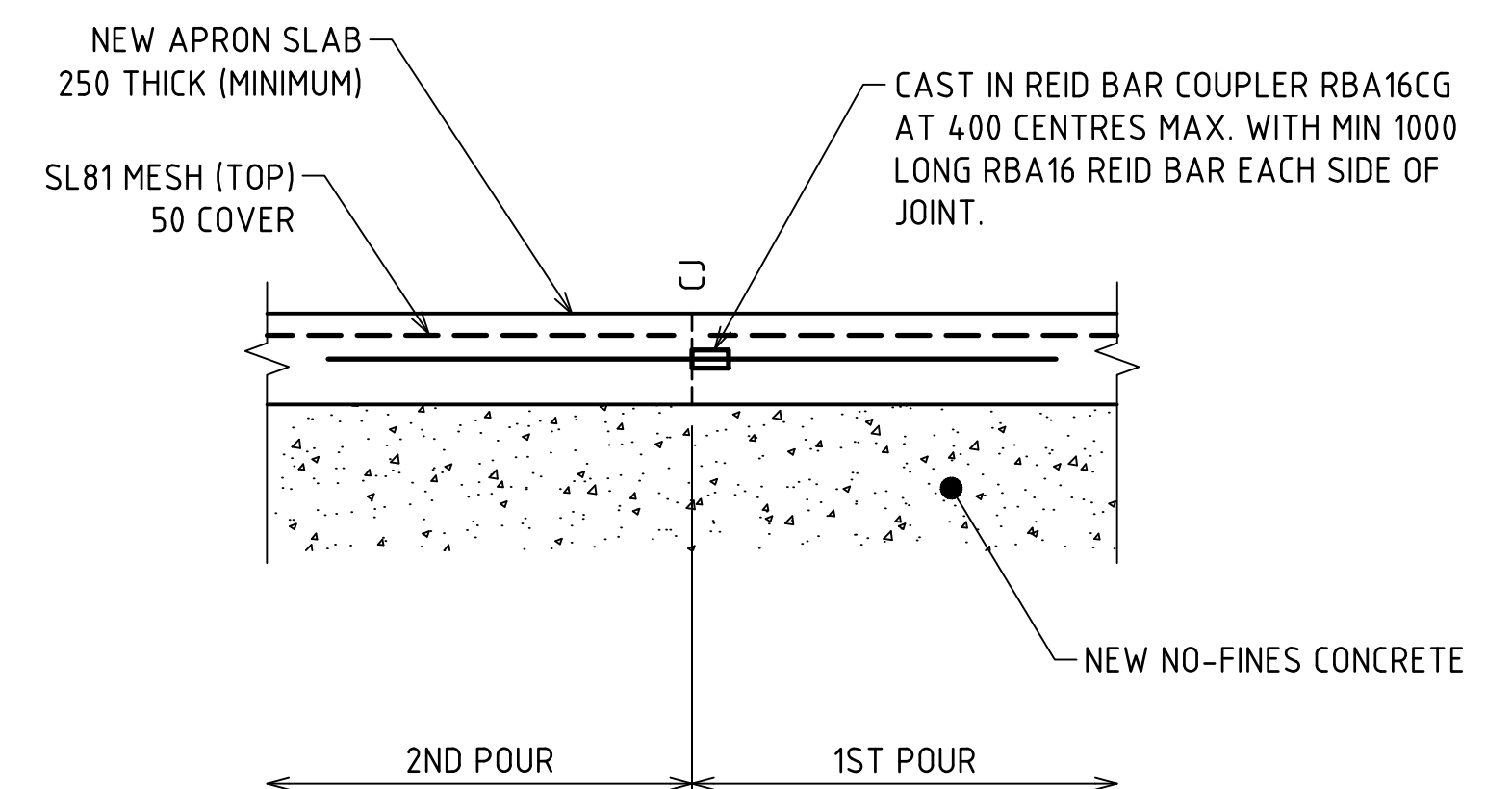
GENERAL NOTES:

- SCALE 0 200 400 600 800 1 000mm OR AS SHOWN
200 100
- FOR GENERAL NOTES AND CONCRETE NOTES RELATING TO THIS DRAWING REFER TO SHEET No.4


DETAIL D
SCALE 1:20



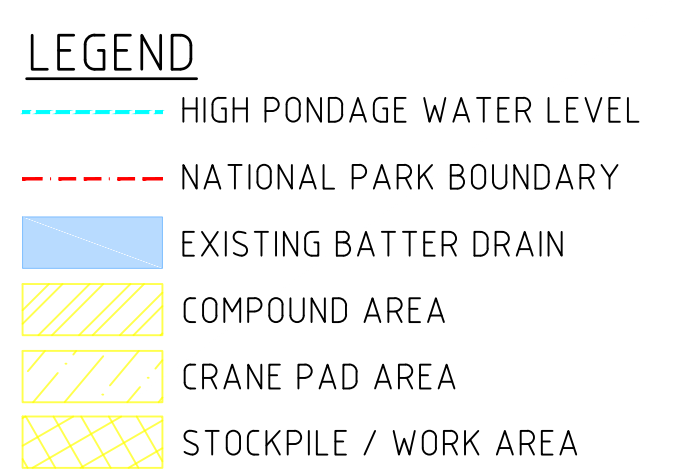
SECTION F
SCALE 1:20




SECTION E
SCALE 1:20

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A	13.07.18	80% DETAIL DESIGN				C.R.	T.F.		
Rev.	Date	Description				By	Ch'd	App'd	
ROADS AND MARITIME SERVICES									
B72 - SNOWY MOUNTAINS HIGHWAY					SNOWY VALLEYS COUNCIL				
JOUNAMA CREEK CULVERT									
CULVERT REPAIRS									
CONCRETE DETAILS - SHEET 2									
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com						 Transport Roads & Maritime Services			
PREPARED		CHECKED		REGISTRATION No OF PLANS					
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DRAWING CRYE				RMS BRIDGE NUMBER		5460			
APPROVED DESIGN QA RECORDS				ISSUE STATUS: 100% DETAIL DESIGN					
				SHEET No.		7		ISSUE B	


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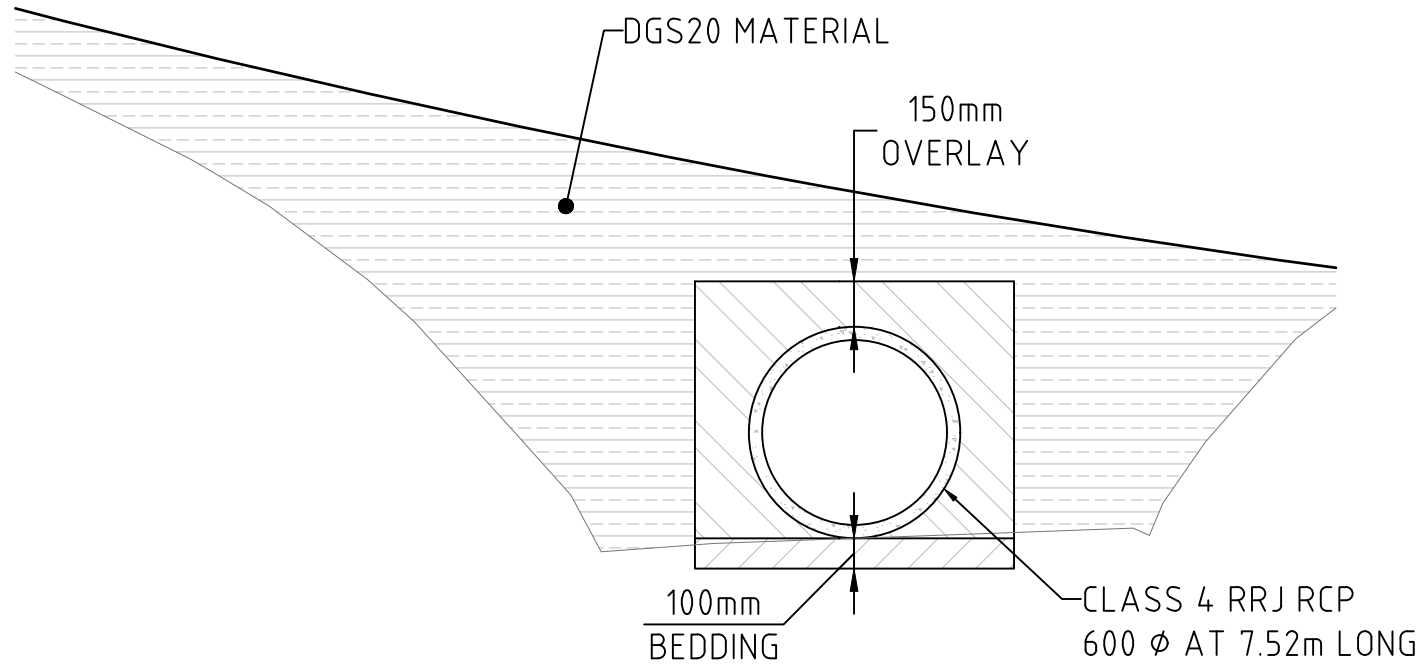
SCALE  OR AS SHOWN

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. CHAINAGES AND REDUCED LEVELS ARE IN METRES.
3. REDUCED LEVELS ARE TO AHD.
4. LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
5. MAX PONDAGE WATER LEVEL 392.4m SHD = 391.223m AHD
6. FOLLOWING COMPLETION OF WORKS THE 600 Ø PIPE CROSSING WITHIN THE CREEK CHANNEL IS TO BE REMOVED.
7. THE GRAVEL ACCESS ROAD BELOW JOUNAMA PONDAGE HIGH WATER LEVEL OF 391.223m AHD IS TO BE REMOVED AND REINSTATED TO NATURAL VEGETATION UPON COMPLETION OF WORKS. GRAVEL ACCESS ELSEWHERE TO BE PERMANENT.
8. REMOVE TOPSOIL FROM ROAD FOOTPRINT AND COMPACT SUBGRADE IN ACCORDANCE WITH RMS SPECIFICATION R44. PLACE MIN 300mm THICK DGS GRAVEL ACCESS ROAD. PLACE AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R71.
9. GUARDRAIL TERMINALS TO BE RELOCATED TEMPORARILY AT THE HIGHWAY ENTRY POINT TO THE ACCESS ROAD. TERMINALS TO BE REINSTATED UPON COMPLETION OF WORKS.
10. REMOVE VEGETATION AS REQUIRED FROM COMPOUND AREA, CRANE PAD AREA AND STOCKPILE / WORK AREA.



B	17.08.18	100% DETAIL DESIGN		A.B.	T.F.
A	13.07.18	80% DETAIL DESIGN		A.B.	T.F.
Rev.	Date	Description		By	Ch'd
<div>ROADS AND MARITIME SERVICES</div> <div>B72 - SNOWY MOUNTAINS HIGHWAY SNOWY VALLEYS COUNCIL</div> <div>JOUNAMA CREEK CULVERT</div> <div>CULVERT REPAIRS</div> <div>ACCESS ROAD PLAN AND LONG SECTION</div>					
<div>GHD</div> <div>GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E info@ghd.com W www.ghd.com</div>			<div>  <div> <div>Transport</div> <div>Roads & Maritime Services</div> </div> </div>		
<div>PREPARED</div> <div>DESIGN T.F.</div> <div>DRAWING A.B.</div>		<div>CHECKED</div> <div>.....</div>	<div>REGISTRATION No OF PLANS</div> <div>DS2018 / 001306</div>		
<div>APPROVED DESIGN QA RECORDS</div> <div>.....</div> <div>DIRECTOR</div>		<div>RMS BRIDGE NUMBER</div> <div>5460</div>		<div>ISSUE STATUS: 100% DETAIL DESIGN</div>	
		<div>SHEET No.</div> <div>8</div>		<div>ISSUE</div> <div>B</div>	

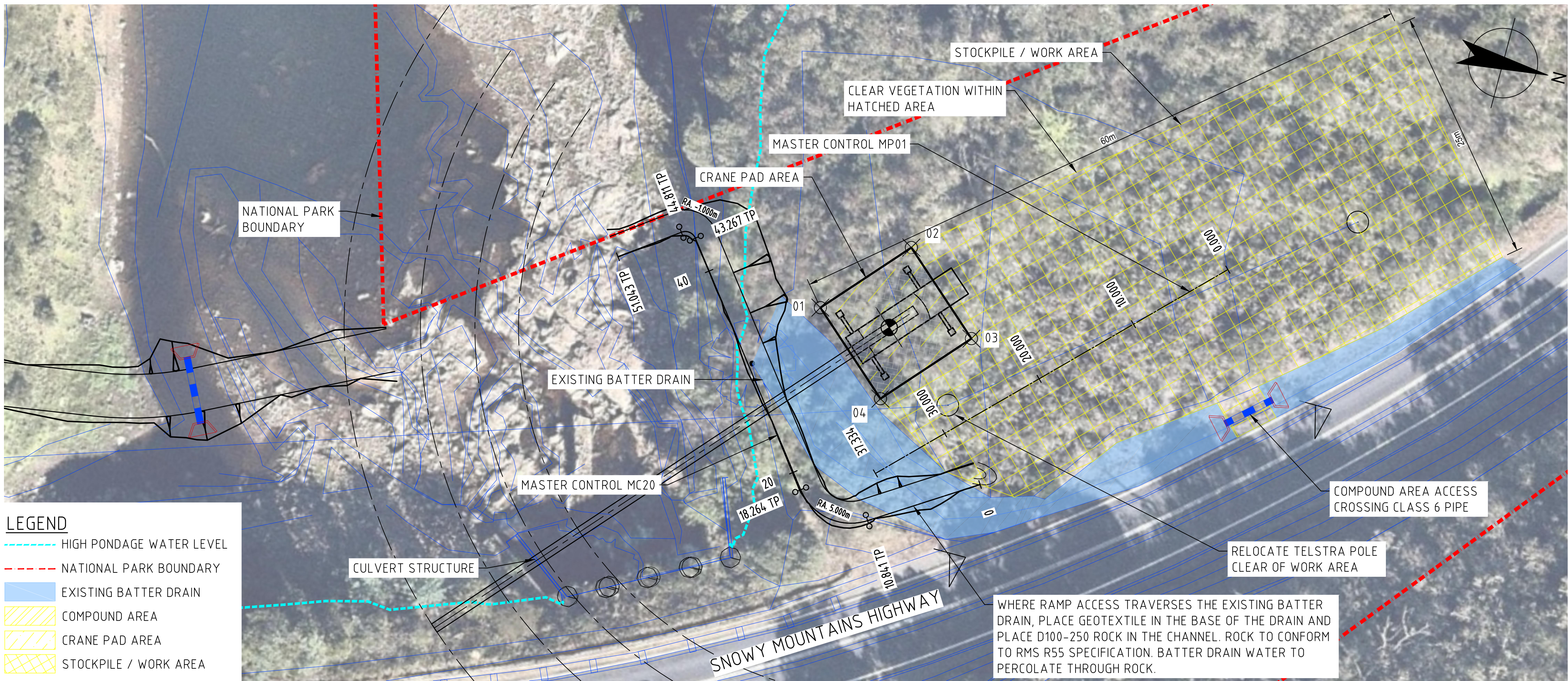
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TEMPORARY PIPE CROSSING DETAIL
SCALE 1:100

TEMPORARY PIPE CROSSING INSTALLATION NOTES

1. FILL CREEK CHANNEL WITH DGS20 MATERIAL AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R71.
2. EXCAVATE THROUGH COMPACTED MATERIAL TO BED LEVEL TO A WIDTH SUITABLE FOR INSTALLATION OF 600mm Ø PIPE CULVERT.
3. PREPARE BEDDING, LAY PIPES AND BACKFILL IN ACCORDANCE WITH RMS SPECIFICATION R11 TO TOP OF OVERLAY ZONE.
4. PLACE AND COMPACT DGS MATERIAL ABOVE TOP OF OVERLAY ZONE UNTIL DESIGN LEVEL IS ACHIEVED

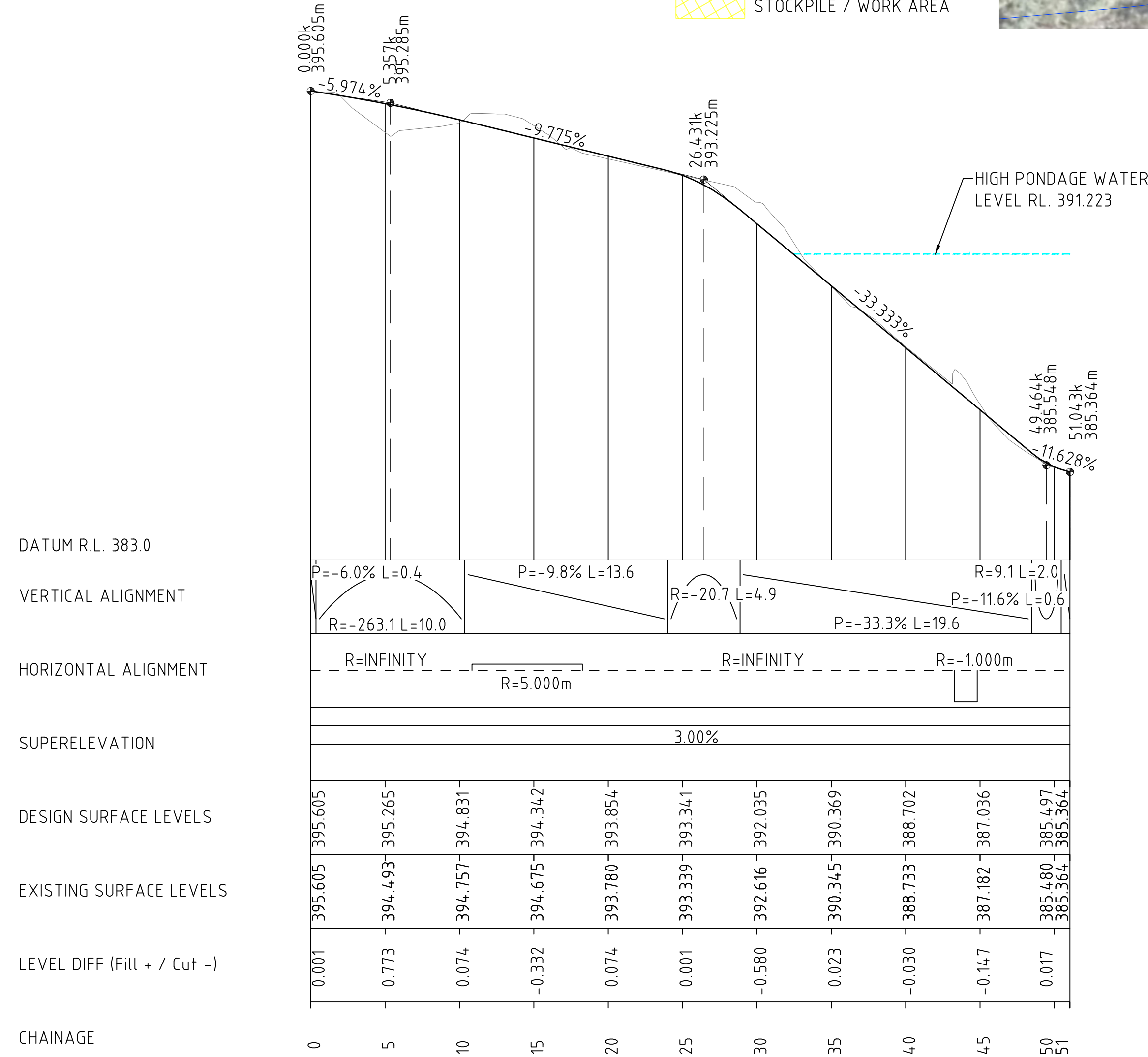


PLAN
SCALE 1:250

GENERAL NOTES:

SCALE 0 10 20 30m OR AS SHOWN
10 5

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. CHAINAGES AND REDUCED LEVELS ARE IN METRES.
3. REDUCED LEVELS ARE TO AHD.
4. LOCATION OF ALL EXISTING SERVICES TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
5. MAX PONDAGE WATER LEVEL 392.4m SHD = 391.223m AHD
6. REMOVE TOPSOIL FROM ROAD FOOTPRINT AND COMPACT SUBGRADE IN ACCORDANCE WITH RMS SPECIFICATION R44. PLACE MIN 300mm THICK DGS GRAVEL ACCESS ROAD. PLACE AND COMPACT IN ACCORDANCE WITH RMS SPECIFICATION R44.
7. REMOVE VEGETATION AS REQUIRED FROM COMPOUND AREA, CRANE PAD AREA AND STOCKPILE / WORK AREA. PLACE AND COMPACT 100mm DGS20 OVER COMPOUND AREA
8. COMPOUND AREA ACCESS CROSSING - PREPARE BEDDING, LAY PIPES AND BACKFILL IN ACCORDANCE WITH RMS SPECIFICATION R11 TO TOP OF OVERLAY ZONE. PLACE AND COMPACT DGS MATERIAL ABOVE TOP OF OVERLAY ZONE UNTIL DESIGN LEVEL IS ACHIEVED



LONGITUDINAL SECTION - CRANE ACCESS CONTROL MC20
SCALE 1:250H 1:100V

CRANE PAD COORDINATES		
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02	620090.751	6063396.866
03	620097.387	6063404.347
04	620104.868	6063397.711

NOTE: CRANE PAD TO HAVE MAXIMUM FALL OF 500mm IN ANY DIRECTION

DATUM R.L. 391.0

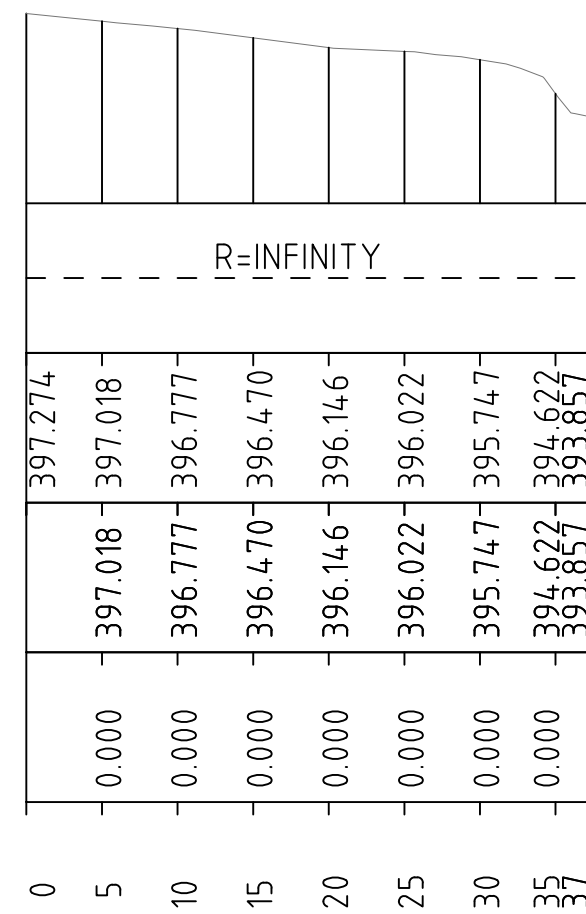
HORIZONTAL ALIGNMENT

DESIGN SURFACE LEVELS


EXISTING SURFACE LEVELS

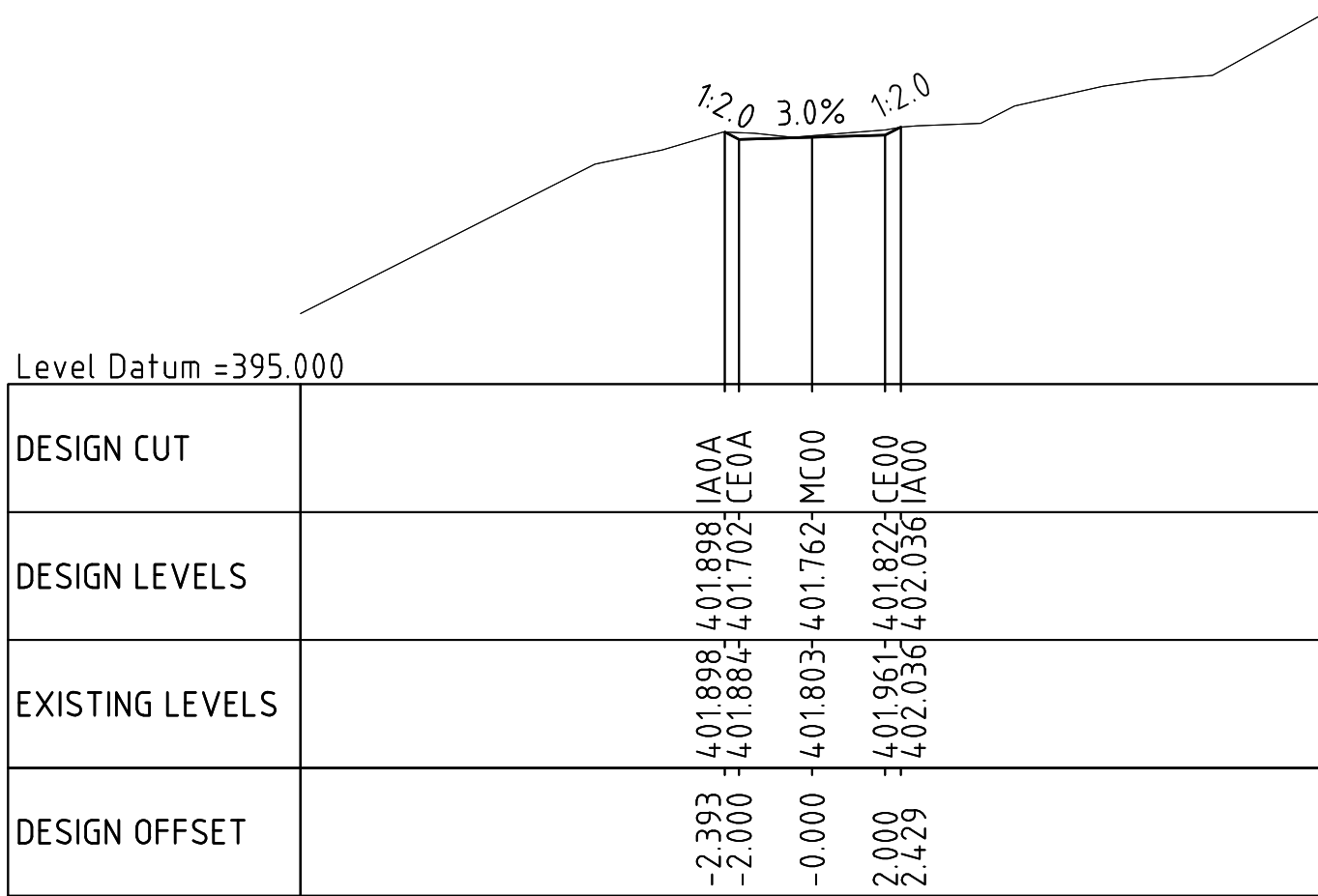
LEVEL DIFF (Fill + / Cut -)

CHAINAGE

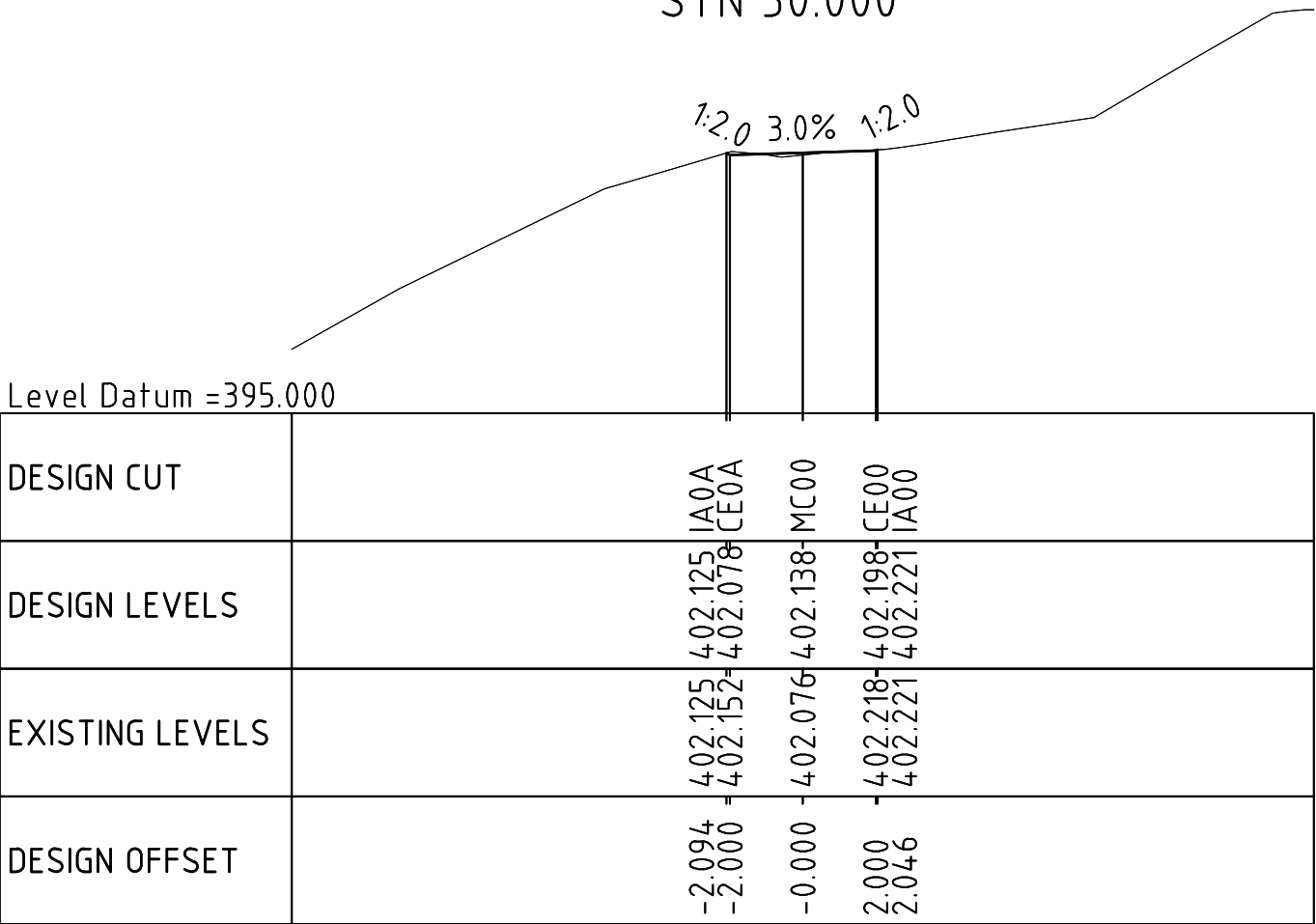


LONGITUDINAL SECTION - SITE COMPOUND CONTROL MP01
SCALE 1:250H 1:100V

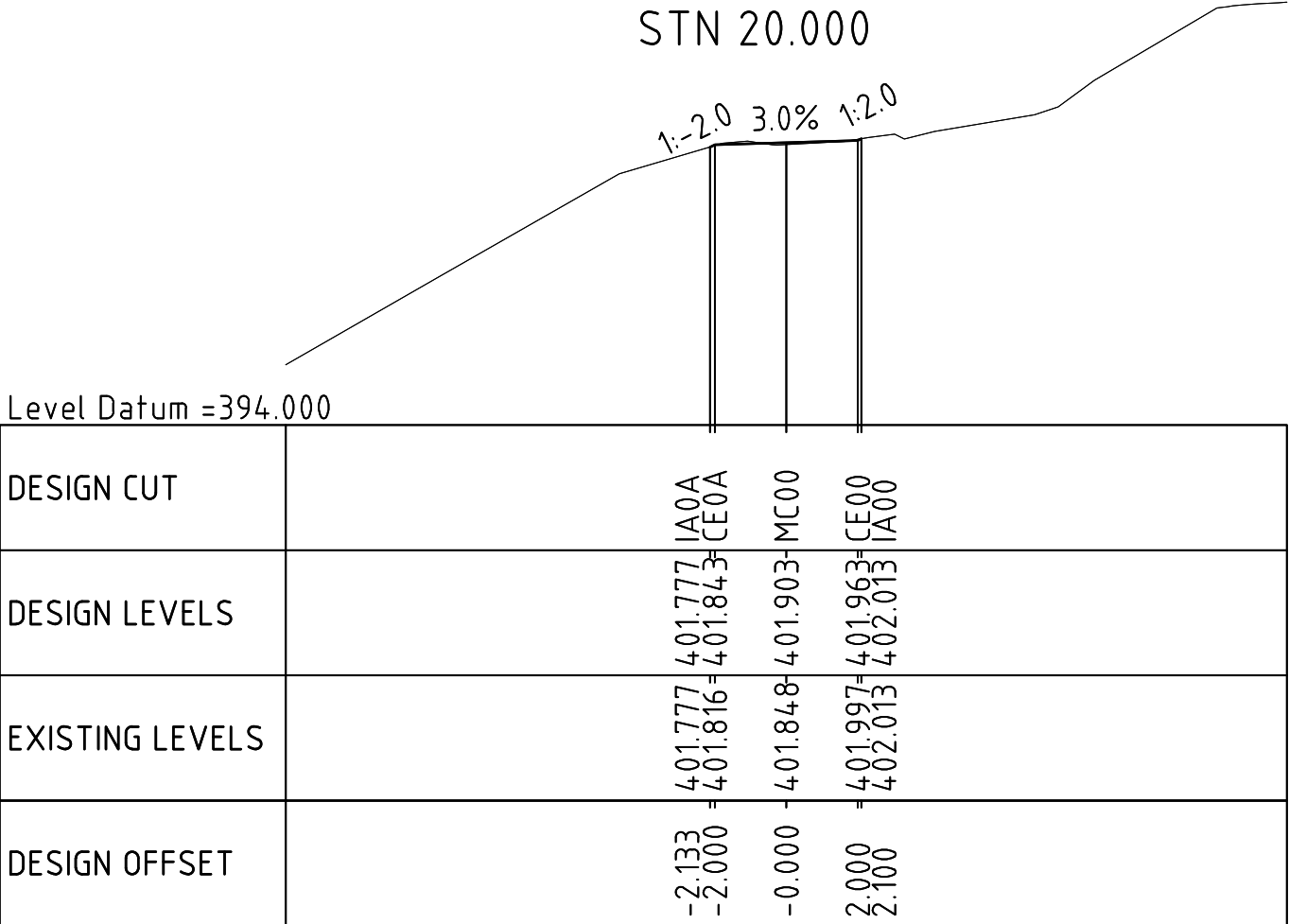
B	17.08.18	100% DETAIL DESIGN	A.B.	T.F.	S.F.
A	13.07.18	80% DETAIL DESIGN	A.B.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
EXCAVATOR ACCESS PLAN AND LONG SECTION					
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
PREPARED		CHECKED	REGISTRATION No OF PLANS		
DESIGN T.F.			DS2018 / 001306		
DRAWING A.B.			RMS BRIDGE NUMBER		5460
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
..... DIRECTOR			SHEET No. 9		ISSUE B



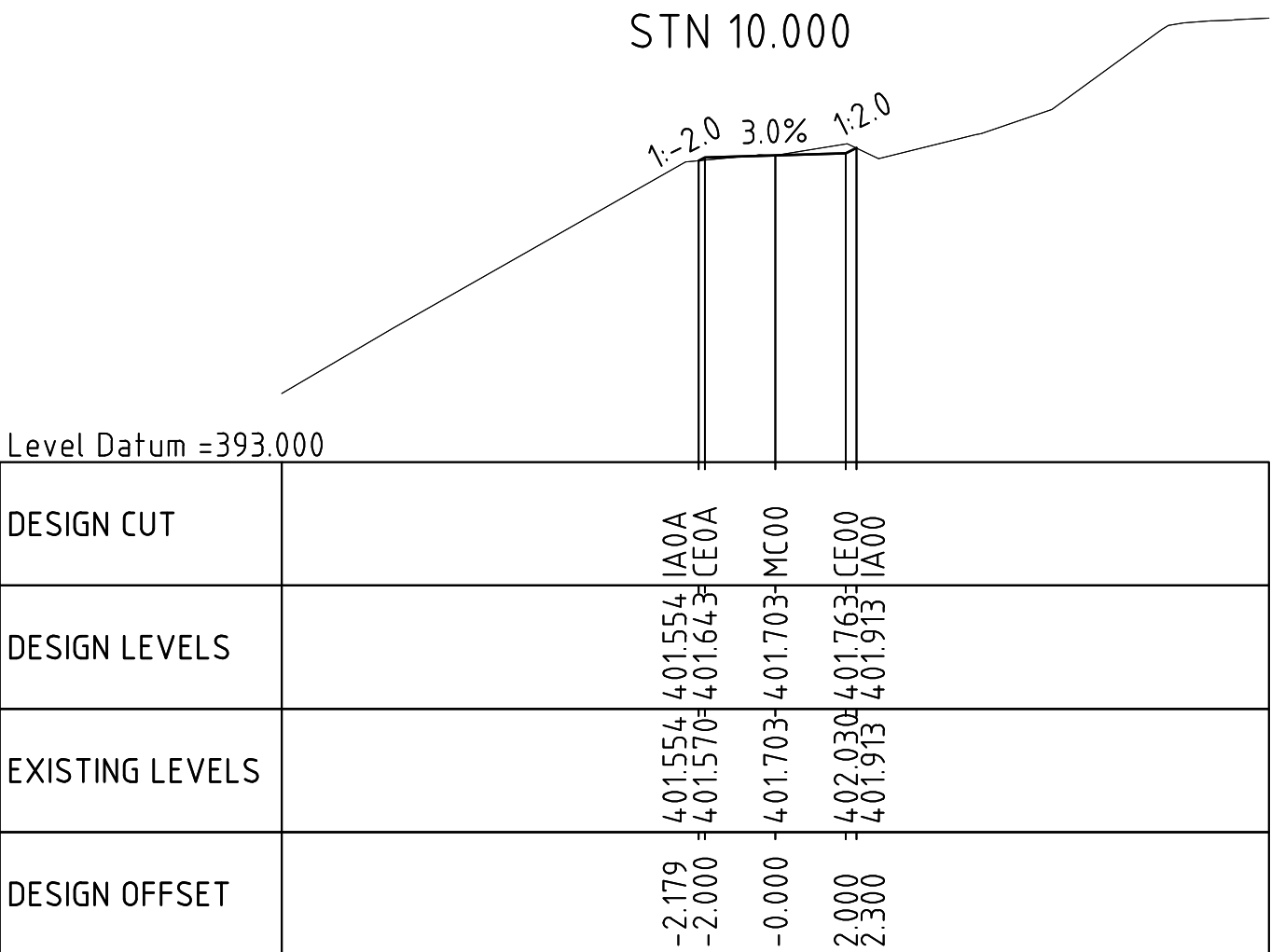
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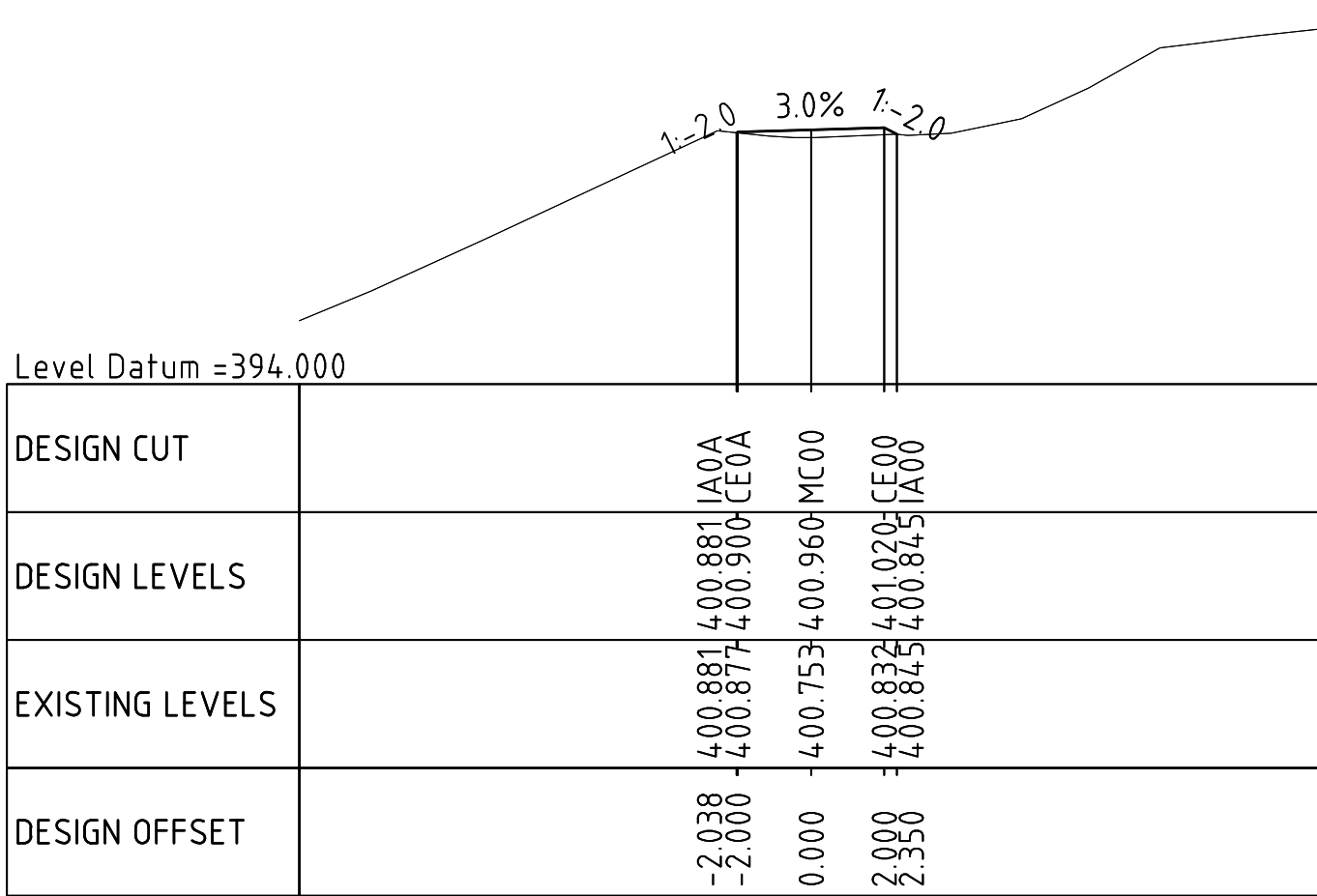
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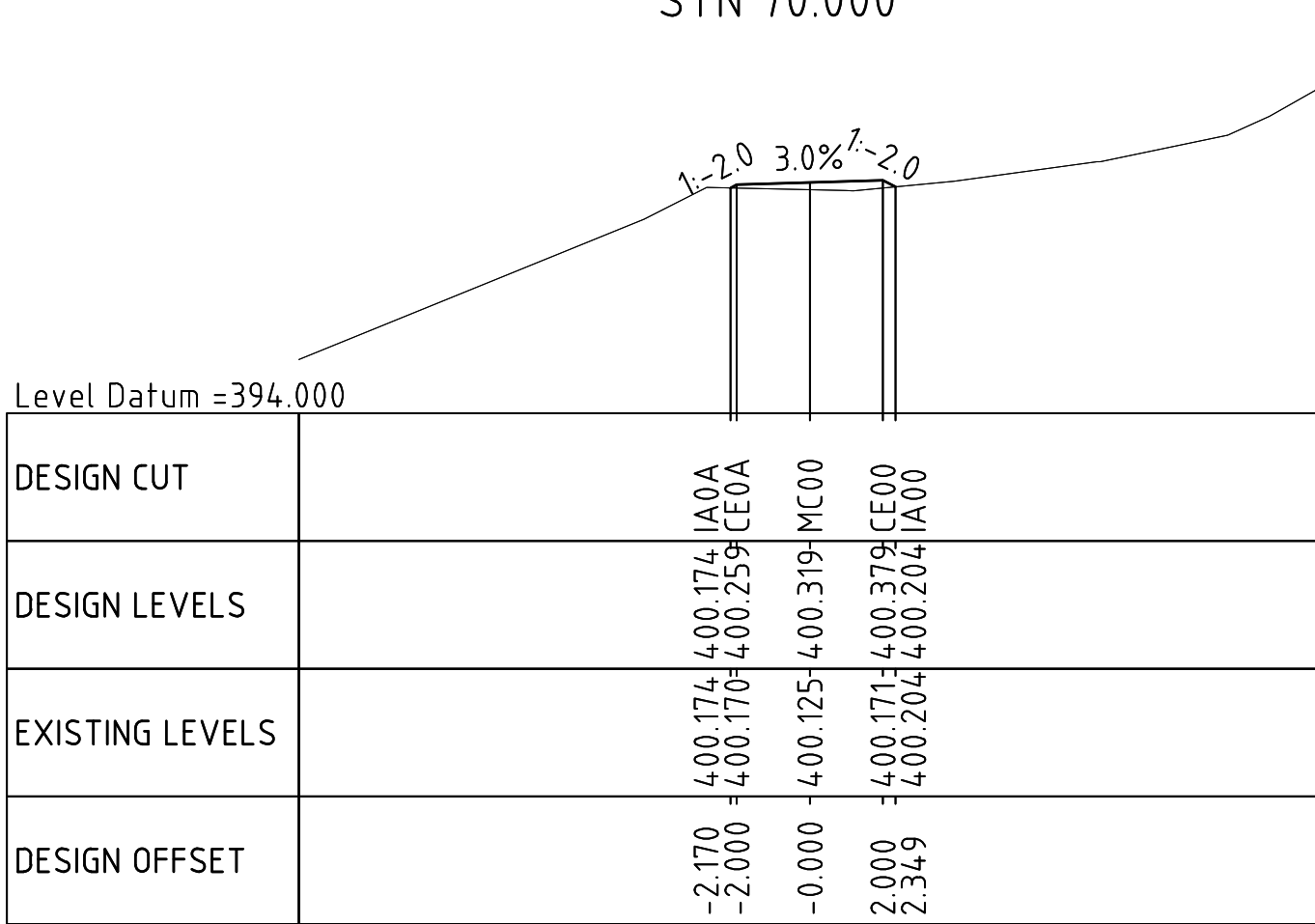
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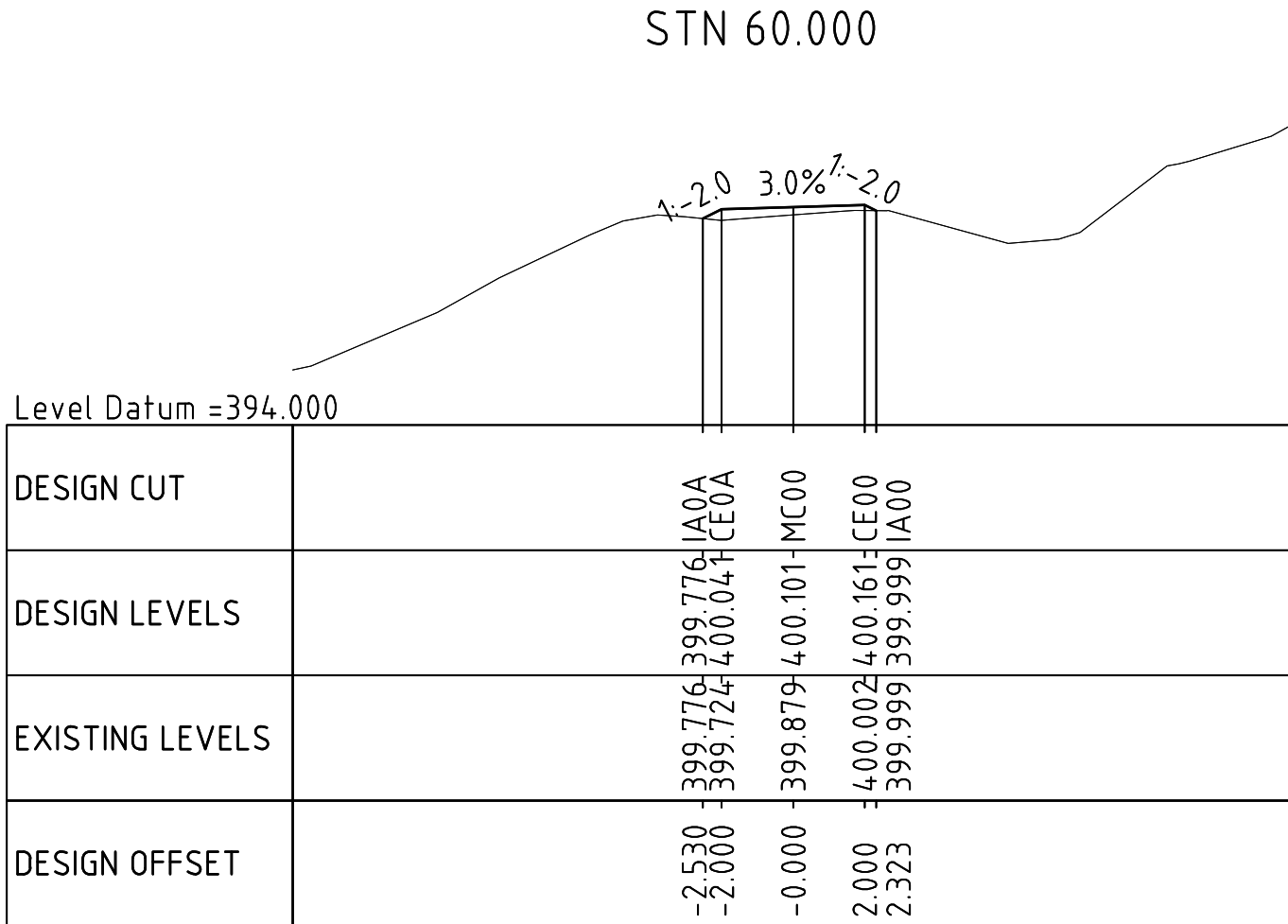
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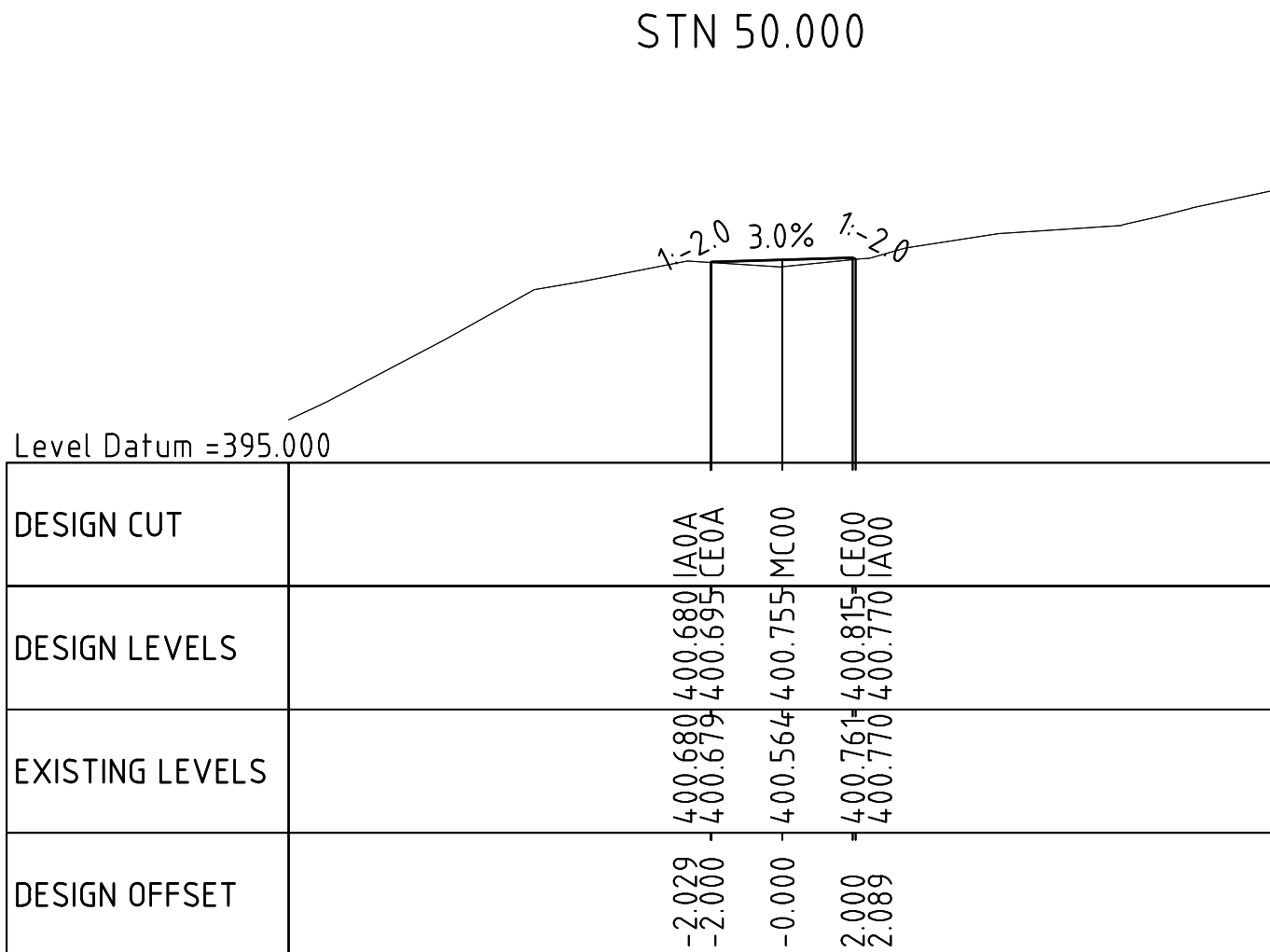
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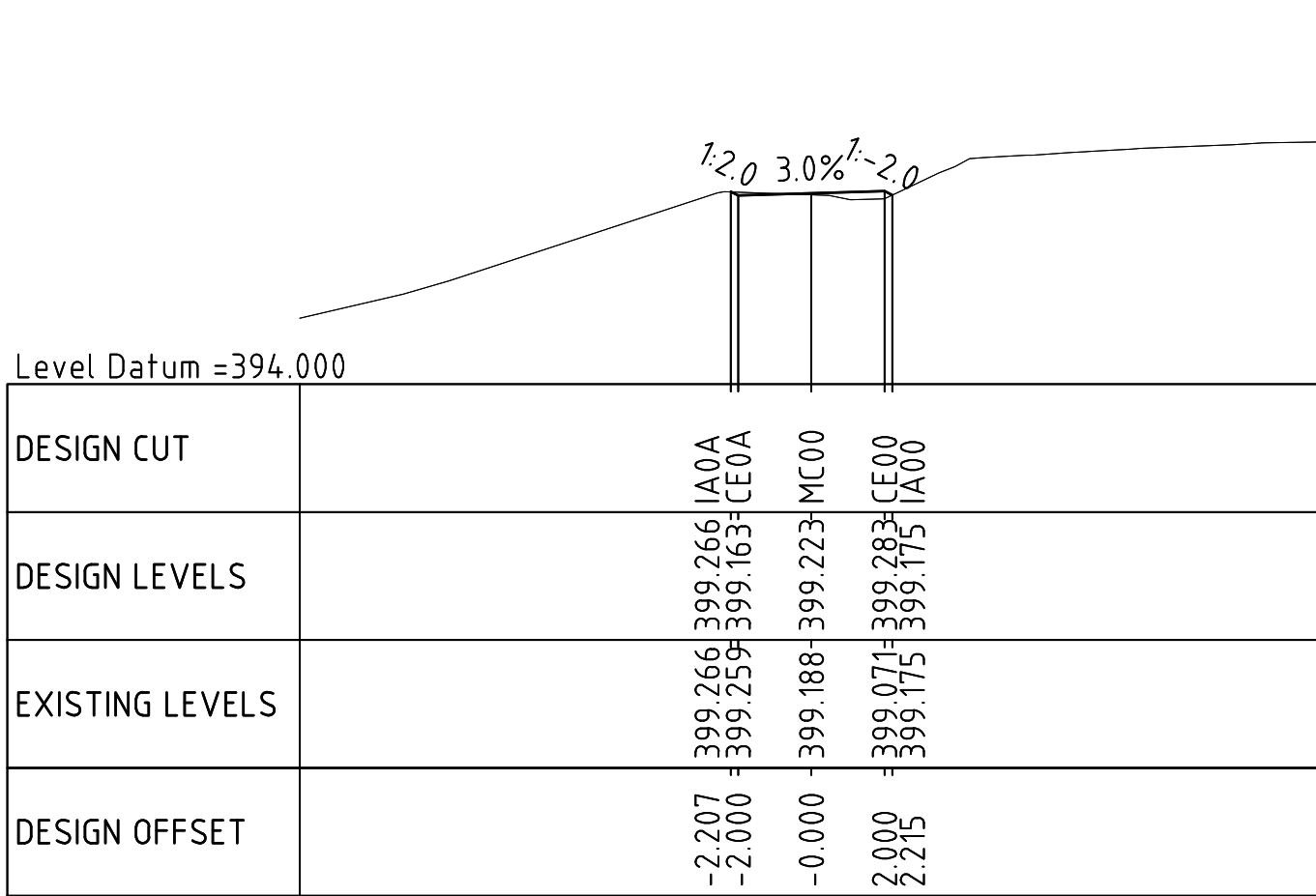
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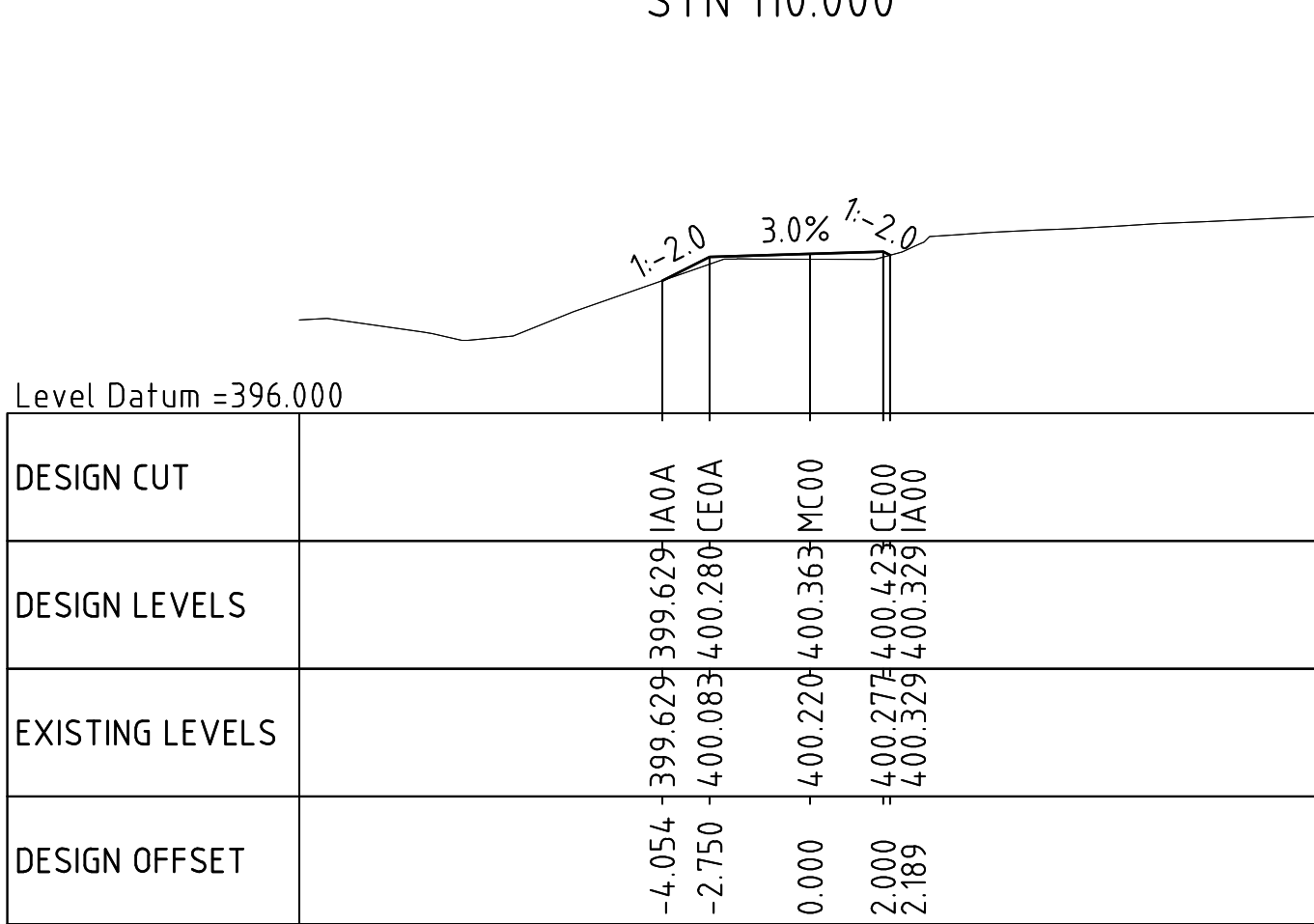
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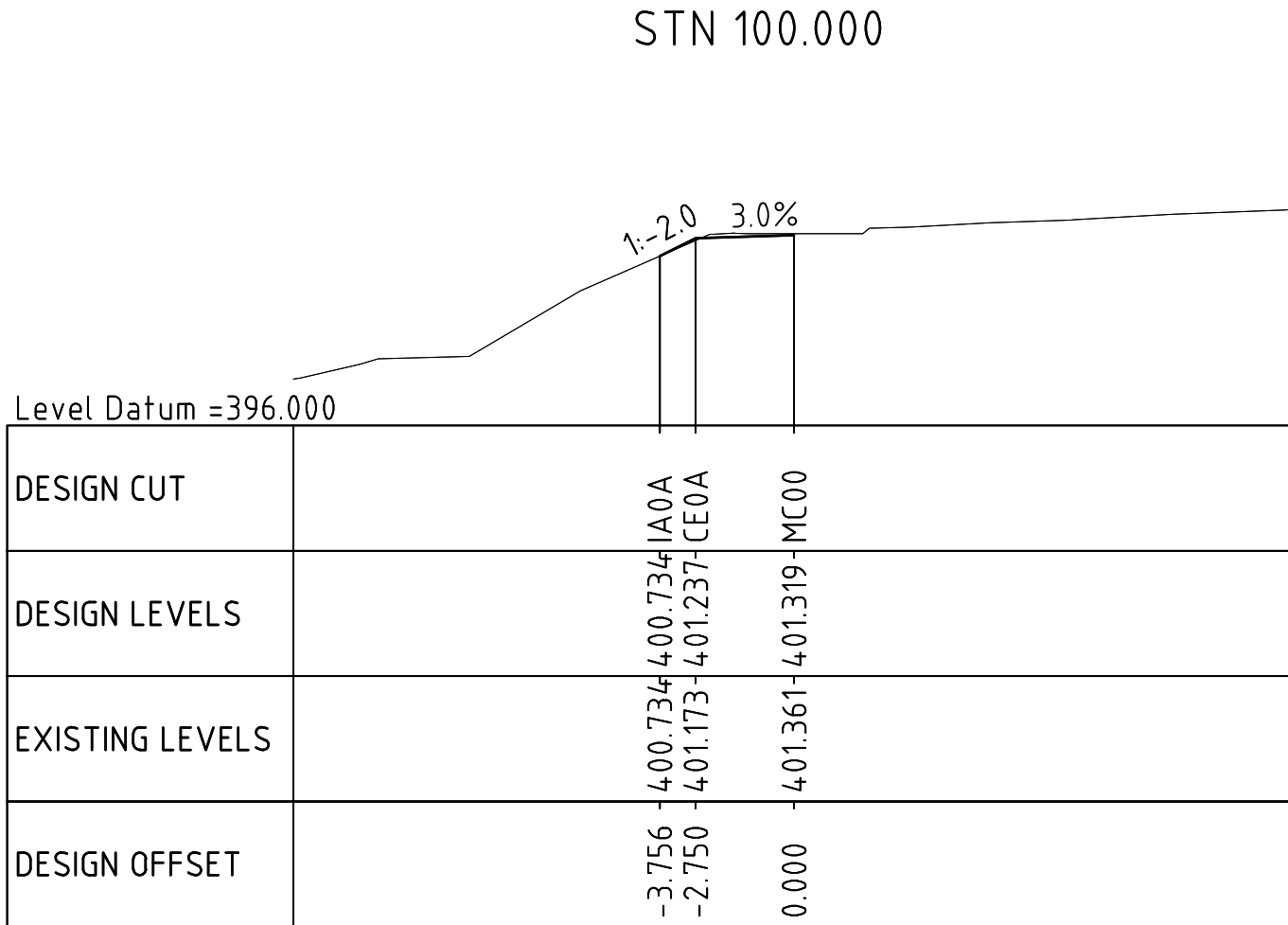
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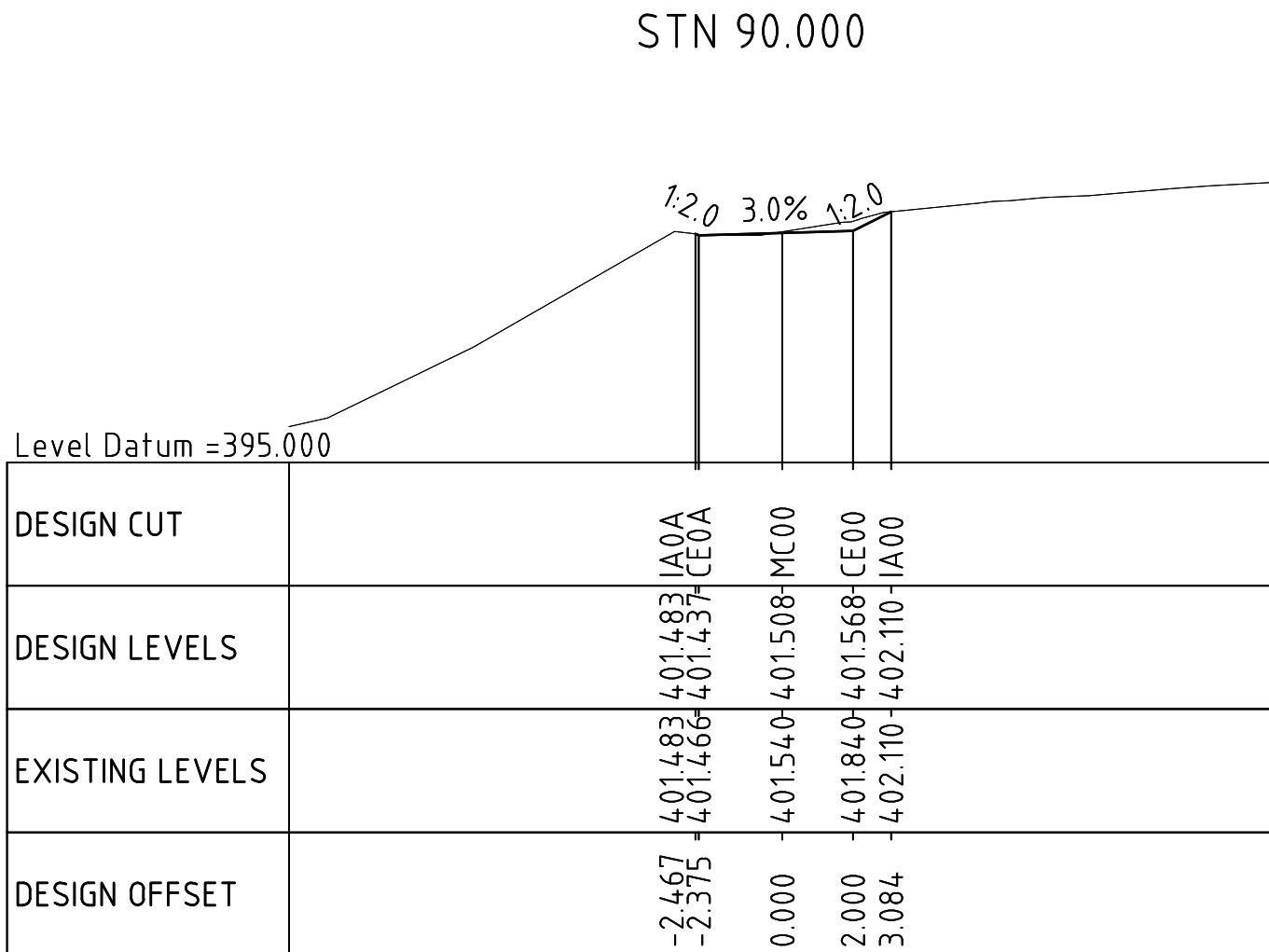
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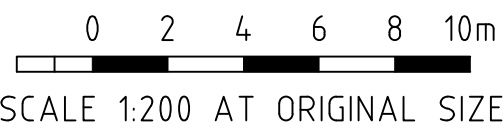
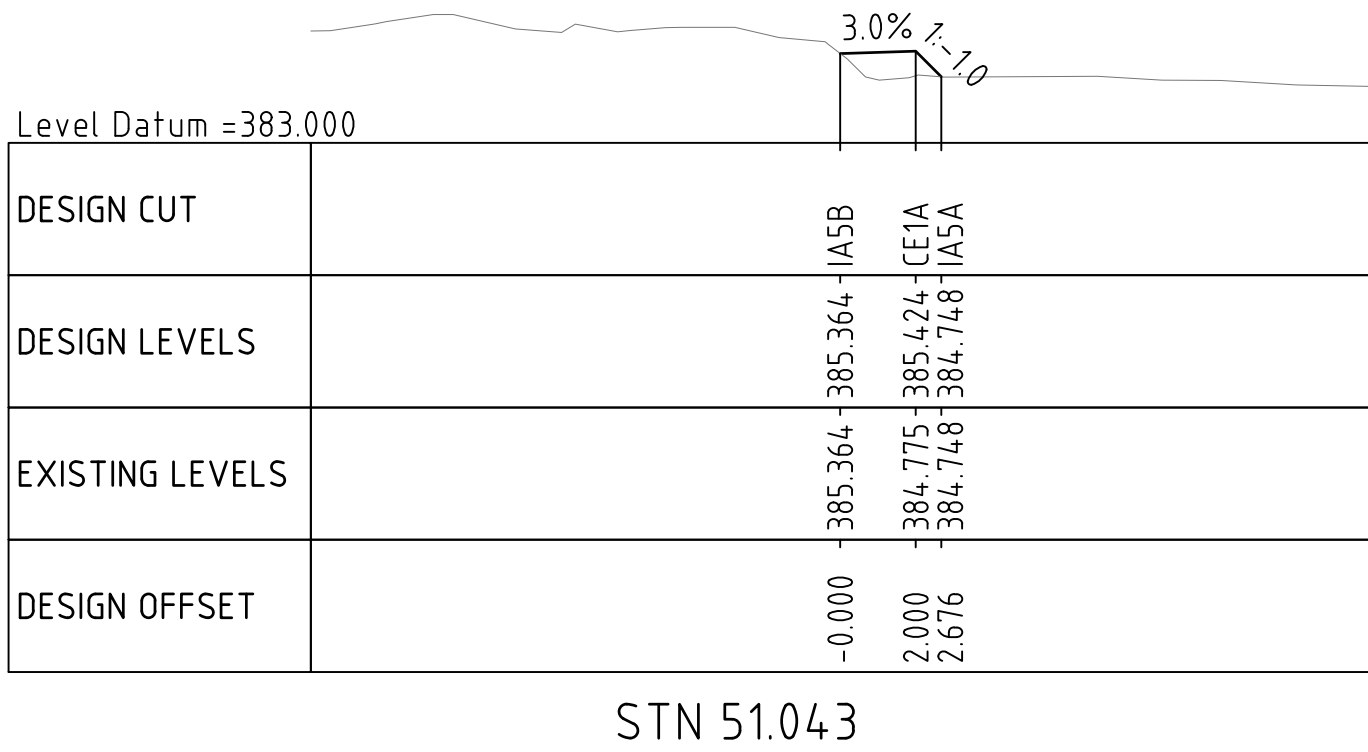
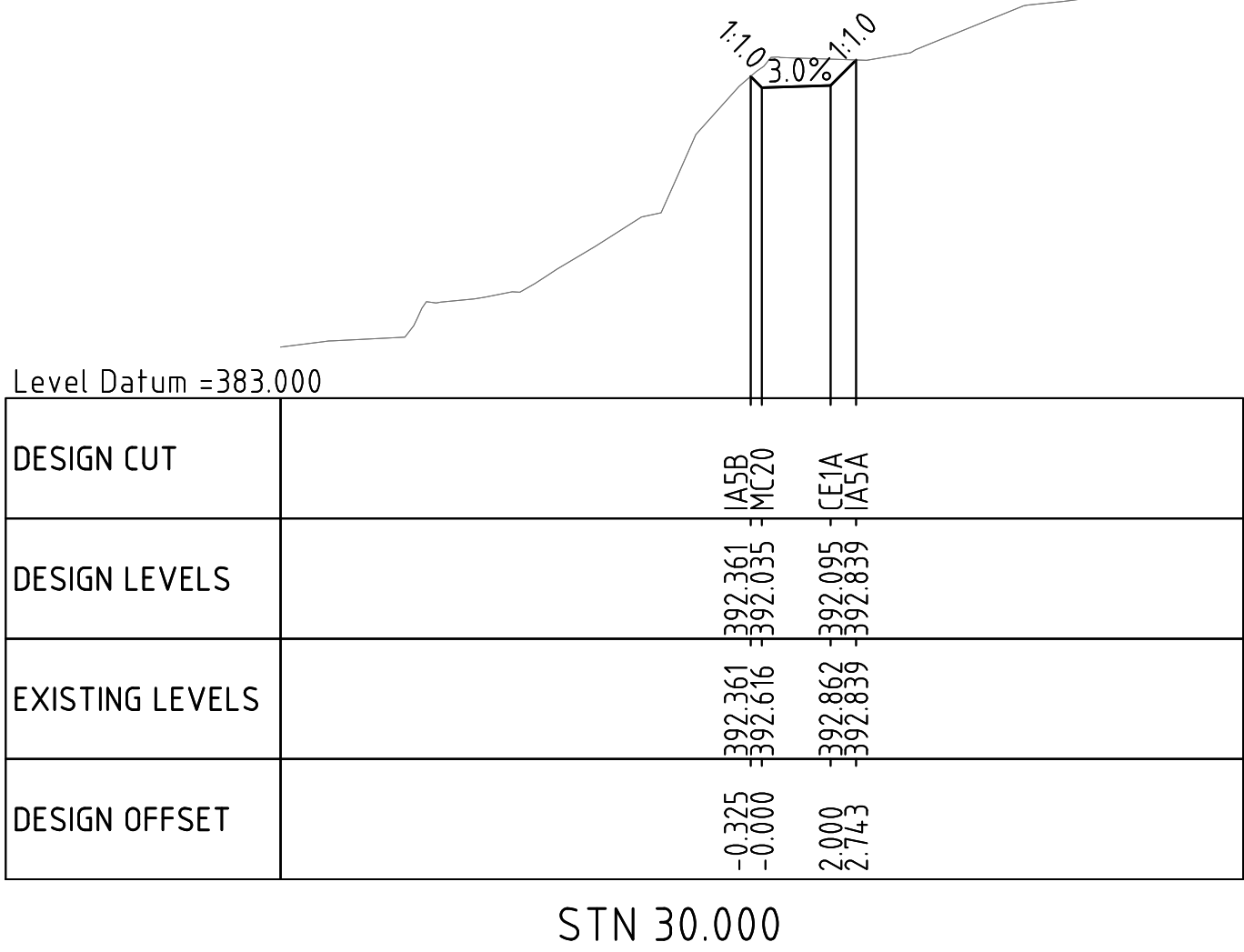
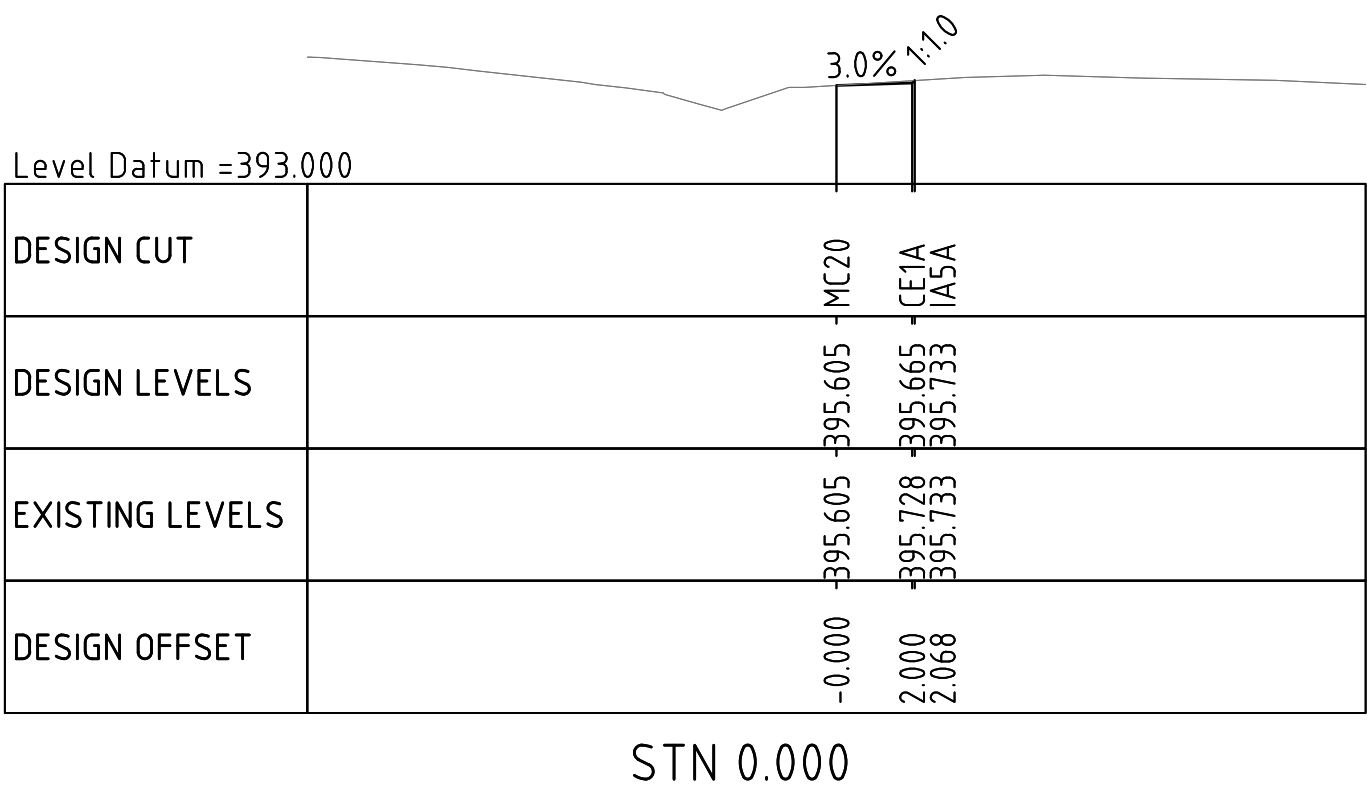
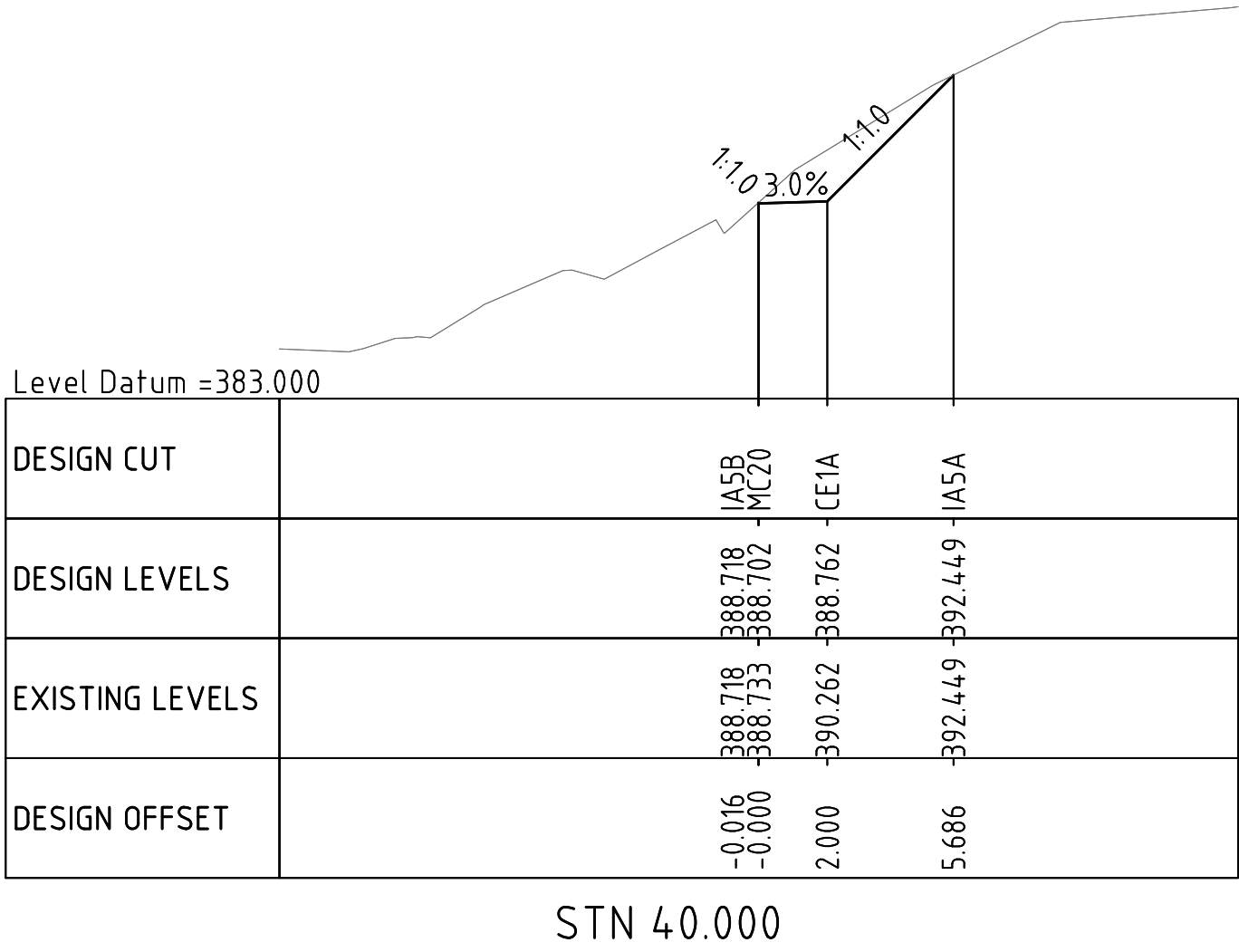
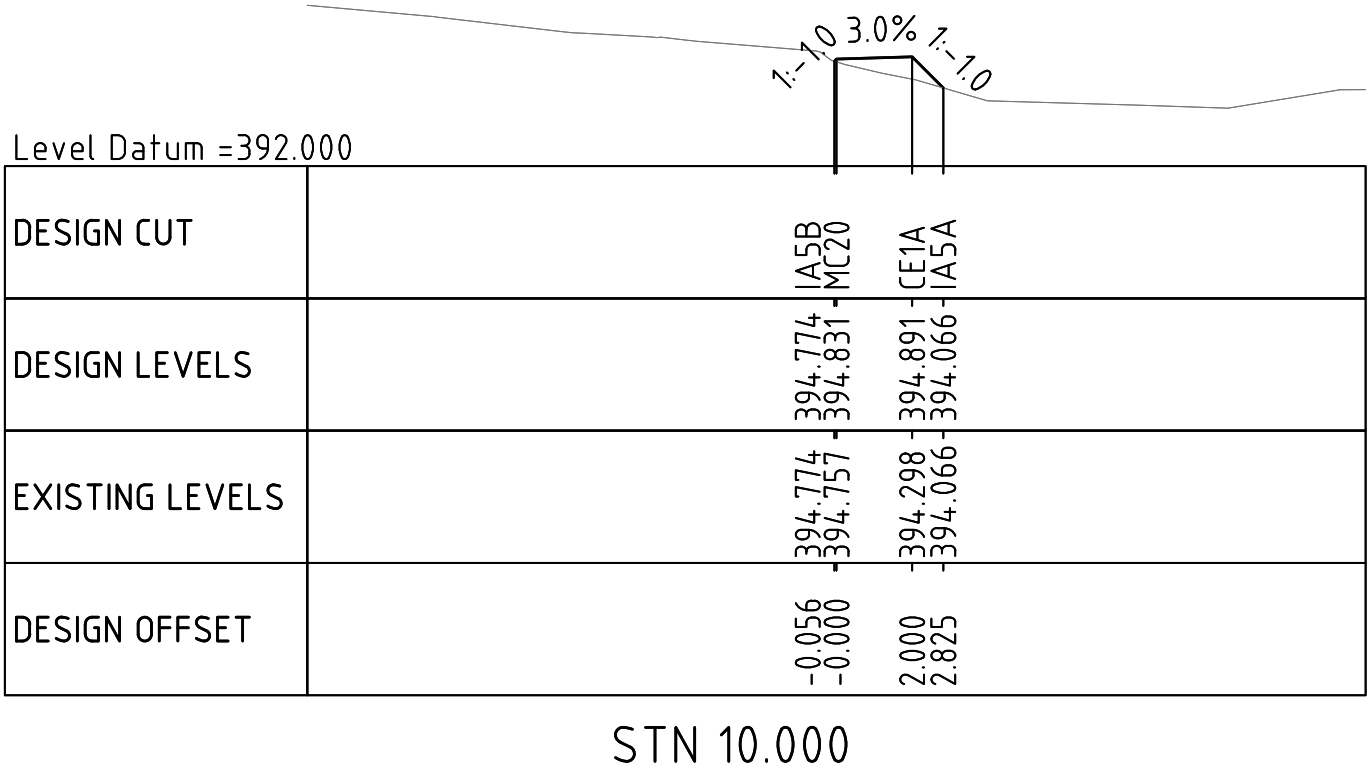
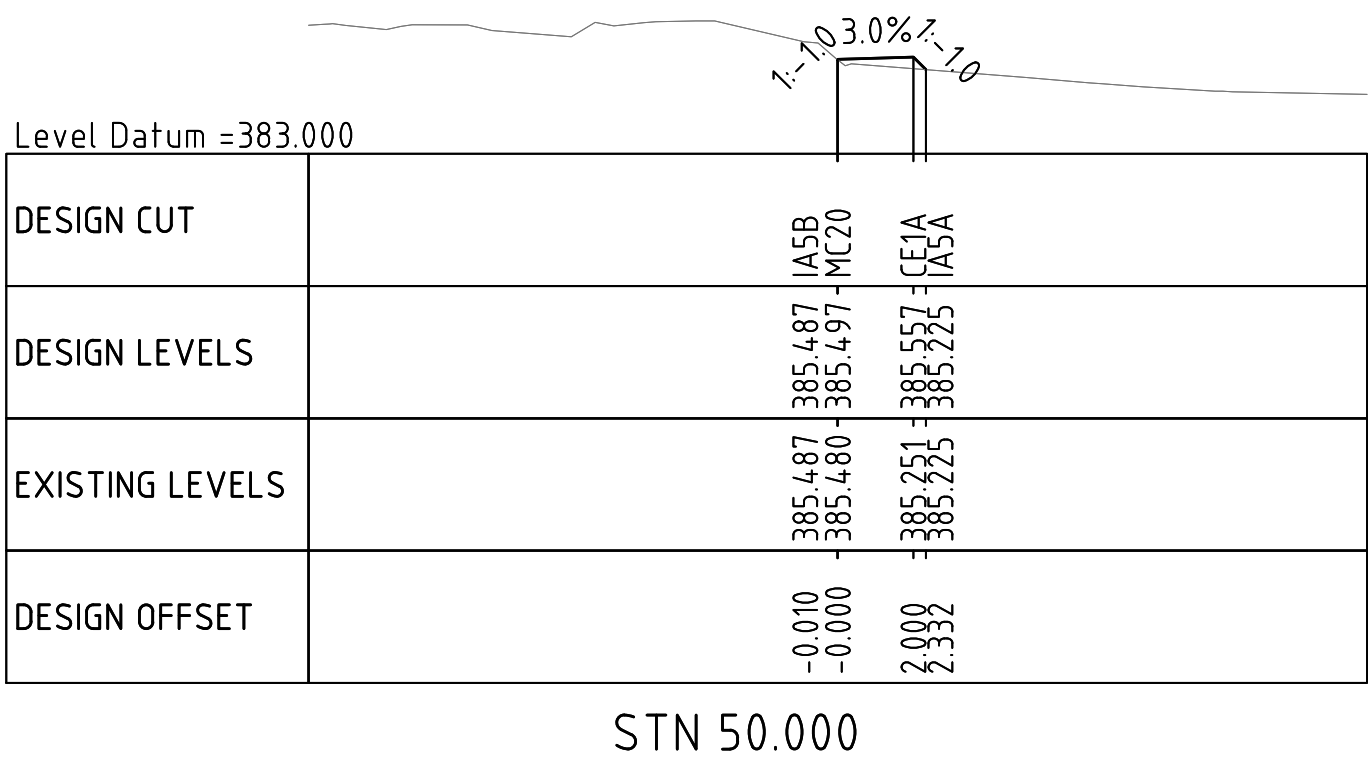
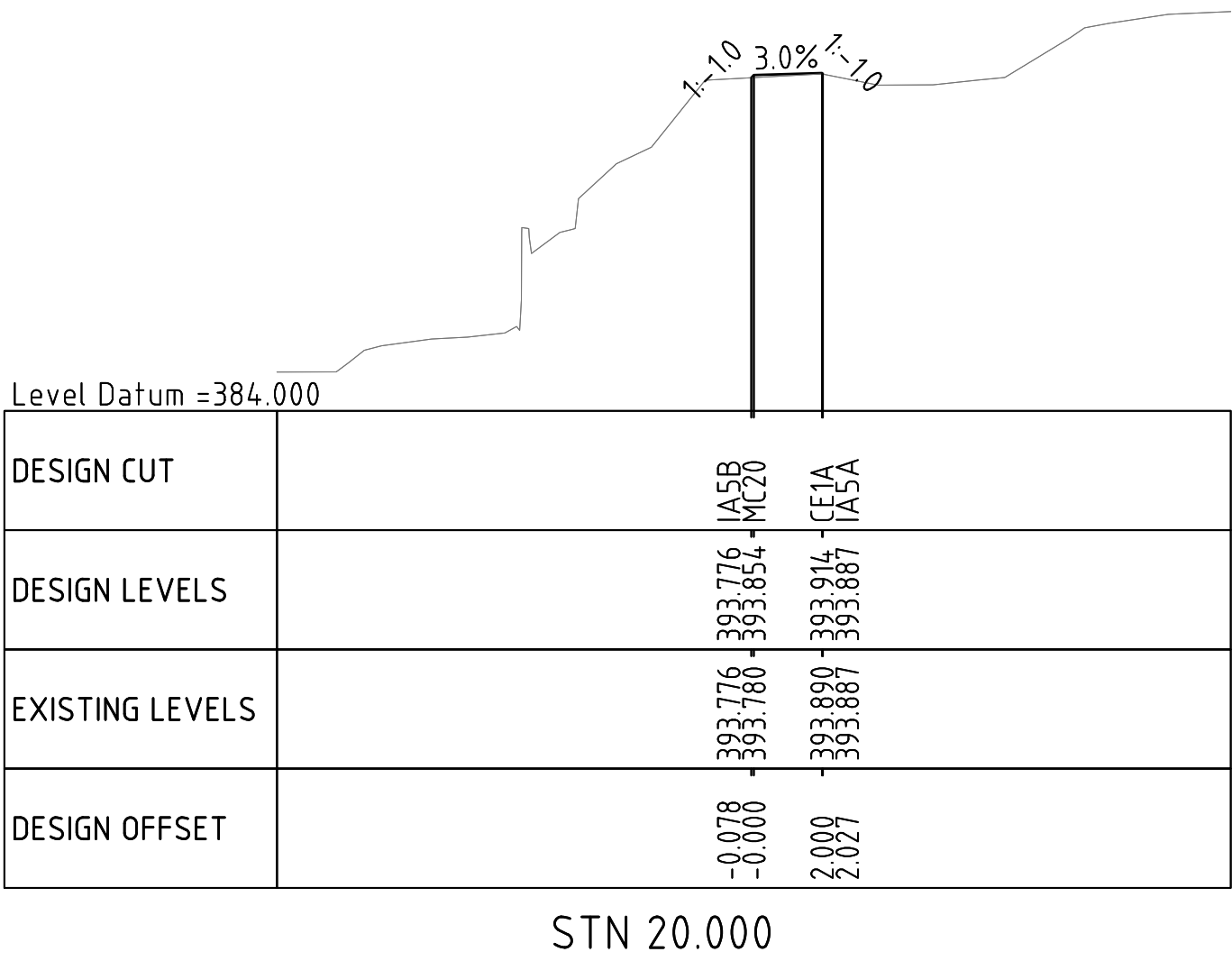
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A	13.07.18	80% DETAIL DESIGN	A.B.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
ACCESS ROAD - CROSS SECTIONS - SHEET 1					
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
PREPARED		CHECKED	REGISTRATION No OF PLANS		
DESIGN T.F.			DS2018 / 001306		
DRAWING A.B.			RMS BRIDGE NUMBER	5460	
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
DIRECTOR			SHEET No.	10	ISSUE B



B	17.08.18	100% DETAIL DESIGN	C.R.	T.F.	S.F.
A	13.07.18	80% DETAIL DESIGN	A.B.	T.F.	
Rev.	Date	Description	By	Ch'd	App'd
ROADS AND MARITIME SERVICES					
B72 - SNOWY MOUNTAINS HIGHWAY			SNOWY VALLEYS COUNCIL		
JOUNAMA CREEK CULVERT					
CULVERT REPAIRS					
EXCAVATOR ACCESS - CROSS SECTIONS - SHEET 1					
GHD GHD Tower, Level 3 24 Honeysuckle Drive, Newcastle NSW 2300 Australia PO Box 5403 Hunter Rgn Mail Cent. NSW 2310 T 61 2 4979 9999 F 61 2 4979 9988 E ntmail@ghd.com W www.ghd.com			 Transport Roads & Maritime Services		
PREPARED DESIGN T.F.		CHECKED	REGISTRATION No OF PLANS DS2018 / 001306		
DRAWING A.B.			RMS BRIDGE NUMBER		5460
APPROVED DESIGN QA RECORDS			ISSUE STATUS: 100% DETAIL DESIGN		
DIRECTOR			SHEET No.		12
			ISSUE		B



Date: 16 March 2018

Leigh Maloney
Senior Ecologist
GHD
PO Box 484
WAGGA WAGGA NSW 2650

Dear Leigh,

Jounama Creek culvert remediation.

Thank you for seeking DPI Fisheries comments regarding the Review of Environmental Factors (REF) for the remediation works to the Snowy Mountains Highway, Jounama Creek culvert.

The Departments requirements for the preparation of an REF or similar environmental assessment document are attached to this letter. As any works that involve works within waterways have the potential to impact on aquatic habitats and associated species, any environmental assessment document prepared for Roads and Maritime Services (RMS) should be forwarded to DPI Fisheries for review and comment before the works commence. Adequate time should be given for consultation between RMS and DPI Fisheries on the design and construction of the bridge works to be undertaken.

RMS should be aware that if the culvert works involve any dredging and reclamation works, as per Section 199 of the *Fisheries Management Act*, written notice of the work must be provided and consider any matters concerning the proposed work that are raised within 28 days after giving of the notice. If the proposed works will permanently or temporarily inhibit, obstruct or block the movement of fish then the applicants will be required to obtain a permit under Part 7 of the *Fisheries Management Act*

The REF should assess whether there is likely to be any significant impacts on listed aquatic threatened species, populations or communities. A 7 part test as per Section 5A of the *Environmental Planning and Assessment Act 1979* should be undertaken for aquatic threatened species potentially impacted on by the proposal.

Further information and a comprehensive list of threatened species, populations and ecological communities can be found on our website.

Key Threatening Process (KTP) are also listed under the threatened species provisions of the Fisheries Management Act 1994. The REF should outline any KTPs that are going to be undertaken as part of or as a result of the works, these may include the degradation of native riparian vegetation (including aquatic vegetation), removal of large wood debris, or the installation and operation of instream structures that alter the natural flow regimes of rivers or streams. Information should also be presented outlining any mitigation measures that are to be undertaken as part of the proposal (i.e revegetation).

Please include in the REF any impact mitigation measures that will be undertaken before, during and after the proposed works are completed including sediment and erosion control and site rehabilitation measures.

If you have any queries please call me on (02) 6051 7768

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'L Pearce'.

Luke Pearce
Regional Assessment Officer South
Aquatic Habitat Protection
NSW Department of Primary Industries

NSW DEPARTMENT OF PRIMARY INDUSTRIES REQUIREMENTS FOR THE PREPARATION OF ENVIRONMENTAL PLANNING AND ASSESSMENT DOCUMENTS

DPI Fisheries is responsible for managing aquatic species (including aquatic invertebrates), aquatic habitat and aquatic biodiversity throughout NSW. Aquatic biodiversity occurs in permanent and intermittent waterways including marine, estuarine, fresh, flowing and still waters.

DPI Fisheries requirements for the preparation of environmental planning and assessment documents are outlined in the current NSW DPI *Policy and guidelines for fish habitat conservation and management (Update 2013)*. This document can be viewed on the Fisheries website (www.dpi.nsw.gov.au).

Of primary concern to DPI Fisheries are the disturbance and/or destruction of aquatic habitats and any adverse impacts on aquatic species. Disturbance can be in the form of siltation from excessive sediment runoff, blockages to fish passage such as the construction of causeways, culverts and temporary crossings and direct impacts on aquatic habitat such as the removal of aquatic vegetation and desnagging activities.

DPI Fisheries has also introduced threatened aquatic species legislation, which allows for the listing of aquatic species, populations or communities as either endangered or vulnerable. This legislation is outlined in Part 7A of the *Fisheries Management Act 1994*. Aquatic threatened species are widely distributed across NSW and should be considered in any environmental assessment process. Up to date information is available on the DPI Fisheries website (www.dpi.nsw.gov.au).

Any environmental planning and assessment documents should include the following information as **an absolute minimum** to allow staff from DPI Fisheries to make an informed decision about the potential impacts that any proposed works may have on aquatic species and their habitats.

- ☐ Location of works (including topographic map)
- ☐ Name of adjacent watercourse(s)
- ☐ Description of works to be undertaken
 - ☐ Method/s of construction
 - ☐ Timing and duration of works
- ☐ Obstructions to fish passage (temporary and permanent) identified
- ☐ Aquatic habitat conditions at the site – particularly riparian and aquatic vegetation, water depth, permanence of water flow and snags in the vicinity of the proposed works.
- ☐ Potential impacts upon aquatic and riparian habitats (both temporary and permanent)
- ☐ Proposals to mitigate impacts upon riparian and aquatic vegetation and aquatic habitats.
- ☐ Potential impacts upon water quality of the proposed works.
- ☐ Proposals to mitigate impacts upon water quality.
- ☐ An assessment of the potential impact that proposed works may have on aquatic threatened species, populations and ecological communities.

The above list outlines the minimal amount of information that is required by Fisheries NSW to undertake an assessment of the potential impacts that a proposed activity or works may have on the local aquatic environment. Large scale works will require more detailed information to be submitted to the Department for assessment.

Further information can be obtained from:

Luke Pearce
Regional Assessment Officer South
NSW Department of Primary Industries
Unit , 620 Macauley St
ALBURY NSW 2640
Ph: (02) 6053 7768



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 02/02/18 14:16:18

[Summary](#)

[Details](#)

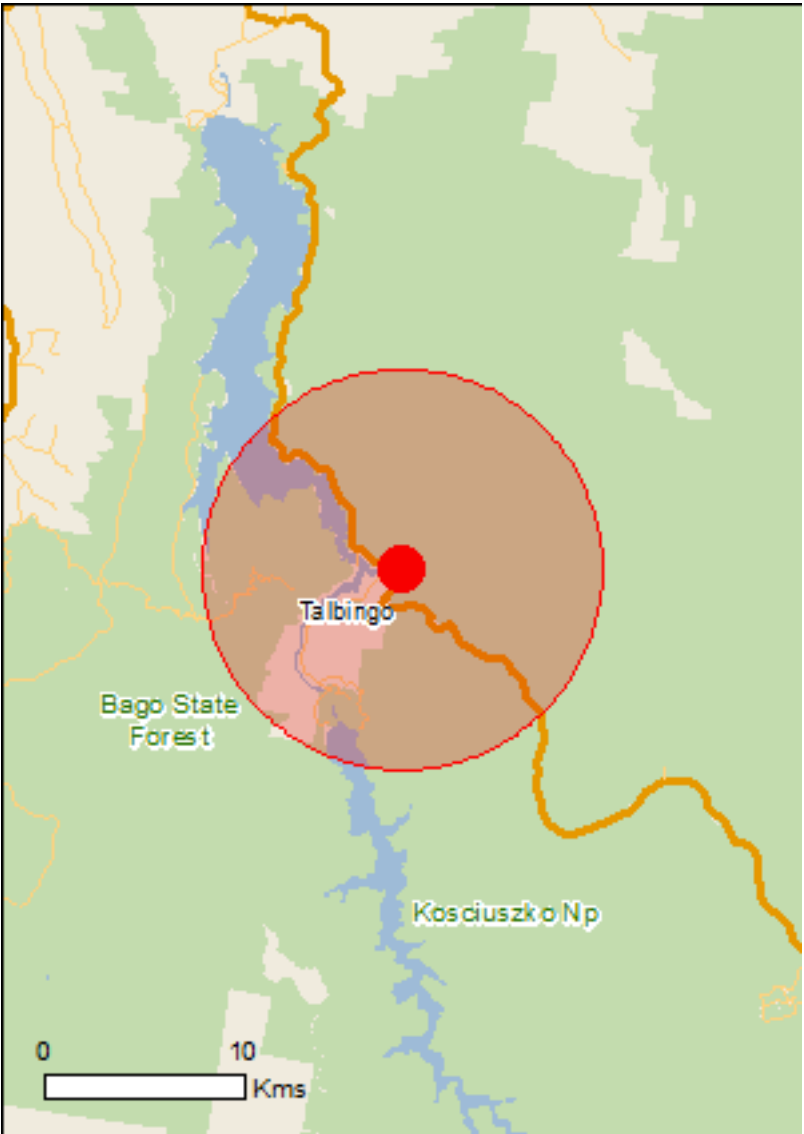
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

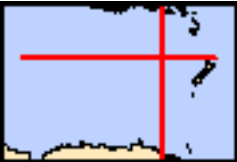
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	2
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	35
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Australian Alps National Parks and Reserves	NSW	Listed place
Historic		
Snowy Mountains Scheme	NSW	Listed place

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Banrock station wetland complex	700 - 800km upstream	
Hattah-kulkyne lakes	500 - 600km upstream	
Riverland	600 - 700km upstream	
The coorong, and lakes alexandrina and albert wetland	700 - 800km upstream	

Listed Threatened Ecological Communities	[Resource Information]
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For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Alpine Sphagnum Bogs and Associated Fens	Endangered	Community likely to occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species	[Resource Information]
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Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Fish		
Maccullochella macquariensis Trout Cod [26171]	Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Translocated population known to occur within area
Frogs		
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat likely to occur within area
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Litoria verreauxii alpina Alpine Tree Frog, Verreaux's Alpine Tree Frog [66669]	Vulnerable	Species or species habitat likely to occur within area
Pseudophryne pengilleyi Northern Corroboree Frog [66670]	Critically Endangered	Species or species habitat known to occur within area
Insects		
Synemon plana Golden Sun Moth [25234]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Vulnerable	Species or species habitat known to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		

Name	Status	Type of Presence
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat may occur within area
Colobanthus curtisiae Curtis' Colobanth [23961]	Vulnerable	Species or species habitat likely to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat may occur within area
Prasophyllum bagoense Bago Leek-orchid [84276]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum innubum Brandy Marys Leek-orchid [83603]	Critically Endangered	Species or species habitat may occur within area
Prasophyllum keltonii Kelton's Leek-orchid [83604]	Critically Endangered	Species or species habitat may occur within area
Prasophyllum petilum Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
Pterostylis oreophila Blue-tongued Orchid, Kiandra Greenhood [22903]	Critically Endangered	Species or species habitat likely to occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]	Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area
Delma impar Striped Legless Lizard [1649]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land		[Resource Information]
The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.		
Name		
Commonwealth Land - Telstra Corporation Limited		
Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name		State
Kosciuszko		NSW
Regional Forest Agreements		[Resource Information]
Note that all areas with completed RFAs have been included.		
Name		State
Southern RFA		New South Wales
Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.		
Name	Status	Type of Presence

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-35.56672 148.32665

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



rms.nsw.gov.au



contactus@rms.nsw.gov.au



Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059



Transport
Roads & Maritime
Services

Appendix E

Responses to government agency consultation



DOC18/108290-03

The Senior Ecologist
GHD Pty Ltd
Suite 3, Level 1
161-169 Bayliss Street
WAGGA WAGGA NSW 2650

By email: leigh.maloney@ghd.com

Dear Ms Maloney

Re Jounama Creek culvert remediation

I refer to your letter dated 22 February 2018 to the Environment Protection Authority (EPA) seeking our input to the Review of Environmental Factors (REF) being prepared for the proposed culvert maintenance over the Jounama Creek/Talbingo Pondage on the Snowy Mountains Highway.

The REF should consider the potential impacts of the proposal on the surrounding environment as well as the disposal of waste from the project. The issues that we consider that need to be assessed in the REF include water and waste water management, construction noise, dust, and waste management. Details of our specific requirements and guidance documents are provided at Attachments A and B respectively.

The REF must consider the potential water quality impact of the proposed works and clearly detail the best practice measures that will be adopted to mitigate the potential impacts from this activity. It must also consider the potential impact of dust and noise associated with the construction activities. Where appropriate measures must be designed and implemented to minimise and control the emission of dust and noise that have the potential to impact on neighbouring properties.

If you have any further enquiries about this matter please contact me by telephoning 02 6969 0700.

Yours sincerely

 27.3.2018

CRAIG BRETHERTON
Manager Regional Operations – Riverina Far West Region
Environment Protection Authority

Phone +61 2 6969 0700 Fax +61 2 6969 0710 PO Box 397
Phone 131 555 TTY 133 677 Griffith
(from outside NSW) ABN 43 692 285 758 NSW 2680 Australia

Suite 7
130-140 Banna Ave www.epa.nsw.gov.au
Griffith NSW riverina.farwest@epa.nsw.gov.au
2680 Australia

ATTACHMENT A

Potential environmental impacts of the project

1. The following potential environmental impacts of the project need to be assessed, quantified and reported on.

- Air
- Noise
- Water
- Land
- Waste and chemicals.

The Review of Environmental Factors (REF) should address how the required environmental goals will be met for each potential impact.

2. Describe the management strategies for the treatment and processing/utilisation of all wastes proposed to be received at the facility.
3. Describe mitigation and management options that will be used to prevent, control, abate or mitigate identified potential environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment.

This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Potential impacts on water quantity and quality

All State and Territories have adopted the National Water Quality Management Strategy (NWQMS) for managing water quality. The NWQMS is grounded in the principles of ecologically sustainable development which in turn implies a clear predisposition towards protecting and enhancing the quality of the nation's water resources. As a policy principle, it provides a fundamental strategic direction to water quality management. The central technical reference document with the NWQMS is the ANZECC Guidelines. These provide an agreed framework for assessing and conserving ambient water quality according to whether the water is suitable for a range of environmental values. The NWQMS and ANZECC Guidelines are fundamental to the EPA's decision-making on water pollution.

The EPA's corporate policy is that water pollution be avoided in the first instance. When this is not possible, the NSW Water Quality Objectives and ANZECC Guidelines are used to assess potential pollution impacts. It is the responsibility of the proponent undertaking the works or activity to undertake an assessment to consider the potential impact on receiving waters. If the impacts are unacceptable, mitigation measures that prevent or minimise impacts on water quality should be considered.

The EPA makes use of a range of guidance material on urban and rural soil erosion and sediment control, stormwater management, unsealed road maintenance, and other guidance, including *Managing Urban Stormwater Soils and Construction Volumes 1* (the Blue Book). The practices and principles in these guidelines can be used to help manage the identified impacts of land disturbance activities on the water quality of receiving waters. The nature and extent of the management measures adopted will be determined by the required water quality outcomes.

The goals of the project should include the following.

- No pollution of waters (including surface and groundwater), except to the extent authorised by EPA (ie in accordance with an Environment Protection Licence);
- Polluted water is captured on the site and collected, treated and beneficially reused, where this is safe and practicable to do so;

- It is undertaken in accordance with best management practices; and
- It is acceptable in terms of the achievement or protection of the River Flow Objectives and Water Quality Objectives.

The REF for the project should demonstrate whether the discharge criteria for pollutants will maintain or restore the environmental values of the receiving waters. Where the project will cause, or is likely to cause water pollution, and where it is demonstrated that the environmental values will not be maintained or restored, the project must also consider any practical measures that can be taken to restore or maintain the environmental values of the receiving waters.

Details of the site drainage and any natural or artificial waters within or adjacent to the development must be identified and where applicable measures proposed to mitigate potential impacts of the development on these waters.

A characterisation of potential water pollutants at the site should also be undertaken including the identification of any proposed water pollution controls and their performance. This should include details of the design and location of the manure composting sites as well as wastewater and effluent management controls.

The REF should provide details of any water management systems for the site to ensure surface waters are protected from contaminants. Spill management measures, including items such as bunding, and emergency procedures should be clearly outlined.

The REF should document the measures that will achieve the above goals.

Potential impacts on air quality

The goals of the project in relation to air quality should include mitigation of air quality impacts such that potential impacts on sensitive receptors are minimised in accordance with the Environment Protection Authority (EPA) particulate matter and deposited dust criteria.

The potential for dust impacts a concern with potential emissions including but not necessarily limited to construction, traffic movements, open exposed areas, material processing and handling, transfer points, and loading unloading facilities. All potentially impacted residential or sensitive premises likely to be impacted by the development must be identified.

The REF will need to document the proposed measures to manage and mitigate dust from these activities and their anticipated performance to achieve the goals above.

Potential impacts of noise

The goals of the project should include construction of the facility in accordance with relevant EPA policy, guidelines and criteria, and in order to minimise potential impacts from noise.

The EPA expects that potential noise sources are assessed in accordance with the Construction Noise Guideline (DECC, 2009), and where required all feasible and reasonable work practices and mitigation measures to minimise noise impacts are proposed. All residential or noise sensitive premises likely to be impacted by the development must be identified and included in the assessment.

Potential impacts on land

The goals of the project should include the following.

- No pollution of land, except to the extent authorised by EPA (ie in accordance with an Environment Protection Licence); and
- The potential impact of land erosion from the development is mitigated.

The REF should document the measures that will achieve the above goals.

Waste

The goals of the project should include the following.

- It is in accordance with the principles of the waste hierarchy and cleaner production;
- Where potential impacts associated with the handling, processing and storage of all waste materials generated at the premises are identified, these be satisfactorily mitigated;
- The beneficial reuse of all wastes generated at the premises are maximised where it is safe and practical to do so; and
- No waste disposal occurs on site except in accordance with an Environment Protection Licence.

The REF needs to identify the proposed type, quantity and location of wastes to be generated and/or stored at the site, and the means of lawful disposal of these wastes.

ATTACHMENT B

<u>Title</u>	<u>Web address</u>
Relevant Legislation	
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+O+N
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+O+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+O+N
Licensing	
Guide to Licensing	http://www.epa.nsw.gov.au/licensing/licenceguide.htm
Air Issues	
Approved methods for modelling and assessment of air pollutants in NSW (2005)	http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf
Assessment and management of odour from stationary sources in NSW (DEC, 2006)	Technical framework: http://www.environment.nsw.gov.au/resources/air/20060440framework.pdf Technical notes: http://www.environment.nsw.gov.au/resources/air/20060441notes.pdf
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+428+2010+cd+O+N
Noise and Vibration	
Construction Noise Guideline (DECC, 2009)	http://www.epa.nsw.gov.au/noise/constructnoise.htm
Noise Policy for Industry (EPA, 2017)	http://www.epa.nsw.gov.au/your-environment/noise/industrialnoise/nsw-industrial-noise-policy
A guide to the Noise Policy for Industry (EPA, 2017)	http://www.epa.nsw.gov.au/publications/noise/17p0543-guide-to-noise-policy-for-industry
NSW Road Noise Policy (DECCW, 2011)	http://www.epa.nsw.gov.au/noise/traffic.htm
Road Noise Policy Application Notes	http://www.epa.nsw.gov.au/noise/roadnoiseappnotes.htm

Waste	
Waste Classification Guidelines (EPA, 2014)	http://www.epa.nsw.gov.au/resources/wasteregulation/140796classify-waste.pdf
Resource recovery orders and exemptions	http://www.epa.nsw.gov.au/wasteregulation/recoveryexemptions.htm
Soils	
Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)	Available for purchase at http://www.shop.nsw.gov.au/pubdetails.jsp?publication=839
Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B. Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008)	Vol land 2 http://www.environment.nsw.gov.au/stormwater/publications.htm
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
Environmental Guidelines: Use of Effluent by Irrigation (DEC, 2004)	http://www.environment.nsw.gov.au/resources/water/effguide.pdf
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.environment.gov.au/water/policy-programs/nwqms/
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf
NSW Groundwater Quality Protection Policy (DLWC, 1998)	http://www.water.nsw.gov.au/Water-Management/Waterquality/Groundwater/Groundwater/default.aspx
NSW Water Quality and River Flow Objectives (DEC 2006)	http://environment.nsw.gov.au/ieo/catchlist.htm
Managing Urban Stormwater: Soils and Construction — Volume 2C Unsealed roads	http://www.environment.nsw.gov.au/stormwater/publications.htm



Date: 16 March 2018

Leigh Maloney
Senior Ecologist
GHD
PO Box 484
WAGGA WAGGA NSW 2650

Dear Leigh,

Jounama Creek culvert remediation.

Thank you for seeking DPI Fisheries comments regarding the Review of Environmental Factors (REF) for the remediation works to the Snowy Mountains Highway, Jounama Creek culvert.

The Departments requirements for the preparation of an REF or similar environmental assessment document are attached to this letter. As any works that involve works within waterways have the potential to impact on aquatic habitats and associated species, any environmental assessment document prepared for Roads and Maritime Services (RMS) should be forwarded to DPI Fisheries for review and comment before the works commence. Adequate time should be given for consultation between RMS and DPI Fisheries on the design and construction of the bridge works to be undertaken.

RMS should be aware that if the culvert works involve any dredging and reclamation works, as per Section 199 of the *Fisheries Management Act*, written notice of the work must be provided and consider any matters concerning the proposed work that are raised within 28 days after giving of the notice. If the proposed works will permanently or temporarily inhibit, obstruct or block the movement of fish then the applicants will be required to obtain a permit under Part 7 of the *Fisheries Management Act*

The REF should assess whether there is likely to be any significant impacts on listed aquatic threatened species, populations or communities. A 7 part test as per Section 5A of the *Environmental Planning and Assessment Act 1979* should be undertaken for aquatic threatened species potentially impacted on by the proposal.

Further information and a comprehensive list of threatened species, populations and ecological communities can be found on our website.

Key Threatening Process (KTP) are also listed under the threatened species provisions of the Fisheries Management Act 1994. The REF should outline any KTPs that are going to be undertaken as part of or as a result of the works, these may include the degradation of native riparian vegetation (including aquatic vegetation), removal of large wood debris, or the installation and operation of instream structures that alter the natural flow regimes of rivers or streams. Information should also be presented outlining any mitigation measures that are to be undertaken as part of the proposal (i.e revegetation).

Please include in the REF any impact mitigation measures that will be undertaken before, during and after the proposed works are completed including sediment and erosion control and site rehabilitation measures.

If you have any queries please call me on (02) 6051 7768

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'L Pearce'.

Luke Pearce
Regional Assessment Officer South
Aquatic Habitat Protection
NSW Department of Primary Industries

NSW DEPARTMENT OF PRIMARY INDUSTRIES REQUIREMENTS FOR THE PREPARATION OF ENVIRONMENTAL PLANNING AND ASSESSMENT DOCUMENTS

DPI Fisheries is responsible for managing aquatic species (including aquatic invertebrates), aquatic habitat and aquatic biodiversity throughout NSW. Aquatic biodiversity occurs in permanent and intermittent waterways including marine, estuarine, fresh, flowing and still waters.

DPI Fisheries requirements for the preparation of environmental planning and assessment documents are outlined in the current NSW DPI *Policy and guidelines for fish habitat conservation and management (Update 2013)*. This document can be viewed on the Fisheries website (www.dpi.nsw.gov.au).

Of primary concern to DPI Fisheries are the disturbance and/or destruction of aquatic habitats and any adverse impacts on aquatic species. Disturbance can be in the form of siltation from excessive sediment runoff, blockages to fish passage such as the construction of causeways, culverts and temporary crossings and direct impacts on aquatic habitat such as the removal of aquatic vegetation and desnagging activities.

DPI Fisheries has also introduced threatened aquatic species legislation, which allows for the listing of aquatic species, populations or communities as either endangered or vulnerable. This legislation is outlined in Part 7A of the *Fisheries Management Act 1994*. Aquatic threatened species are widely distributed across NSW and should be considered in any environmental assessment process. Up to date information is available on the DPI Fisheries website (www.dpi.nsw.gov.au).

Any environmental planning and assessment documents should include the following information as **an absolute minimum** to allow staff from DPI Fisheries to make an informed decision about the potential impacts that any proposed works may have on aquatic species and their habitats.

- ☐ Location of works (including topographic map)
- ☐ Name of adjacent watercourse(s)
- ☐ Description of works to be undertaken
 - ☐ Method/s of construction
 - ☐ Timing and duration of works
- ☐ Obstructions to fish passage (temporary and permanent) identified
- ☐ Aquatic habitat conditions at the site – particularly riparian and aquatic vegetation, water depth, permanence of water flow and snags in the vicinity of the proposed works.
- ☐ Potential impacts upon aquatic and riparian habitats (both temporary and permanent)
- ☐ Proposals to mitigate impacts upon riparian and aquatic vegetation and aquatic habitats.
- ☐ Potential impacts upon water quality of the proposed works.
- ☐ Proposals to mitigate impacts upon water quality.
- ☐ An assessment of the potential impact that proposed works may have on aquatic threatened species, populations and ecological communities.

The above list outlines the minimal amount of information that is required by Fisheries NSW to undertake an assessment of the potential impacts that a proposed activity or works may have on the local aquatic environment. Large scale works will require more detailed information to be submitted to the Department for assessment.

Further information can be obtained from:

Luke Pearce
Regional Assessment Officer South
NSW Department of Primary Industries
Unit , 620 Macauley St
ALBURY NSW 2640
Ph: (02) 6053 7768

Appendix F

Database searches

Search Results

7 results found.

Australian Alps National Parks and Reserves	The Alpine Way	Thredbo Village, NSW, Australia	(Listed place) National Heritage List
Cooibil Hut		Talbingo, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Jounama Pine Arboretum	Goobragandra Power Line Rd	Yarrangobilly via Talbingo, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Kosciuszko National Park	Snowy Mountains Hwy	Tumut, NSW, Australia	(Nomination now ineligible for PPAL) National Heritage List
Kosciuszko National Park (1981 boundary)	Snowy Mountains Hwy	Tumut, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Snowy Mountains Scheme	Snowy Mountains Hwy	Cabramurra, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Yarrangobilly Caves House Precinct		Yarrangobilly via Talbingo, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)

Report Produced: Thu Mar 22 09:25:52 2018

GHD Pty Ltd

Date: 22 March 2018

161 -169 Baylis Street
Wagga Wagga New South Wales 2650

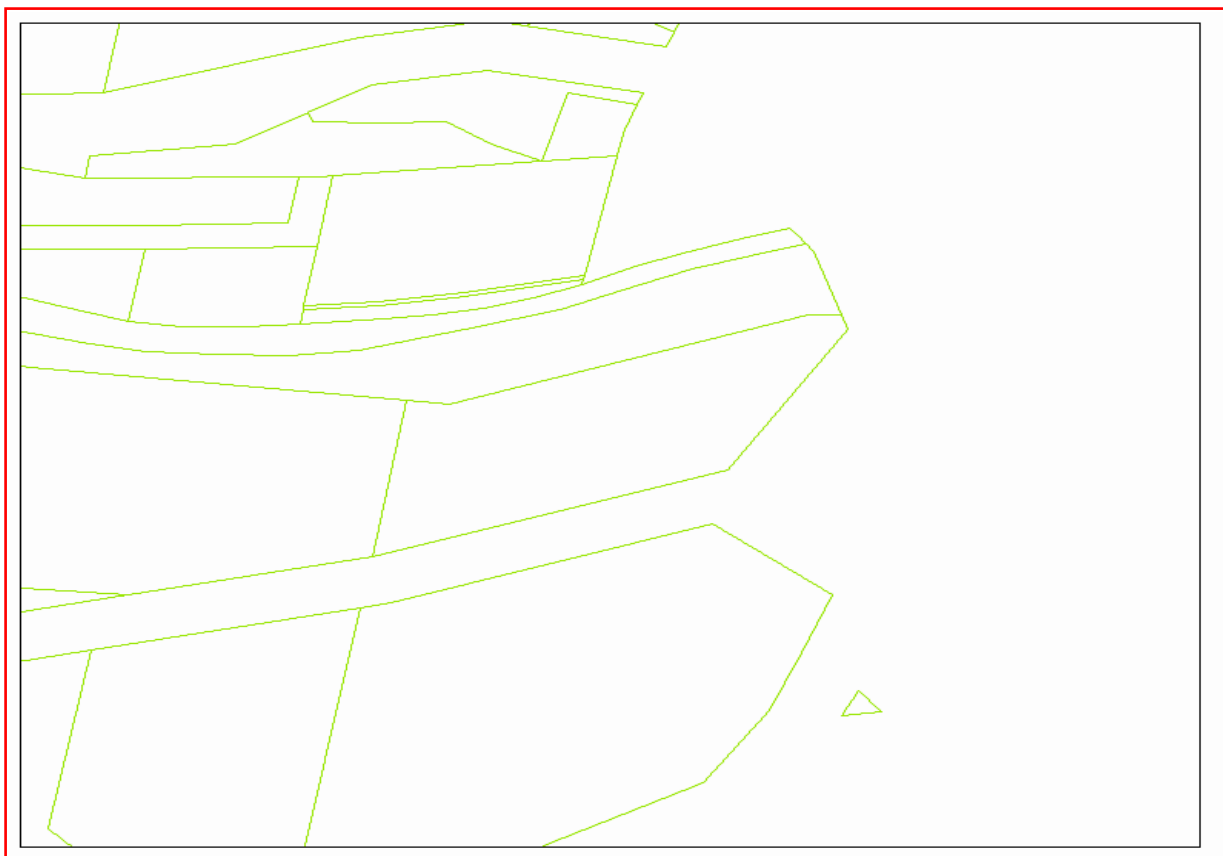
Attention: Alexandra Williams

Email: alexandra.williams@ghd.com

Dear Sir or Madam:

**AHIMS Web Service search for the following area at Lot : 12, DP:DP728290 with a Buffer of 200 meters,
conducted by Alexandra Williams on 22 March 2018.**

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(http://www.nsw.gov.au/gazette\)](http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

[Home](#) [Contaminated land](#) [Record of notices](#)

Site and notice details

Your search for: LGA: Tumut Shire Council 1 notice on 1 site were matched.

[Return to list of search results](#)

[Search Again](#)

[Refine Search](#)

Area No: 3175

The information below was correct at the time the notices were issued.

Site: T3 Spoil dump and adjoining river sediments

Address: Off Snowy Mountains HIGHWAY, TALBINGO

LGA: Tumut Shire Council

Occupier: Rana Petroleum

Owner: Snowy Hydro Limited

Lot 5 DP 235380

Notices relating to this site (0 current and 1 former)

(Map) where available, maps show the part of the site affected by the notice

*notice matched search criteria

Notice recipient	Notice type & number	Status	Date
Snowy Hydro Limited	Agreed Voluntary Investigation Proposal * 19021	Former	Issued 13 Feb 2004 Completed 22 Sep 2005

22 March 2018

For business and industry ()

For local government ()

Contact us

☎ 131 555 (tel:131555)

💻 Online
(<http://www.epa.nsw.gov.au/about-us/contact-us/feedback/feedback-form>)

✉ info@epa.nsw.gov.au
(mailto:info@epa.nsw.gov.au)

📍 EPA Office Locations
(<http://www.epa.nsw.gov.au/about-us/contact-us/locations>)

[Accessibility \(http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/help-index\)](http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/help-index)

[Disclaimer \(http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/disclaimer\)](http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/disclaimer)

[Privacy \(http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/privacy\)](http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/privacy)

[Copyright \(http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/copyright\)](http://www.epa.nsw.gov.au/about-us/contact-us/website-service-standards/copyright)

Find us on     <https://www.epa.nsw.gov.au/>

COPY
original on file

Our Reference : Agreement No. 19021
File No. HO3651/HOF39637

ENVIRONMENT PROTECTION AUTHORITY (EPA)

**VOLUNTARY INVESTIGATION PROPOSAL:
EPA AGREEMENT**

SECTION 19 CONTAMINATED LAND MANAGEMENT ACT 1997

Service: By Registered Mail to Place of Business

**To: Snowy Hydro Limited (ACN 090 574 431)
Monaro Highway
COOMA NSW 2630**

(referred to in this notice as "the Proponent").

Attention: Environment Manager

Date: 13/2/04

Land:

The land to which this voluntary proposal relates to ("the site") is described as:

- Lot 5, deposited plan 235380, commonly referred to as the T3 Spoil Dump

in the local government area of Tumut.

The location of the site is shown as the bolded green shaded area and the associated broader study area is denoted by the hatched area in the attached diagram provided by the proponent titled *Plan showing T3 Spoil Dump Study Area Boundary* dated 30 June 2003 (Attachment 1).

Contamination:

The EPA has reasonable grounds to believe that Polychlorinated Biphenyls (referred to in this agreement as "the contamination") detected in soils, sediment, biota, groundwater and surface water within and adjacent to the site, present a significant risk of harm to human health and the environment.

Background:

The proponent has furnished the EPA with a proposal for investigations to further assess the nature and extent of the contamination at the site in accordance with s.19 of the *Contaminated Land Management Act 1997* ("the Act").

The investigation proposal ("the Proposal") is set out in the following documents:

- A report titled "Voluntary Investigation Proposal T3 Spoil Dump Talbingo, NSW" prepared by URS Australia Pty Limited, dated 19 February 2003 (refer Attachment 2);
- Letter from Snowy Hydro incorporating addendum to the voluntary investigation proposal (prepared by URS Australia) dated 18 September 2003 (refer Attachment 2).
- Letter from Snowy Hydro to EPA dated 17 March 2003 and s.19 undertaking not to recover costs (refer Attachment 3).
- Letter from Snowy Hydro to EPA indicating concurrence with the terms of this agreement dated 29 January 2004 (refer Attachment 4).

OBJECTIVES:

The agreed objective for the investigation under this agreement is to:

- Enable sufficient information to be gathered to allow the EPA to determine whether a significant risk of harm is in fact posed by the contamination at the site.

THE PRINCIPAL FEATURES OF THE PROPOSAL:

The features of the Proposal include, but are not limited to, the following:

- The review of aerial photographs and interviews with the Proponent's staff;
- The assessment of possible PCB sources in the vicinity of the T3 Workshop;
- The assessment of possible PCB mobilisation from the Spoil Dump;
- The assessment of possible PCB contamination within the Old Tumut River;
- The assessment of possible PCB accumulation in aquatic biota;
- The undertaking of a screening-level human health risk assessment;
- Providing the EPA with reports following the completion of each of the investigation tasks associated with the Proposal with the final report being provided to the EPA by 30 September 2004; and
- All works and reports required by the Proposal must be consistent with guidelines made or approved by the EPA under s 105 of the Act (Attachment 5).

LIFETIME OF THE PROPOSAL:

All works and reports associated with the Proposal must be completed by **30 September 2004**.

If any unexpected or unforeseen circumstances arise which delay the completion of this proposal within the specified timeframe the EPA must be notified as soon as practicable and a request may be made for an extension to the timeframe. The EPA may not necessarily grant such an extension.

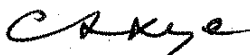
If, following the completion of the investigations under this agreement, the EPA considers that further investigation is required this may be the subject of further action under the Act.

EPA AGREEMENT:

The EPA is satisfied that:

- (i) The terms of the Proposal are appropriate for investigation of the land to which this agreement relates; and
- (ii) The proponent has undertaken in writing to the EPA not to recover contributions under Part 3 Division 6 of the Act in respect of the investigation under the Proposal.

In accordance with the provisions of Part 3 of the Act, the EPA agrees that it will not issue an investigation order against the proponent with respect to the investigation described in this agreement if the investigation is carried out in accordance with the Proposal, and the objectives, environmental outcomes and milestones are met within the agreed timeframes.

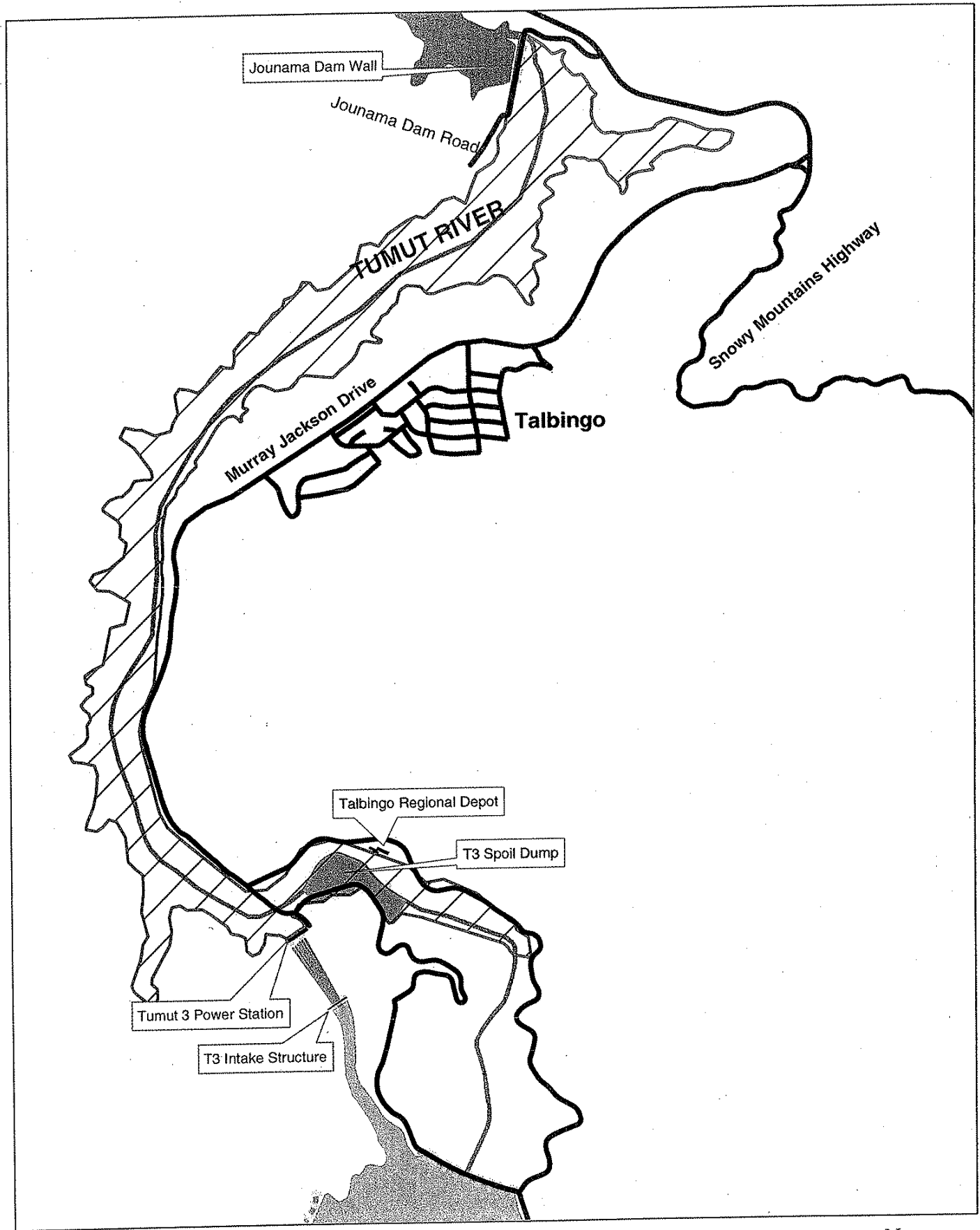


CAROLYN STRANGE
Director Contaminated Sites
Department of Environment and Conservation

Attachment 1	Site location and boundary
Attachment 2	Title and contents pages of "the Proposal"
Attachment 3	Snowy Hydro letter to EPA dated 17 March 2003 (s.19 undertaking not to recover costs).
Attachment 4	Snowy Hydro letter to EPA dated 29 January 2004 concurring with the terms of this agreement.
Attachment 5	List of Guidelines

NOTE:

- 1 For the purposes of clarification, the principal features of this agreement refer to the elements of the proposed investigations and assessments as detailed in Snowy Hydro's voluntary investigation proposal prepared by URS Australia Pty Limited and dated February 2003. The principal features do not refer to the elements contained within the 'Concept Plan' that forms Appendix A of this voluntary investigation proposal.
- 2 The EPA is not prevented by this agreement from making an investigation order against persons (including public authorities) with whom it has made no such agreement (whether or not they were originally parties to the proposal).
- 3 The EPA is not prevented by this agreement from making an investigation order against one or more of the proponents who is an appropriate person (as defined by the Act) if, in the opinion of the EPA, the terms of the proposal are not carried out.
- 4 Section 58 of the Act requires the EPA to maintain a public record of certain matters. Notification of the making of this voluntary agreement will be included in the public record.
- 5 Section 59 of the Act requires the EPA to notify the relevant local council of the making of this agreement and when the terms of the agreement have been fulfilled. The council is required to note on any planning certificate issued pursuant to s.149(2) of the Environmental Planning and Assessment Act with respect to the land that the land is currently subject to a voluntary agreement until the council receives EPA notification that the terms have been fulfilled.



Plan showing T3 Spoil Dump Study Area Boundary

- Roads
- ▨ Study Area Boundary
- T3 Spoil Dump
- Blowering Reservoir
- Talbingo Reservoir

0 250 500 1,000 1,500 2,000 Metres





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Search for NSW heritage

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Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

- **Section 1** - contains Aboriginal Places declared by the **Minister for the Environment** under the National Parks and Wildlife Act. This information is provided by the Heritage Division.
- **Section 2** - contains heritage items listed by the **Heritage Council of NSW** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- **Section 3** - contains items listed by **local councils** on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and **State government agencies** under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search returned 2 records.

Aboriginal place name	Local government area	Local Aboriginal Land Council	Latitude	Longitude	Gazettal date and page numbers	Comments
<u>Brungle Cemetery</u>	Tumut	Brungle/Tumut	-35.1562165541	148.236918857	07/08/2011 p. 4922-4923	
<u>Hannibal Hamilton Grave</u>	Tumut	Brungle/Tumut	-35.325818849	148.238963899	11/02/2001 p. 9043	

Section 2. Items listed under the NSW Heritage Act.

Your search returned 4 records.

Item name	Address	Suburb	LGA	SHR
<u>Adelong Falls Gold Workings/Reserve</u>		Tumut	Tumut	00072
<u>Junction Bridge</u>	Tumut Plains Road	Tumut	Tumut	01471
<u>Montreal Community Theatre and Moveable Heritage Collection</u>	46 Russell Street	Tumut	Tumut	01909
<u>Tumut Railway Station group</u>	Cootamundra-Tumut railway	Tumut	Tumut	01273

Section 3. Items listed by Local Government and State Agencies.

Your search returned 30 records.

Item name	Address	Suburb	LGA	Information source
<u>Adelong Police Station and Official Residence</u>	Lockhart Street and Campbell Street	Adelong	Tumut	SGOV
<u>Adelong Urban Conservation Area</u>		Adelong	Tumut	GAZ
<u>All Saints Anglican Church</u>	River Street	Tumut	Tumut	GAZ
<u>Bank and Hotel Group</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Bank of New South Wales</u>	Tumut Street	Adelong	Tumut	GAZ
<u>Blowering Dam</u>	Tumut River	Tumut	Tumut	SGOV
<u>Commercial Hotel</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Courthouse</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>House</u>	12 Wynyard Street	Tumut	Tumut	GAZ
<u>Infants School (former)</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Junction Bridge over Tumut River</u>	Tumut Plains Road	Tumut	Tumut	SGOV
<u>National Aust Bank</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Oriental Hotel</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Police Station, Residence & Lockup</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Post Office</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Public School and Headmaster's residence</u>	Gilmore Road	Adelong	Tumut	GAZ
<u>Royal Hotel formerly Rising Moon</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>School of Arts</u>	Wynyard Street	Tumut	Tumut	GAZ
<u>Snowy Mntns Hwy, 3 timber Brs-Nacki-Necki Creek</u>		Mount Adrah	Tumut	GAZ
<u>St. Mary's Roman Catholic Church & Presbytery</u>	Capper Street	Tumut	Tumut	GAZ
		Adelong	Tumut	GAZ

<u>St. Paul's Anglican Church</u>	Gilmore Road			
<u>Tumut Courthouse</u>	Wynyard Street and Fitzroy Street	Tumut	Tumut	SGOV
<u>Tumut Fire Station</u>	146 Wynyard Street	Tumut	Tumut	SGOV
<u>Tumut Official Residence 2</u>	20 Wynyard Street	Tumut	Tumut	SGOV
<u>Tumut Police Station</u>	20 Wynyard Street	Tumut	Tumut	SGOV
<u>Tumut Railway Precinct</u>	Snowy Mountains Hwy	Tumut	Tumut	SGOV
<u>Tumut Star Hotel</u>	59 Russell Street	Tumut	Tumut	GAZ
<u>Tumut Urban Conservation Area</u>		Tumut	Tumut	GAZ
<u>Uniting Church Methodist, Wesleyan (former)</u>	Lockhart Street	Adelong	Tumut	GAZ
<u>Westpac Bank</u>	Wynyard Street	Tumut	Tumut	GAZ

There was a total of 36 records matching your search criteria.

Key:

LGA = Local Government Area

GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.



National Pollutant Inventory

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2015/2016 data within TUMUT - All Substances from Facilities (Industry)

A map of all facilities which match the current search results. Markers with numbers indicate the number of facilities in an area. Markers with no numbers indicate the location of an individual facility. At higher zoom levels, the number of markers with numbers will decrease. Click on a facility marker (a marker with no numbers) to view a facility's annual report.

NPI

- [NPI Home](#)
- [NPI Database Search](#)

Search Criteria

- Source Type = Facility (Industry)
- Include subthreshold facility data = Yes
- Reporting year = 2015/2016
- State = National
- LGA = TUMUT
- Substance = All
- Destination type = All

[Edit Criteria](#)

Key

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