

1930-31-32.

LEGISLATIVE ASSEMBLY.
NEW SOUTH WALES.

REPORT
OF THE
DEPARTMENT OF PUBLIC WORKS
FOR THE
YEAR ENDED 30TH JUNE, 1931,
Together with Diagrams.

Ordered by the Legislative Assembly to be printed, 16 March, 1932.



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THE DEPARTMENT OF PUBLIC WORKS.

(ANNUAL REPORT FOR THE YEAR 1930-31).

The Director of Works to the Honorable the Minister for Public Works.

Department of Public Works, N.S.W.,
Sydney, 5 January, 1932.

Dear Sir,

The operations of the Public Works Department for the financial year ended 30th June, 1931, are summarised in the following Report, and described in detail in the accompanying reports by the heads of the respective branches of the Department.

FINANCIAL.

The measure of the activities of the Department is reflected in the gross expenditure, which for the year under review amounted to £4,448,531 10s. 5d. The salaries paid to permanent officers, exclusive of Dredge Service, decreased by £17,056 to £153,938, the number being reduced from 400 to 378.

The moneys expended were provided from the following sources :—

	£	s.	d.
Consolidated Revenue	498,665	11	9
Special purposes (Revenue) Fund	10,587	0	8
General Loans	2,241,780	14	9
River Murray Commission and Miscellaneous	115,656	0	10
Special Deposits Account	1,327,165	0	1
Other Departments Votes	254,677	2	4
Total	£4,448,531	10	5

In addition to this direct expenditure, work to the value of £200,081 was supervised for the Education Department.

The expenditure of the Loan Funds was distributed amongst the following principal branches :—

	£
Sydney Harbour Bridge	1,438,218
Water Supply	356,952
Sewerage	258,683
Harbours and Rivers	72,684
Electrical	39,909
Public Buildings	57,699
River Murray...	114,687

The Special Deposits Account covers mainly funds raised by a special rate for the Sydney Harbour Bridge, finances connected with the administration of the Broken Hill and Junee Water Supply Schemes, funds provided by the Main Roads Board, the administration of the Burrinjuck and Port Kembla electricity undertakings, Port Kembla coal shipping, and funds provided by the State and Commonwealth Governments for unemployment relief works. The amount expended on unemployment relief works from funds provided by the State Government was £556,093.

The Department has a considerable amount of administrative work to do in connection with schemes which are more in the nature of industrial enterprises, such as the Broken Hill Water Supply, the electricity undertakings in connection with the Burrinjuck Dam and the Port Kembla power stations, and the wharfage business at Port Kembla. The electrical business of the Department has been an expanding one. For instance, in the previous year 1929-30, the receipts from the Burrinjuck scheme amounted to £56,601 3s. 3d., while for the year 1930-31 the figure was £78,625 9s 2d., notwithstanding the general depression. The receipts from the Port Kembla electricity undertaking and also the coal shipping, however, showed a slight decrease due to the prevailing slackness of trade. The decrease was 5 per cent. which is much less than might have been anticipated in the circumstances.

WATER SUPPLY AND SEWERAGE BRANCH.

Water Supply and Sewerage Generally.

So far as natural conditions were concerned, the year was a favourable one, the rainfall having been above the average, and no shortages of water were reported from any of the water supply schemes.

Country towns water supply schemes in operation at the end of the year numbered 85, while sewerage schemes numbered 14. The total expenditure for the year on water supply was £515,782 and on sewerage £391,465.

Water Supply.

Works of water supply were brought to completion in 23 towns and 3 Government institutions, the principal works being at Bathurst (£11,996), Broken Hill (£50,820), Cargelligo (£16,566), Glen Innes (£5,773), Junee (£11,369), Mittagong (£5,953), Orange (£86,478), Scone (£22,517), Tenterfield (£77,074) and Wellington (£12,825).

With funds provided by the Unemployment Relief Council minor works of water supply were carried out at Barellan, Goulburn, Gunnedah, Kiama, Moss Vale, Molong and Murwillumbah.

At the close of the year, works of water supply were in hand at the following towns:—Broken Hill (Electric Pumping Plant at Stephens Creek), Casino, Grenfell, Katoomba, Moama, Mudgee, Tenterfield, Wagga and Werris Creek. Works were also in hand from funds provided by the Unemployment Relief Council at Bathurst, Bourke, Culcairn, Glen Innes, Mudgee, Nyngan and Orange. The works in hand consisted for the most part of pumping plants and new mains.

The principal scheme in hand was the South West Tablelands which has been under construction for some time. It is anticipated that water will be available for supply to Cootamundra from the scheme early in 1932.

Work in connection with the Newcastle and Hunter River District Sewerage and Stormwater Channels was continued during the year, the expenditure having been £130,392, making a total cost to date of £370,305. The Throsby Creek Stormwater Drainage System, the enabling Act for which was passed in April, 1931, is being carried on with funds provided by the Unemployment Relief Council. A number of other stormwater drains in the district are being carried out under similar conditions. The Cessnock Sewerage System has been continued and the total cost to date has amounted to £125,689.

Country Towns Sewerage and Stormwater Channels.

At Bathurst a low level reticulation scheme with pumping station, treatment works, &c., was carried out by day labour, the total expenditure to 30th June, 1931 being £38,532. The Forbes Sewerage Scheme was brought to completion at a total cost of £70,129 approximately. Extensions of sewerage at North and South Lismore were completed at a cost of £27,377 by the State Monier Pipe Works. Reticulation extensions were carried out at Orange (£17,576) and Wagga (£23,115).

Water Supply and Sewerage—Treatment, Purification and General Investigation.

The installation of water filtration plants and sewage treatment works is an increasing factor in the work of the Branch. Filtration plants were constructed and put into operation at Glen Innes, Lake Cargelligo, Wellington and Orange. A filter plant at Jugiong has also been completed and will be put into operation when the pumping plant is started. To ensure the continuous successful working of these plants, particularly the sewage treatment, regular visits of inspection are made, samples taken for analysis, and the Councils advised on the management of the plants.

HARBOURS, ROADS AND BRIDGES BRANCH.

The total expenditure by this Branch amounted to £708,706. In the expenditure of this amount employment was distributed as much as possible by a system of rationing. In addition to ordinary departmental work the permanent staff has been engaged in the supervision of works carried out with funds provided by the Unemployment Relief Council, as well as in various services for other departments.

HARBOUR WORKS.

Operations in connection with the major improvement works at Port Kembla, Newcastle and Coff's Harbour were continued during the year by day labour, whilst repairs of a varied nature were effected at the several river entrances. The eastern breakwater at Port Kembla was extended 83 feet.

Dredging.

The quantity of material lifted by the dredge plant totalled 3,412,049 tons at an average cost of 9.55d. per ton. The cost per ton in the previous year was 12.57d. The reduction in cost is attributed to the overhaul and repair of the dredge plant having been confined in the interests of economy to the barest necessities. The hopper dredge "Hermes" was brought to completion during the year and placed in commission.

Maintenance.

The general work of maintenance of harbour and river works, ocean jetties and moorings, river docks, &c., has received attention to the fullest extent permitted by the funds available. With funds provided by the Unemployment Relief Council a quantity of levelling work for factory sites, &c., was carried out at Port Kembla, about £10,000 being expended.

Newcastle Harbour.

Operations for removal of rock from the bar at entrance to Newcastle Harbour were continued. The minimum depth now available is 25 feet 6 inches. The Hexham barrage was carried to local low water level when operations were terminated for the time being.

Roads.

Roadworks in the Western Division had the benefit of £91,661 from the Federal Aid Roads Vote and also £25,100 from the State Unemployment Relief Council. Upon relief works in the Metropolitan and Newcastle districts £138,456 was expended on roads, and £90,033 on levelling of Crown lands, &c.

Bridges.

The only new bridges carried out under the supervision of the branch were over Georges River at Milperra (£5,969), over Goulburn River at Martindale (£6,421), Freemantle Subdivision Bridge, Bathurst (£1,862) and Stock Bridge over the Lachlan River at Condobolin (£907). Seven minor bridges were carried out with funds from the Federal Aid Road Vote.

Public Watering Places.

Improvements were carried out at a number of public watering places in the Western Division, the total expenditure amounting to £32,008, of which £13,152 was provided by the Unemployment Relief Council.

Punts and Ferries.

The amount expended by the Department for maintenance of punts and ferries was £9,008, while an expenditure of £6,112 was supervised on behalf of the Main Roads Board.

River Murray Waters Agreement.

An important matter in this connection was the decision arrived at by a conference of the contracting parties in February, 1930, and which was to the effect that the construction be carried forward on a basis of 1,250,000 acre feet of storage, operations to be then suspended pending further consideration. Following the conference, three matters are still under reference to the contracting Governments, viz., the construction of two diversion weirs on the Murrumbidgee River, protection of the lower Murray from salinity and the allocation of maintenance costs. Work on the Hume Weir progressed during the year to the extent of 28,518 cubic yards of concrete, bringing the total to 382,845 cubic yards. The Bethanga bridge was completed and is now in use. The construction of road deviations has also proceeded, in which connection it was found necessary to ration the men one week in four in order to avoid dismissals. The contract for spillway gates mentioned in last year's report was completed, but the whole of the work has not yet been placed in position. The expenditure by the Department was £141,020 for the year, the total to date being £2,984,903.

ELECTRICAL ENGINEERING BRANCH.

No new hydro-electric investigation work was undertaken by this branch during the year, but the investigations in connection with various proposals were brought to completion. The Wyangala Dam Hydro-electric Development is proceeding satisfactorily, the outlet pipes having been placed in position and concreted; rock foundations have been cleared for the power station and screen structure. The construction of No. 2 Power Station at Burrinjuck has also progressed, while there has been moderate development of operations in connection with the Burrinjuck transmission lines, sub-stations, &c. The operation of the Burrinjuck electric system has been satisfactory, and the energy sold increased by twenty-five per cent. The possibilities of obtaining additional consumers are being explored. Supplies were provided to Temora in July, 1930, and for Junee Water Supply in February, 1931. Negotiations are proceeding for supplies to Adelong, Batlow, Koorawatha and Greenthorpe.

The Port Kembla scheme, while satisfactory in operation, suffered a loss of business owing to the prevailing slackness of industries in the district served by the scheme. The energy sold decreased by five per cent. Agreements were executed by the Camden and Picton Municipal Councils and also for emergency supplies by Southern Portland Cement Ltd. and Australian Iron & Steel Ltd. Supplies were provided to the towns of Robertson and Burrawang. Negotiations have been opened up with a number of other towns in the district.

As in previous years, the services of the branch have been largely availed of in connection with the works of other branches (Water Supply, Sewerage, &c.) as well as for other Departments.

SYDNEY HARBOUR BRIDGE.

Northern and Southern Approaches.

Due to curtailment of loan expenditure, operations on the approaches were restricted in the previous year, and in order to adhere to the construction programme, it became necessary to expedite the work. Rationing of employment was introduced in September, 1930, but additional men were engaged so that the desired rate of progress could be maintained.

On the northern approach, the principal features were the construction of the Kirribilli Station and the North Shore local viaduct. Excavation amounted to 27,361 cubic yards, and concrete was poured to the extent of 27,029 cubic yards, of which a little more than half was reinforced work. Plastering on parapets, pier faces, &c., amounted to 5,580 square yards.

On the southern approach, 39,934 cubic yards were excavated, and 31,162 cubic yards of concrete poured. A commencement was made with the plastering, the quantity carried out to the end of June being 600 feet on the west retaining wall parapet and about 120 feet on the east retaining wall.

The total number of men employed in connection with the bridge and approaches was 1,509, of whom 893 were employed by the Department on the approaches.

Dorman, Long & Co. Contract.

Pylon construction has proceeded rapidly. A satisfactory coke concrete for roadway purposes was devised which is only sixty per cent. of the weight of blue metal concrete. The asphalt surfacing of the roadway and footways has also proceeded at a satisfactory rate. It was necessary to make a careful selection of the material for this purpose, as it required to be elastic enough in cold weather to follow the rapid temperature movements of the steel trough plates. The sleepers of the railway tracks was commenced, each sleeper receiving one coat of oil and three of paint before being bolted in position.

Electric substations have been built in both pylons, and the high tension electric cables have been brought in and connected.

During the year, the quantity of steelwork erected was 13,067 tons. The total amount of steel delivered to the workshops to date is 52,108 tons, of which 41,353 came from England and 10,755 from Australia.

The erection of the bridge arch reached an important stage this year, the arch trusses being completed and permanently joined on 10th September, 1930. Since that date the construction of the suspended deck has been completed.

GENERAL.

It has now been arranged that the official opening of the bridge is to take place on 19th March, 1932, which is the earliest date by which it is anticipated the roadways, &c., will be in a condition to take regular traffic.

Statements attached to the report of the Chief Engineer, Dr. Bradfield, show that the total expenditure up to the end of June, 1930, has been £8,136,946 10s. 4d., including the cost of resumptions, and interest during construction.

GOVERNMENT ARCHITECT'S BRANCH.

The expenditure by the Government Architect's Branch for the year under review was £333,892. Practically half the expenditure was provided by the Unemployment Relief Council, viz. £137,613. The amount of direct expenditure does not, however, reflect the full activities of the branch, as in addition the branch supervises a considerable quantity of work for the Education Department, which for 1930-31 amounted to £200,081.

The principal works financed from Unemployment Relief Funds and their estimated cost were :—

State Hospitals.—Coast Hospital, medical officers' quarters, £6,000; laundry, £2,405. Lidcombe State Hospital, infectious unit, £8,900; medical officers' residence, £1,800. Liverpool State Hospital, nurses' home, £11,000; recreation hall, £2,220; manager's cottage, £1,280.

Mental Hospitals.—Broughton Hall, psychiatric Clinic, new ward block, £14,000; Orange Mental Hospital, epileptic wards, £38,000; Morisset Mental Hospital, admission blocks, £24,000; chronic male ward, £11,000.

Schools.—Manly Domestic Science School, £15,000; Canterbury Domestic Science School, £21,000; Mortlake Public School, £12,000; Punchbowl Public School, £9,106; Russell Lea Infants' School, £7,449; Darlinghurst Infants' School, £5,226; Coonamble Public School, class rooms, &c., £7,500; Dubbo North Infants' School, £3,300; Parkes Intermediate High School, £11,950; Grenfell Public School, £6,000; Armidale Teachers' Training College, ground improvements, £2,890; Armidale High School, additions, £4,882; Cessnock West Public School, £3,336; New Lambton School, £14,157; Newcastle Central Domestic Science School, £30,000; Wagga High School, additions, £9,500.

Police Buildings.—£51,102, comprising mainly additions, alterations, &c., to a number of buildings. The largest works were new police buildings at Bondi, £4,000; garages at Alexandria, £2,550; Redfern Police Depot, additions, £2,650; Bourke, additions, alterations, &c., £1,196.

New huts were erected at the La Perouse Aborigines Reserve at an estimated cost of £4,000, and thirty-three huts were provided for erection on various aborigines reserves in the country at a total estimated cost of £3,036.

The principal buildings erected in addition to those financed from Unemployment Relief Funds, were :—

Schools.—North Sydney (Crow's Nest) Infants' School, £6,321; Cowra, new building, £9,247; Ballina High School, £8,556; Ben Venue School, £4,272; Lismore Public School, £19,128; Forbes Intermediate High School, additions, £2,630.

Mental Hospitals.—Orange, staff dining room, £7,112, two wards for unrecovered male patients, £41,428; recreation block, £10,400; administrative block, £8,921; two blocks for quiet and industrious patients, £21,574; ward block and new stables, £3,113.

Hospitals Generally.—Manly Peace Memorial Hospital, nurses' home, £15,590; Balmain District Hospital, out-patients' department, £5,757; Coonabarabran District Hospital, isolation block, £2,113; Griffith District Hospital, new buildings £24,000; Wallsend Mining District Hospital, operating theatre, £2,735.

Police Stations and Court Houses.—Coff's Harbour, £3,040; Quirindi, £4,393.

As in previous years, a large proportion of the time of the staff has been occupied with designs for future works. Amongst these, school buildings predominated, the estimated expenditure ranging from £7,100 to £61,500 for individual works. Hospital projects constitute an appreciable portion of the work of the branch, new buildings being estimated to cost from £5,000 to £42,000. Minor hospital works, mostly additions, were also designed, ranging in estimates between £5,700 and £18,800. Plans and specifications were prepared for projected works in connection with the various State and Mental Hospitals, the principal items being new nurses' quarters at the Coast Hospital, additional buildings at Broughton Hall, and additions to the ward blocks at Gladesville Mental Hospital. Other schemes for which sketches have been drawn include an additional storey to the Lands Department building, an additional storey to the Treasury buildings, and an alternative scheme for completion of the Treasury building.

The University authorities contemplate the erection of a new medical school building with funds provided by the Rockefeller Foundation. The working drawings and specifications for this work are in an advanced stage. The cost of the building and equipment will be in the neighbourhood of £100,000.

Increased maintenance by the Engineering Branch was required for the services which have expanded very considerably during recent years, and also due to the advanced age of many of the installations in public institutions and Departments. The Government Architect in his report draws attention to the decrease in capital costs of recent designs, which he considers is indicative of the progress made in standardising equipment.

ENGINEERING DESIGN BRANCH.

The Engineering Design Branch established in the previous year by the amalgamation of the various Engineering Branch Drawing Offices has had the anticipated effect of economy and uniformity, and the staff was fully and usefully employed during the year. Preliminary designs were prepared for a number of proposed works. The bulk of the work of the Branch consisted in the preparation of plans and specifications for extensions or additions to existing works or schemes in progress.

TESTING AND INSPECTION BRANCH.

The work in this Branch has shown an appreciable falling off as compared with the previous year, and this may be attributed to the prevailing economic depression. The value of the material sampled, tested, and inspected was £598,916. The fees charged amounted to £7,892.

SURVEY AND SURVEY DRAFTING BRANCH.

This Branch has been occupied with general survey, drafting, heliographing, plan mounting, and recording, in connection with the works carried out by the Engineering and Architectural Branches of the Department. Heliographing and plan mounting were also done for the Railway, Education, Valuer-General, and Fisheries Departments.

A total of 29,431 helios was printed and 1,840 plans mounted. The new plans numbered 2,695, and Field and Level Books 210.

GOVERNMENT DOCKYARD, NEWCASTLE.

This establishment has suffered a serious decrease in volume of work, the sequel to the reduced expenditure by the State Government during the financial year. The figures showing the financial position of the Dockyard are not available for this report, but will be dealt with in connection with the report by the Auditor-General. The construction and repair of dredges and the manufacture of steel pipes provided, the bulk of the work carried out. The management reports that the floating dock has been well occupied considering the unprecedented slackness in shipping. The average number of employees has fallen to 600, and it was also necessary to introduce rationing for both the staff and employees.

GENERAL.

A change of Government took place during the year, as result of which the Hon. E. A. Buttenshaw, M.L.A., was succeeded by the Hon. M. A. Davidson, M.L.A., Minister for Public Works, the change taking effect from 4th November, 1930.

The Department has had the greatest measure of co-operation from the staff in carrying on the business of the Department throughout a period which has been one of unprecedented difficulty.

G. W. MITCHELL,
Director of Works.

Accountant's Report.

For the Year ended 30th June, 1931.

The staff of the Department, and the annual salary charges as at the 30th June, 1931, and the comparison of these with the similar particulars of the previous year will be found in the following:—

Year.	Permanent Officers.		Temporary Officers.		Total.	
	No.	Salary.	No.	Salary.	No.	Salary.
1930-31—		£		£		£
General Staff	378	153,938	295	88,917	673	242,855
Dredge Service Staff.....	123	37,791	123	33,016	246	70,807
1930-31 totals	501	191,729	418	121,933	919	313,662
1929-30—						
General Staff	400	170,944	306	99,841	706	270,785
Dredge Service Staff.....	129	40,367	161	43,566	290	83,933
1929-30 totals	529	211,311	467	143,407	996	354,718

NOTE.—The foregoing does not include Industrial Undertakings and Government Dockyard staffs.

Following are particulars of the expenditure and receipts of the Department for the year ended 30th June, 1931:—

	Expenditure.		Receipts.	
	£	s. d.	£	s. d.
1. Consolidated Revenue Fund—				
(a) Salaries and payments in the nature of salaries	125,219	18 1		
(b) Maintenance and working expenses, other than salaries	22,272	16 11		
(c) Maintenance of Public Works and Services, &c.—	£	s. d.		
Roads.....	13,959	8 1		
Bridges.....	15,224	11 10		
Punts, ferries and flood-boats	9,008	0 8		
Public watering-places	12,644	4 7		
Harbours and rivers	17,153	4 11		
Dredge services	129,153	13 10		
Public buildings	38,357	3 6		
Water supply, sewerage, and stormwater drainage	4,158	18 10		
State power supply.....	1,544	1 11		
State telephones.....	28,681	14 7		
Electricity and gas.....	45,585	2 10		
Miscellaneous	35,702	11 2		
	351,172	16 9		
	498,665	11 9		
2. Special Purposes (Revenue) Fund—				
Purchase of motor vehicles	315	5 9		
Bridges.....	52	8 10		
Public watering-places	1,324	17 10		
Harbours and rivers	150	4 5		
Public buildings	8,734	8 5		
Punts and ferries	9	15 5		
	10,587	0 8		
3. General Loan—				
Bridges.....	1,450,985	16 1		
Harbours and rivers	72,683	17 5		
Water supply works	356,952	6 1		
Sewerage and stormwater drainage works.....	258,682	13 3		
Public buildings	57,698	11 6		
Electrical works.....	39,909	6 7		
Public watering-places	4,868	3 10		
River Murray Commission—				
State contribution to their funds—Purchase of plant, &c.	114,686	16 5		
Sales, &c., of No. 1 Plant.....			6,112	10 1
Plant depreciation charge			8,900	7 9
Miscellaneous	969	4 5		
	£2,357,436	15 7	£15,012	17 10

Particulars of Expenditure and Receipts for Year ended 30th June, 1931—*continued*.

4. <i>Special Deposits Account.</i>	Balance at 1st July, 1930.	Receipts.	Total.	Expenditure.	Balance at 30th June, 1931.
<i>Name of Account.</i>	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Public Works Store Advance Account	86,581 16 11	74,517 0 8	161,098 17 7	56,025 9 9	105,073 7 10
Sydney Harbour Bridge—Municipal and Shire Rates Account	316,850 19 3	.....	316,850 19 3	224,784 13 1	92,066 6 2
Junee Water Supply Administration Account...	769 0 5	16,091 19 10	16,861 0 3	15,338 19 11	1,522 0 4
Junee Water Supply—Renewal Account	8,831 15 9	213 15 11	9,045 11 8	9,000 0 0	45 11 8
Broken Hill Water Supply Administration Account	65,173 19 8	51,947 19 7	117,121 19 3	80,518 2 1	36,603 17 2
Medlow Bath Township Water Supply	31 2 9	350 18 1	382 0 10	330 9 11	51 10 11
Bethungra Water Supply	403 13 8	137 12 9	547 6 5	20 0 3	527 6 2
Public Works Department Working Account ...	7,751 5 5	27,586 10 4	35,337 15 9	26,780 0 1	8,557 15 8
Public Works Department—Suspense Account— General	475 7 3	0 6 8	475 13 11	18 6 5	457 7 6
Main Roads Board	109,531 10 4	.....	109,531 10 4	103,154 11 9	6,376 18 7
Lands Department	2,026 6 8	.....	2,026 6 8	2,026 6 8	.....
Burrinjuck Hydro-Electric Undertaking	6,829 2 11	78,625 9 2	85,454 12 1	81,503 7 10	3,951 4 3
Port Kembla Electricity Undertaking	2,961 4 0	63,339 9 2	66,300 13 2	63,568 7 0	2,732 6 2
Coal Loading and Shipping at Port Kembla ...	12,356 3 11	18,544 11 5	30,900 15 4	17,108 13 9	13,792 1 7
Leichhardt Depot Working Account	3,202 5 7	16,693 10 2	19,895 15 9	16,739 16 2	3,155 19 7
Testing Branch Working Account	3,270 8 11	9,919 8 4	13,189 17 3	12,676 2 2	513 15 1
Lighting and Heating all Departments	294 0 5	5,447 10 9	5,741 11 2	5,386 4 4	355 6 10
Unclaimed Salaries and Wages	1,089 9 9	1,121 14 4	2,211 4 1	1,088 3 11	1,123 0 2
Unclaimed Moneys	155 6 0	48 9 8	203 15 8	123 2 8	80 13 0
Security Deposit Account	11,047 6 1	10,791 2 4	21,838 8 5	18,217 13 6	3,620 14 11
State Sawmills	2,330 17 3	5,457 1 4	7,787 18 7	136 6 9	7,651 11 10
State Timber Yards	1,785 2 7	99 4 10	1,884 7 5	.....	1,884 7 5
State Brickworks, Botany.....	.....	239 4 0	239 4 0	.....	239 4 0
Advances to Officers to purchase Motor Cars.....	.....	66 13 4	66 13 4	.....	66 13 4
Middle Harbour-The Spit Bridge Surplus Tolls Account	1,027 4 5	.....	1,027 4 5	1,026 10 8	0 13 9
Commonwealth Government Unemployment Relief	37,500 0 0	.....	37,500 0 0	35,500 8 7	1,999 11 5
Unemployment Relief	1,035,840 10 5	.....	1,035,840 10 5	556,093 2 10	479,747 7 7
£	1,718,122 0 4	381,239 12 8	2,099,361 13 0	1,327,165 0 1	772,196 12 11

5. *Operations on other Departments' Loan, Revenue, Special Purposes, and Special Deposit Accounts to meet Expenditure on Works carried out for them—*

	Expenditure. £ s. d.	Receipts. £ s. d.
Loan votes	1,101 19 6	.....
Consolidated Revenue Votes— Treasurer's Advance Account	175 6 8	.....
Special Purposes (Revenue) Votes	1,962 5 9	.....
Special Deposits Accounts	1,045 6 10	40 19 5
	£4,284 18 9	£40 19 5

6. *Payments made by other Departments for Works and Services carried out by this Department—*

Department.	Expenditure.	Receipts.
Agriculture	757 18 6	.....
Child Welfare	1,816 1 5	.....
* Education	1,203 18 1	.....
Family Endowment.....	842 16 1	.....
Hospitals Commission	75,584 7 5	.....
Labour and Industry.....	558 5 10	.....
Lands	867 15 9	.....
Government Stores	416 8 8	.....
Main Roads Board	224 12 10	.....
Mines	211 3 1	.....
Government Dockyard.....	256 15 6	.....
River Murray Commission	160,789 9 10	18,435 2 11
Sydney University.....	482 16 1	.....
Taxation Department	1,402 9 5	.....
Government Tourist Bureau	204 14 7	.....
Resumed Properties	484 3 5	.....
Sydney Hospital.....	1,668 16 4	.....
Water Conservation and Irrigation Commission	1,524 14 4	.....
Miscellaneous	1,094 16 11	.....
	£250,392 3 7	£18,435 2 11

7. *Revenue Received and Paid into Consolidated Revenue—*

Re-payments made to previous year's Consolidated Revenue Votes	7,104 18 1
Rents, exclusive of land	7,761 16 9
Miscellaneous services rendered	7,891 15 7
Unclassified receipts	329,009 15 4
Exchange on remittances	83 10 9
Fees	1 0 0
	£351,852 16 6

* In addition, work to the value of £155,081 has been carried out in districts outside the metropolitan area for the Department of Education. This expenditure, although the work is directed and supervised by the Departmental Officers, does not go through Head Office Books.

JAMES ROBERTSON,
Accountant.
23rd September, 1931.

The Secretary.

Water Supply and Sewerage Branch.

Report for Year ended 30th June, 1931.

(A) GENERAL REPORT

- (1) Water Supply and Sewerage generally.
- (2) Water Supplies administered by the Department.
- (3) Expenditure for Year.
- (4) Legislation.
- (5) Staff and Administration.

1. WATER SUPPLY AND SEWERAGE GENERALLY.

At the end of the year public water supplies constructed at a capital cost of £4,018,668 were in operation in eighty-five towns.

Fourteen towns are now seweraged, while stormwater channels have been constructed in sixteen towns. The total capital cost of sewerage schemes and stormwater channels amounts to £1,100,872.

The cities and towns in the Metropolitan and Hunter River Districts are not included in these figures.

The rainfall for the year 1930-31 was much above the average, particularly during the latter part from March, 1930, when floods occurred in various parts of the State. In December, 1930, the new weir on the Bogan River at Nyngan was badly breached by flood waters, and repairs are now in hand, the design being somewhat amended.

Owing to the plentiful rainfall no shortages were reported from the existing Country Towns Water Supplies.

During the year several new schemes of water supply and sewerage, and augmentation to existing schemes, were carried out with money obtained by special taxation under the "Prevention and Relief of Unemployment Act, 1930."

Works of water supply were brought to completion in twenty-three towns and at three Government institutions. At 30th June, 1931, similar works were in progress at twelve towns, of which four were new schemes for areas not previously supplied.

Investigations of new schemes of water supply were carried out in seven areas, and for the augmentation of existing supplies in four towns.

The sewerage of Forbes was completed, and that of Parkes and Mudgee was in progress.

2. WATER SUPPLIES ADMINISTERED BY THE DEPARTMENT.

For the two supplies administered by the Department the corresponding period is the twelve months ending 31st December in each year.

(a) BROKEN HILL WATER SUPPLY.

The total quantities of water pumped from the two storage reservoirs were :—

	Gallons.
Umberumberka	295,074,000
Stephens Creek	268,351,000
Total	563,425,000

The average cost of pumping was approximately :—

Umberumberka	5·24d. per 1,000 gallons.
Stephens Creek	10·67d. per 1,000 gallons.

The average for the two was about 7·82d. per 1,000 gallons.

(b) JUNEES WATER SUPPLY.

Pumped at Tenandra.	Cost per 1,000 gallons to Railway Commissioners and Junees Council.	Supply from Bethungra to Railway Commissioners.	
Gallons.		Gallons.	Cost per 1,000 gals.
101,736,000	3/8-44,646	2,312,400	8d.

3. EXPENDITURE FOR YEAR.

	£
Water Supply Works	515,782
Sewerage Works	391,465
Total	£907,247

4. LEGISLATION.

The following legislation affecting the works of the Branch was passed during the year :—

The Unemployment Relief (Tax) Act (No. 25).
 The Prevention and Relief of Unemployment Act (No. 34).
 The Prevention and Relief of Unemployment (Amendment) Act (No. 50).
 The Unemployment Relief (Tax) Amendment Act (No. 52).
 Grafton and South Grafton Water Supply (Amendment) Act (No. 7).
 Throsby Creek Stormwater Drainage Act (No. 6).
 Cessnock Sewerage Act (No. 5).

5. STAFF AND ADMINISTRATION.

Mr. W. T. Smith, Supervising Engineer, who reached the age limit for Departmental officers, entered upon leave prior to retirement, after long and meritorious service.

B. DETAIL REPORT.

(I) WATER SUPPLY.

(a) Country Towns Water Supply.

1. Works completed.
2. Works under construction.
3. Works proposed and investigations.

(II) SEWERAGE.

(a) Newcastle Sewerage and Stormwater Channels.

(b) Country Towns Sewerage and Stormwater Channels.

1. Works completed.
2. Works under construction.

(III) WATER SUPPLY AND SEWERAGE.

Treatment and purification and general investigation.

(a) Country Towns Water Supply.

(i) WORKS COMPLETED—(LOAN VOTE).

Bathurst.—An additional reinforced concrete service reservoir, with a capacity of two million gallons, was completed by the State Monier Pipe Works at a cost of £11,996. This reservoir is intended to augment the supply to the town, and a connection was made to the existing reticulation by day labour at a cost of £3,484 to 30th June, 1931.

Bowral.—An additional concrete service reservoir of the banked type, with a capacity of 400,000 gallons, was constructed during the year. The excavation and pipe connections were carried out by the Bowral Council by day labour, and the concrete lining was done by contract, the total cost being £843 to 30th June, 1931.

A high lift electrically-driven pump, with a capacity of 14,400 g.p.h. was installed at a cost of £399 to 30th June, 1931, to take the place of one of the existing pumps.

Broken Hill.—An additional rising main, comprised of 18-inch steel pipes was laid by day labour from Stephens Creek to the service reservoirs on Block 10, with an 18-inch branch to the Mica-street service reservoir. The total cost was £50,820 to 11th July, 1931.

Cargelligo.—A filtration plant was installed for this water supply system, which had been completed during the previous year. A booster pump was also installed to increase the pressure in the town main. The total cost of the whole scheme was £16,566 to 30th June, 1931.

Deniliquin.—Two electrically-driven pumps, to take the place of the old plant, were installed, having capacities of 30,000 and 18,000 g.p.h. respectively, with transmission line and substation. A new pump well, suction main and staging were also included in the work, which cost a total amount of £4,588.

Glen Innes.—A filtration plant for the treatment of the water was installed by contract by the State Monier Pipe Works, at a cost of £5,773 to 30th June, 1931.

Hay.—An additional pumping unit, with a capacity of 45,000 g.p.h., was installed at a cost of £614 to 30th June, 1931, to replace an existing pump which was transferred to Tenterfield.

Junee.—Electrically-driven pumps in duplicate, each set consisting of a high level and a low level pump with a capacity of 40,000 g.p.h., were installed in a new pump well to take the place of the existing steam plant. A new suction main and staging and a steel rising main to existing service reservoir were also constructed at a total cost of £11,369 to 13th June, 1931. The pumps are operated with current from Burrenjack.

Mittagong.—An additional concrete storage dam, with a capacity of 23 million gallons, was completed during the year on Nattai Creek above the existing storage reservoir, at a cost of £5,953 to 30th June, 1931.

Morisset Mental Hospital.—The raising of the dam was carried out by day labour, at a cost of £2,634. An electrically-operated pump, with a capacity of 8,000 g.p.h., was installed to take the place of the existing steam plant, and a booster pump, with a capacity of 1,200 g.p.h. was installed near service reservoir. Total cost, £878.

Muswellbrook.—An electrically-operated pump unit of the borehole type, with a capacity of 30,000 g.p.h., was installed at a cost of £1,596 to 3rd June, 1931.

Orange.—An additional storage reservoir, consisting of an earth bank, with a concrete core wall and having a capacity of 660 million gallons, was constructed by contract on Gosling Creek, to augment the present supply to the town. A filtration plant was also erected by the State Monier Pipe Works for the purpose of treating the water, together with all necessary piping, etc., to connect up to the present system. The total cost was £86,478 to 30th June, 1931.

An electrically-driven pumping plant, consisting of two units, with capacities of 40,000 and 80,000 g.p.h. respectively was installed at new dam, and a similar plant was installed in filtration house at a cost of £1,938 to 30th June, 1931.

Picton.—A portion of the existing 8-inch cast-iron gravitation main was renewed, with 10-inch pipes, at a cost of £420.

Scone.—A water supply for the town was constructed by contract, and consists in a pump well, pump house, and machinery consisting of two units of the borehole type with capacities of 18,000 and 12,000 g.p.h. respectively, a rising main and reticulation, and a concrete service reservoir with a capacity of 300,000 gallons. The total cost was £22,517 to 30th June, 1931.

Stockton Mental Hospital.—A reinforced concrete elevated tank was constructed by the State Monier Pipe Works at a cost of £2,298.

Taree-Wingham.—A cottage was constructed for the pumping engineer at a cost of £824 to 30th June, 1931.

Tenterfield.—A scheme for the town was completed by day labour at a total cost of £77,074 to 30th June, 1931. This consists of a concrete storage dam on Tenterfield Creek, with a capacity of 180 million gallons, a pumping station below the dam with two electrically-driven pumps having capacities of 20,000 and 15,000 g.p.h. respectively, cast-iron suction and rising mains, a concrete service reservoir, with a capacity of 450,000 gallons, a service main, and reticulation.

The pumps are driven by current generated at the council's power station.

A filtration plant has also been installed by contract by the State Monier Pipe Works at a cost of £2,435.

Waterfall Hospital.—An additional reinforced concrete water tower, with a capacity of 250,000 gallons was constructed by the State Monier Pipe Works at a cost of £3,396.

Wellington.—Electrically-driven pumps, in duplicate, each with a capacity of 40,000 g.p.h., were installed in existing well, the existing high lift pump being transferred to filtration house. An additional electrically-driven high lift pump, with a capacity of 40,000 g.p.h., was also installed in filtration house. The total cost was £12,825 to 30th June, 1931.

Unemployment Relief Works.

Bowral.—Reticulation extensions were carried out by the Council with material supplied by the Department at a cost of £966 to 30th June, 1931.

Goulburn.—The Goulburn Council replaced some of the 4-inch reticulation with 6-inch pipes supplied by the Department at a cost of £2,695 to 30th June, 1931.

Gunnedah.—Reticulation extensions were carried out by the Council with material supplied by the Department at a cost of £496.

Kiama.—Extensions to reticulation to Bombo and Minnamurra were carried out by the Council with material supplied by the Department at a cost of £681 to 30th June, 1931.

Moss Vale.—The mains in Argyle-street were taken up and replaced by the Council with new pipes supplied by the Department at a cost of £783 to 30th June, 1931.

Molong.—Reticulation extensions were carried out by the Council with material supplied by the Department at a cost of £675 to 30th June, 1931.

Murwillumbah.—Reticulation extensions were carried out by the Council with material supplied by the Department at a cost of £1,168.

(II) WORKS UNDER CONSTRUCTION—(LOAN VOTE).

Broken Hill.—An electrically-driven pumping plant, with a capacity of 96,000 g.p.h., is being installed in the Stephens Creek Pumping Station.

Casino.—An additional electrically-operated pumping plant, consisting of a borehole type pump, with a capacity of 24,000 g.p.h., is being installed in existing well.

Grenfell.—This scheme, which was commenced in the previous year by day labour is still in hand. It consists in an earth dam with a concrete core on Bogolong Creek, a pump station, rising main, service main, service reservoir, and reticulation. The electrically-driven pumps in two units, with capacities of 10,000 and 20,000 g.p.h., respectively, will be operated with current from the Burrenjack System.

Katoomba.—An additional pumping plant, consisting of an electrically-operated pump, with a capacity of 60,000 g.p.h., also a transformer substation.

Moama.—An electrically-operated pumping plant, of 10,000 g.p.h. capacity, is being installed, also an additional 6-inch rising main.

Mudgee.—An additional 8-inch cast-iron rising main is being installed to augment the supply to the town.

South-West Tablelands.—During the year, considerable progress was made with the South-west Tablelands Water Supply Scheme. The first section of the scheme, namely, as far as Cootamundra, was brought to a state bordering on completion by the 30th June, this section including the pump well, suction main, pumping plant, electric substation, transmission line and filtration plant at Jugiong, rising main of 22-inches diameter steel pipes from Jugiong to Cowang Range, a second pumping station at a point approximately midway along the above rising main, and a gravitation main to the new service reservoir near Cootamundra. Of the service reservoirs at Cowang Range, one was practically completed, and the excavation for the second well advanced. Practically the whole of the work enumerated above was carried out by contract. The 22-inch main was supplied by the Government Dockyard, Newcastle, and the 16-inch main by Australian Iron & Steel, Ltd.

The contract was also placed with the Government Dockyard for approximately 15 miles of 15-inch steel main for the next section of the work to be undertaken, namely, from Cowang Reservoir to Harden.

Tenterfield.—An electrically-driven pumping unit, with a capacity of 20,000 g.p.h., is being installed in pump house.

Wagga.—A pumping plant, consisting of one unit of 10,000 gallons per hour, electrically driven, is being installed to supply the high level area.

Werris Creek.—A scheme for the town and to serve railway requirements is still in progress. It consists of a curved concrete dam on Quipolly Creek, having a capacity of 150 million gallons, a 12-inch cast-iron gravitation main, a concrete service reservoir with a capacity of 1,000,000 gallons, a service main and reticulation.

Unemployment Relief Works.

Bathurst.—A concrete dam is being constructed on Winburndale Creek, with a gravitation main connecting up to the reticulation to augment the present supply to the town.

Bourke.—This work consists in a new 9-inch rising main, the electrification of the existing steam pumping plant with one low lift pump and one high lift pump, each with a capacity of 20,000 gallons per hour and the installation of a generating set.

Culcairn.—A complete scheme is being carried out for the town, the water being pumped from the existing well. It consists of a pumping-plant in duplicate, with 2,400 and 3,000 gallons per hour respectively, a combined rising and service main and reticulation. A reinforced concrete reservoir water tower, with an available storage of 50,000 gallons, is being carried out by contract by the State Pipe Works.

Glen Innes.—The erection of a curved concrete storage reservoir, with a capacity of 55 million gallons, is being carried out just upstream of the existing pumping station on the Beardy River to augment the supply to the town.

Mudgee.—A concrete service reservoir, with a capacity of 500,000 gallons, an additional pump-well and drive, also pump-house and electrically-driven pumping machinery of a borehole type, with a capacity of 10,000 gallons per hour, are in course of construction to augment the existing supply to the town.

Nyngan.—Extensive repairs are being carried out to the earth dam on the Bogan River, the design being considerably amended. This weir was breached by flood waters in December, 1930.

Orange.—A 15-inch woodstave pipe is being laid from the 15-inch cast-iron service main leading from the new service reservoir as far as Summer-street to augment the supply to the town.

III. WORKS PROPOSED AND INVESTIGATIONS.

During the year, proposals were investigated for complete supplies for the following towns:—

The Central Western Plains (Bogan Gate to Tottenham), Manildra, Greta-Branxton, Mullumbimby, Oaklands, Barellan, and Lower Macleay River, Crookwell, Lower Blue Mountain villages.

Proposals were investigated for the augmentation or improvement of supplies in the following towns:—

Kiama, Bathurst, extension of Katoomba reticulation to Leura, Cowra, Parkes, Forbes, Goulburn Quirindi, South-west Tablelands water supply.

Surveys for Nowra, Kiama and Bathurst (Charlton) augmentation proposals were carried out, also for deviations in the rising and gravitation pipe-lines of the Greta-Branxton water supply proposals.

Borings were carried out in connection with Greta-Branxton water supply proposals.

Borings were carried out in connection with Greta-Branxton water supply proposal, and also for the proposed water supply augmentation at Tamworth and for the proposed sewerage for West Tamworth.

(a) NEWCASTLE AND HUNTER RIVER DISTRICT SEWERAGE AND STORMWATER CHANNELS.

Newcastle Sewerage Amplification.

Surveys for resumptions and easements for the main sewer at Merewether, in connection with tunnelling in the coal seams, have been carried out.

The sewerage of the industrial areas has been investigated, and the design of the pumping station and screening chambers at Murdering Gully has been completed.

Deep Sinking.—The air line is now complete to Silsoe-street. The tunnelling is completed from Merewether Beach to the pumping station, Murdering Gully. Tunnel work is in progress from the pumping station to No. 10 shaft near Lockyer-street. The remainder is completed.

3,958 cubic yards of rock have been excavated during the period, making a total of 15,154 cubic yards to date. Concrete is now being placed in the tunnel of the gravitation sewer, 289 cubic yards of concrete having been placed during the period.

Shallow Sinking.—The tunnelling has been completed from Glebe-road to the start of the Open Cut near Newtown-road and most of this work is also concreted.

5,013 cubic yards of other than rock have been excavated during the period, making a total of 27,615 cubic yards to date, and 9,735 cubic yards of concrete have been placed in the tunnel and 272 cubic yards in shafts during the period, making a total of 15,310 cubic yards to date.

Open Cut.—This work has now reached Silsoe-street. 7,074 cubic yards of excavation in other than rock have been completed during the period, making a total of 12,307 cubic yards to date. Concreting was begun and 365 cubic yards have been placed.

1,538 lineal feet of monier pipes, 3 feet 6 inches diameter, have been laid.

Total cost during the period, £130,392.

Total cost to date, £370,305.

NEWCASTLE STORMWATER DRAINAGE.

Cottage Creek Stormwater Drainage System.

The acquisition of areas required for the main channel and branches, prior to the transfer of the system to the Hunter District W. S. & S. Board, is still in progress and nearing completion.

Throsby Creek Stormwater Drainage System.

The Enabling Act for this work was passed in April, and the land occupied by the branch channels is now being acquired by resumption.

This work is being carried out from Unemployed Relief Grants. The main channel was completed prior to 30th June, 1930, and progress has been made on the following branches during the past twelve months.

Adamstown Branch.—Completed.

During the period, 552 cubic yards were excavated in other than rock in Open Cut, and 1,124 cubic yards of concrete placed. Structures to carry traffic over the channel were completed in Victoria-street Case-street, Wood-street, and Fletcher-street.

Murray-street Sub-branch.—This branch is practically complete to Moir-street. During the period 559 cubic yards were excavated in other than rock in Open Cut, and 255 cubic yards of concrete placed. Structures to carry traffic over the channel were completed in Wells-street and Joan-street.

Total cost to date of the above two branches, £5,488.

New Lambton Branch.—Incomplete. During the period, 863 cubic yards were excavated in Open Cut and 586 cubic yards of concrete placed. Structures to carry traffic over the channel were completed in Bridges-street, Royal-street, and Evescourt-road.

Total cost to date, £3,505.

Hamilton Branch.—This branch is completed from Throsby Creek to the Railway propeition Brown-street. Reconstruction of the drain across the Railway property is being undertaken by the Railway Commissioners. This portion is incomplete. From the Railway to Bedford-street the drain is practically completed. Excavation work has been progressing in Myer Park.

During the period, 10,639 cubic yards of excavation in other than rock in trench and 2,020 cubic yards in Open Cut have been taken out and 2,843 cubic yards of concrete placed.

Total cost to date, £23,069.

Victoria-street Branch.—This branch is complete from Throsby Creek to Bridge's-road. During the period 757 cubic yards of excavation in other than rock in trench were taken out, and 336 lineal feet of 4 feet 6 inch diameter monier pipes placed.

Total cost to date, £2,526.

Lambton Branch.—During the period, 3,190 cubic yards were excavated in O.T.R. and 194 cubic yards of concrete placed.

Total cost to date, £2,930.

Myer Park.—During the period, 7,435 cubic yards of other than rock have been filled in.

Total cost to date, £1,317.

Lewis-street Bridge.—The work of adding two spans in concrete to the southern end of the existing bridge in connection with the widening of Throsby Creek was carried out at a cost of £2,553 to 30th June, 1931.

Street Construction in extension of Hannell-street.—Six chains of road from Hannell-street bridge over Throsby Creek to Elizabeth-street, Wickham, have been constructed at a cost of £376 to 30th June, 1931.

Wallsend Plattsburg Stormwater Drain.

Unemployed Relief Grants £5,000 and £6,600.—This work is completed from Tyrrell-street to about 300 feet downstream of Boscowen-street.

During the period, 7,496 cubic yards of other than rock and 284 cubic yards of rock were excavated, 382 cubic yards of concrete demolished and 804 cubic yards of concrete placed.

Structures to carry traffic over the channel were widened and completed in Tyrrell-street, Nelson-street, and Boscowen-street.

Total cost to date, £5,958.

Cardiff Stormwater Drain.

Unemployed Relief Grant £8,500.—Resumptions have been made from the various property owners for channel and access thereto.

707 cubic yards of other than rock in Open Cut were excavated during the period.

Total cost to date, £318.

Greta Stormwater Drain.

Unemployed Relief Grant £3,000.—Easements have been obtained from the property owners along the line of the channel, rights of access being included.

120 cubic yards of other than rock in Open Cut were excavated during the period.

Total cost to date, £406.

Cessnock Flood Prevention.

Survey and estimates are under consideration.

Carrington Sewerage.

The marking is completed. Four pumping-station sites are required. The line of a rising main connecting with the Newcastle Main Amplification Sewer at Mayfield has been marked and levelled. The revised survey is nearing completion.

Stockton Sewerage.

One section of this scheme has been set out and sections taken for construction purposes.

Wallsend Sewerage.

Preliminary surveys for an amended scheme embodying two local pumping stations, treatment works &c. have been carried out in connection with the estimates of cost.

Cessnock Sewerage.

During the period, 90,000 feet of 6-inch earthenware pipes, 11,400 feet of 9-inch earthenware pipes, 8,200 feet of 12-inch earthenware pipes, 3,100 feet of 15-inch concrete pipes, 2,600 feet of 18-inch earthenware and concrete pipes, 5,079 feet of 21-inch concrete pipes and 2,898 feet of 30-inch concrete pipes were laid, the total length of sewer laid being 23 miles 1,837 feet. 532 manholes have been constructed. The pump well and building have been completed, and electrically driven pumps in two units each with a capacity of 45,000 g.p.h. are being installed.

Excavation work at the treatment works was commenced. 1,000 cubic yards of earth had been excavated at the end of the period.

Total cost to date, £125,689.

Maitland Sewerage.

An amended design is being prepared in Newcastle Office, with shallower depths of excavation at the pumping stations, at West Maitland, their number being thus increased.

Morriset Mental Hospital Sewerage.

An amplification has been set out, &c., and contour survey extended.

(b) COUNTRY TOWNS SEWERAGE AND STORMWATER CHANNELS.**I. WORKS COMPLETED.**

Bathurst.—This work was carried out by day labour and consisted in low-level reticulation, pumping station, rising main and the conversion of the treatment works from the septic tank system to activated sludge. Two low-level pumping units each with a capacity of 12,000 g.p.h. were installed, also at the treatment works two effluent pumps each with a capacity of 21,000 g.p.h. and two sludge pumps each with a capacity of 6,000 g.p.h. all electrically driven, the total cost being £38,532 at 30th June, 1931.

Forbes.—A complete scheme for the town consisting of two low-level pumping stations with electrically driven pumps of 15,000 and 9,000 g.p.h. capacity respectively, treatment works and reticulation was completed at a cost of £70,129 4s. 8d. to 30th June, 1931.

Lismore.—The reticulation of North and South Lismore was carried out under contract by the State Monier Pipe Works at a cost of £27,377.

Orange.—Extensions of the reticulation to Bletchington, Warrendine, Endsleigh, Glenroy, and to the Mental Hospital were completed by day labour at a cost of £17,576 to 30th June, 1931.

Wagga.—Extensions to the reticulation in Nos. 3 and 4 Districts, two ejector stations and a pump station were carried out by contract by the State Monier Pipe Works. New machinery was installed in No. 1 pump station. The total cost was £23,115 to 30th June, 1931.

II.—WORKS UNDER CONSTRUCTION.

Goulburn.—The reticulation extensions to Garfield are under construction by day labour.

Lismore.—Two additional pumping stations for the North and South Lismore Sewerage and Treatment Works to deal with the whole of the sewage of Lismore are being carried out under contract by the State Monier Pipe Works.

Mudgee.—A complete scheme is in course of construction by day labour for the town, consisting of pumping station, rising main, reticulation and treatment works.

Parkes.—A complete scheme, consisting of sewers, pump station, rising main, and treatment works, was commenced by day labour.

Goulburn.—The old septic tank system of treatment is being converted into that of sedimentation with separate sludge digestion, and a Patterson chlorination plant is being installed.

III.—WATER SUPPLY AND SEWERAGE.*Treatment, Purification and General Investigation.*

Water Supply.—The construction of the filtration plants at Glen Innes, Lake Cargelligo, Wellington and Orange was completed, and the plants put into operation. In each case the concrete construction was carried out by the State Monier Pipe and Reinforced Concrete Works, the mechanical equipment being supplied by the Filtration and Water Softening Co., of Melbourne. All these plants have now been in operation for some months, and have yielded very satisfactory results.

At Jugiong the filter installation has been completed, and is ready for testing as soon as the pumping plant can be started.

Designs and specifications were prepared, and tenders let for the construction of a filtration plant for the Tenterfield Water Supply. The plant has a capacity of some 20,000 g.p.h., and will be ready for operation in July.

Inspections of the catchment areas of the proposed water supply schemes for Manilla, Barraba, Nowra, and Moruya were made in conjunction with officers of the Health Department, and reports furnished on the quality and treatment of the water and the areas to be declared a catchment district.

Regular inspections have been made of the treatment plants in operation at Singleton and Bowral and samples taken for bacteriological and chemical analysis.

A report was made on the Broken Hill filter plant, and plans prepared for remodelling the plant to increase its capacity and efficiency.

Sewerage.—Investigations were made, and reports are in preparation for sewerage schemes for the towns of Casino, Leeton, and Griffith.

At Katoomba the augmentation scheme was revised, and a report and estimate furnished on an amended scheme.

A general design was completed for the Parkes treatment works, and an investigation made and designs prepared for a combined scheme of treatment for the proposed mental hospitals at Morisset.

At Bathurst the remodelling of the old works has been completed, and the Dorr clarifier and Simplex aeration plant have been started up, and have to date yielded satisfactory results.

The chlorinator plant at Dubbo has also been tested and put into operation.

At Forbes the treatment plant has been completed, and is ready for operation as soon as the house connections are started.

At Mudgee the treatment works site has been bored and surveyed, and a general design for the works on the sedimentation, with separate sludge digestion, is in hand.

Designs and estimates have been made for sewage installations for the following hospitals and public buildings :—

Morisset Mental Hospital, Morisset Mental Defectives Home, Lake Cargelligo Hospital, Bingara, Corowa, Nyngan, Collarenebri, Berrima, Griffith Public School.

Reports and advice *re* methods of operation, &c., have also been given with regard to the sewerage installations at the following :—

Glen Innes Hospital, Stockton Mental Hospital, Yarrangobilly Caves House, Scheyville Training Farm and La Perouse Aborigines Camp.

The sewage treatment works at Orange, Bathurst, Lithgow, Goulburn, Hay, Narrandera, Wagga, Albury, Katoomba, Tamworth and Dubbo have been visited regularly by the Departmental Inspector, the effluents tested and samples forwarded for analyses to the Health Department and advice tendered the Councils generally *re* the management of the plants.

HERBERT FLEMING, M.I.E.Aust.,
Chief Engineer for Water Supply and Sewerage.

Harbours, Roads, and Bridges Branch.

Annual Report, 1930-31.

TOTAL EXPENDITURE.

The total expenditure on construction and maintenance of harbour works, dredging, roads, bridges, ferries, public watering-places, &c., amounted to £708,706 (including £273,991 from Unemployment Relief Funds) as detailed hereunder:—

	£
Harbour works (including dredging)	272,957
Roads	334,219
Bridges	54,402
Punts and Ferries	15,120
Public watering-places	32,008
	<hr/>
	£708,706

LOCAL GOVERNMENT INQUIRIES.

Local Government inquiries totalling 27 were conducted by officers of the Branch for the Department of Local Government, including 24 applications from councils for loans totalling £437,123.

INSPECTIONS FOR WATER RIGHTS.

Inspections in connection with water right applications and the supervision of shallow bores in the Western Division were again carried out on behalf of the Water Conservation and Irrigation Commission.

SERVICES ON BEHALF OF OTHER DEPARTMENTS.

During the period under review the Chief Engineer for Local Government reported upon all applications of Shire and Municipal Councils for unemployment relief grants and advances, making inspections where necessary.

Allocations for works were made to Councils throughout the State, and District Engineers submitted reports on these works for the information of the Chief Engineer.

District Engineers under the control of this Branch supervised road work on behalf of the Lands Department and various park trusts.

Maintenance of jetty appurtenances was carried out on behalf of the Navigation Department.

HARBOUR WORKS.

The major improvement works at Port Kembla, Newcastle, and Coff's Harbour were continued by day labour.

Particulars of these works are detailed later. During the year, the following larger repairs and extensions were carried out:—

Tweed River	Repairs to training walls.
Byron Bay	Maintenance and repairs to new jetty and moorings.
Richmond River	Repairs to southern breakwater and construction of new crane wharf at Riley's Hill Dock.
Clarence River	Completion of Ashby Dock enlargement.
Woolgoolga Jetty	General repairs to existing jetty and moorings.
Coff's Harbour	General repairs to existing jetty and moorings.
Macleay River	Repairs to training wall.
Newcastle Harbour	Repairs to King's Wharf.
Port Kembla	The levelling of areas to be used as factory sites and marshalling yards together with the construction of a road to No. 4 jetty and subway to No. 1 jetty, were carried out from Unemployment Relief Funds.

Owing to the limited funds available rationing which was in force on certain works during last year was introduced on all day labour works in the year under review in order to distribute employment as far as possible.

DREDGING.

Of the new dredging plant under construction at the end of year 1929-30 the following was completed and placed in commission during the year:—

New 14-inch suction bar hopper-dredge "Hermes."

The following new dredging plant was still under construction at the end of the year:—

New steel single-screw bucket dredge "Pluto."

Conversion of dredge "Tempe" to all-electric.

The quantity of material lifted during the year totalled 3,412,049 tons at a cost of 9.55d. per ton as compared with 12.57d. for the previous year. The reduction in cost has been mainly due to the limited funds restricting all but absolutely essential overhauls. Particulars of bars and crossings at the various river entrances are shown on Statement "D."

RIVER ENTRANCES.

During the year, most of the river entrances were visited by bar dredges and were maintained at a fairly satisfactory depth in view of the time dredges were available at each port.

GENERAL MAINTENANCE.

The expenditure (excluding dredging and major construction works separately referred to) on the maintenance of the various harbour and river works and ocean jetties amounted to £17,153 1s. 11d.

DOCKS.

The transactions of the docks at the Tweed, Richmond, Clarence, and Manning Rivers are detailed in Statement "E." Cundle Dock on the Manning River was handed over to the Main Roads Board during the year.

HYDROGRAPHIC SURVEYS.

Re-surveys of Botany Bay, Coff's Harbour, Port Kembla, Port Macquarie, and Nambucca River (part) were carried out during the year.

Dredging Surveys were also carried out in the various districts.

INLAND RIVERS.

Snagging operations on the Murray and Darling Rivers were carried out during the year at a total cost of £576 7s. of which £543 0s. 10d. was expended from Federal Unemployment Relief Funds.

BOURKE LOCK AND WEIR.

The expenditure on maintenance and repairs amounted to £173 12s. 7d. on lock and weir and £105 4s. 8d. on wharf.

No shipping was recorded during the year.

SWAMP DRAINAGE.

Twenty-six trusts and twenty-six unions were in operation at the close of the year, Terranora Swamp Drainage Trust having been dissolved after fully discharging its liability to the Crown. During the year, the following unions were constituted:—

Oxley Island, North Oxley Island, Marriott (Macleay River), and Calliope (Clarence River).

The drains and other works of the North Coast Trusts have been maintained in a satisfactory condition and although heavy rains were experienced at the beginning of the latter half of the year, very little damage, if any, has been suffered.

TWEED RIVER.

Repairs to southern training wall were carried out from Unemployment Relief Funds at a cost of £751 8s.

BYRON BAY.

General maintenance and repairs to jetty and moorings were carried out during the year at a cost of £371 0s. 7d.

During the year the stern mooring was removed.

RICHMOND RIVER.

The construction of a new wharf at Riley's Hill for 10-ton crane was completed, the expenditure during the year being £774 19s. 7d. and the completed cost amounting to £1,879 9s. 9d.

Repairs were carried out to the southern breakwater costing £2,416 6s. 2d., and to the northern training wall costing £388 7s. 4d., the total cost of £2,804 13s. 6d. being met from Unemployment Relief Funds.

CLARENCE RIVER.

The 30-feet extension of Ashby Dock was completed, the expenditure for the year under review amounting to £476 7s. 8d., bringing the total expenditure on this extension to £1,120 13s. 6d.

WOOLGOOLGA JETTY.

The expenditure on the maintenance of the jetty amounted to £1,028 1s. 3d., and included the renewal of piles, capwales, girders and decking, and repairs to fenders.

Buoys and moorings were also overhauled and defective cables replaced.

COFF'S HARBOUR.

The construction works in connection with the eastern breakwater were continued throughout the year.

Construction expenditure	...	...	...	...	...	...	...	£30,025 10s. 10d.
Tonnage of stone quarried	...	...	...	...	...	...	...	47,383 tons.

Eastern Breakwater.—Extended 138 feet to chainage 650 feet. A heavy gale during February, 1931, damaged the wall to some extent, but damage was repaired and satisfactory progress made during the year on the limited funds available. During the year, 15,015 tons of stone were deposited, costing £5,911 13s. 11d., making a total of 167,937 tons at a total cost of £113,254 4s. 7d. and unit cost of 13/5·86 per ton.

Concrete Work.—The construction of 40-ton concrete blocks was continued; 576 blocks were tipped on the sea side and centre of breakwater at a cost of £12,842 3s. 2d. 1,130 tons of concrete were placed on top and centre of the wall costing £481 7s. 11d. The total expenditure on the eastern breakwater to 30th June, 1931, amounted to £171,568 12s.

The total expenditure on these works including all charges, amounted during the year to £30,890 1s. 7d.

Coff's Harbour Jetty.—The expenditure during the year for maintenance of and renewal of piles, girders, decking and fenders amounted to £1,060 18s. 1d.

Buoys and moorings were overhauled and defective cables replaced.

Rail tracks were renewed and ballasted at a cost of £591 13s. 5d., this amount being provided from Unemployment Relief Funds.

Sand Drift Prevention.—The reclamation of the beach adjoining the northern breakwater was continued with a view to the prevention of sand drift, 10,599 tons of spoil being deposited.

MACLEAY RIVER.

A contract let during the previous year for repairs to training walls was completed, expenditure during the year under review amounting to £469 3s. 6d.

In addition an amount of £260 8s. 10d. was expended on repairs carried out by day labour.

Further repairs were carried out during the year from Unemployment Relief Funds at a cost £1,793 17s. 6d.

CAMDEN HAVEN.

A contract for repairs to the training wall was let during the year and completed at a cost of £80.

NEWCASTLE.

Submarine Rock Excavation.—The dredges "Minmi" and "Juno" removed 1,883 cubic yards of rock from the bar during the year. As a direct result of these operations, it was possible at the close of the year to declare open a channel 500 feet wide by 25 ft. 6 in. minimum depth between the line of leading marks and the northern breakwater. This depth represents an increase of 2 feet over the former declared minimum depth of 23 ft. 6 in.

The rock drills "Digger" and "Vulcan" were laid up at the end of the preceding year, and the rock-breaker "Cyclops," on loan from Sydney Harbour Trust, continued operations on the bar throughout the year when weather conditions permitted. At the end of the year, it was estimated that about 6,000 cubic yards of rock had been broken and was awaiting dredging.

King's Wharf.—4,000 cubic yards of rock were removed by the dredge "Juno," following on the operations of the rockbreaker "Cyclops." This work was undertaken by the "Cyclops" at such times as weather conditions on the bar were unfavourable.

Newcastle Ferry Wharf.—1,187 cubic yards of rock were broken by the "Cyclops," and removed by dredge "Minmi" from the approach to this wharf. This work was also carried out by the "Cyclops" when weather conditions on the bar were unfavourable.

Removal of Tomago Rocks.—3,732 cubic yards of rock drilled and blasted during the preceding year were removed from the river channel at Tomago at a cost of £1,121 6s. 8d. The total quantity removed to date is 10,537 cubic yards at a cost of £13,810 0s. 2d. These operations were suspended during the year owing to insufficient funds.

Hexham Barrage.—The construction of this barrage in connection with the closing of the South Arm of the Hunter River was continued during the year, and was carried out to local low-water level; 9,140 tons of rock, lifted from the Tomago operations, were placed during the year, making a total of 18,410 tons placed at a cost of £8,312 5s. 6d. At this stage, operations were terminated for the time being.

Floating Dock.—Dredging the floating dock site and approach channel was continued during the year, 30,200 tons of silt being lifted, bringing the total tonnage dredged to 30th June, 1931, to 2,667,874 tons.

Dredging.—The summary of the year's operations in Newcastle Harbour is as follows:—

Description.	Tons.
Harbour improvements and maintenance	1,692,610
Reclamation	63,890
River dredging	134,733
Total tonnage	1,891,233
Cost	£ s. d. 51,547 2 11

(Tonnage lifted includes submarine rock excavation, but excludes dredging floating dock site and approach channel referred to above.)

Lee Wharf Extension.—Construction of road and rail access to the Lee Wharf Wheat Shed was nearing completion at the end of the year, the expenditure during the year being £1,434 0s. 1d.

King's Wharf.—Extensive repairs to Nos. 4 and 5 berths, King's Wharf, were carried out during the year, the cost amounting to £2,090.

General.—Minor repairs were also carried out to Stockton Ferry Wharf and various other wharves and plant within the harbour. Total expenditure on harbour maintenance amounted to £6,853 3s. 10d.

UNEMPLOYED RELIEF WORKS.

Wallis Creek.—Repairs to flood bank were completed, and repairs to Wallis Creek floodgates were in hand at the end of the year. Expenditure during the year on these works amounted to £617 16s. 8d.

Horseshoe Bend-Swiney's Point-West Maitland.—Repairs to bank protection works by stone pitching and construction of new levee bank were commenced, and were still in hand at the close of the year, the expenditure to 30th June amounting to £873 15s. 2d.

HAWKESBURY RIVER AND BRISBANE WATER.

Renewals of beacon piles were carried out in Brisbane Water and Hawkesbury River during the year.

SYDNEY HARBOUR.

Repairs to the training walls along Long Cove Canal were carried out, and mangrove swamps were cleared at Drummoyne and Hen and Chickens Bay. The latter work was carried out from Unemployment Relief Funds at a cost of £53 12s. 1d.

COOK'S RIVER, BOTANY BAY AND GEORGE'S RIVER.

Extensive borings in George's River were carried out on behalf of the Metropolitan Water, Sewerage and Drainage Board. Repairs were carried out to training walls along Cook's River and earth banks were constructed along Cook's River and Shea's Creek for the purpose of retaining dredged material in each locality. Drains leading into Shea's Creek were cleaned out.

The channel in Prospect Creek was deepened and widened by the removal of rock. This work was carried out from Unemployment Relief Funds at a cost of £1,922 7s. 8d. Beacons in George's River were replaced and repaired during the year.

Kurnell Jetty repairs were commenced, and were still in hand at the end of the year.

Removal of rock at the entrance of Cook's River was continued during the year with a view to permanent deepening of the entrance channel.

PORT HACKING.

Extensive borings were continued during the year on behalf of the Metropolitan Water, Sewerage and Drainage Board.

WOLLONGONG HARBOUR.

A new hook-and-eye mooring, set in concrete, was placed, and decking repaired at the Cargo Shed.

Haulage and shipping of coal by the Department ceased in October, 1930, the Departmental facilities being leased from that date.

Including haulage and shipping of coal, the total expenditure for the year amounted to £196 1s. 3d.

PORT KEMBLA.

The year's output from the Gillan's Hill Quarry amounted to 101,104 tons, distributed as follows:—

Eastern breakwater construction	...	...	...	...	...	...	33,126 tons.
Eastern breakwater repairs	...	...	...	...	...	...	2,786 "
Northern breakwater repairs	...	...	...	...	...	...	2,452 "
Sea wall	...	...	...	...	...	...	11,760 "
State Metal Quarries	...	...	...	...	...	...	50,898 "
Australian Iron and Steel, Ltd.	...	...	...	...	...	...	82 "
Total	...	...	...	...	...	...	101,104 "

The total output of the quarry since developmental work ceased up to 30th June, 1931, was 206,673 tons, costing £50,953 14s. 5d. at a unit cost of 59·18 pence per ton.

Eastern Breakwater.—Extended 83 feet during the year to chainage 3,131 feet. During the year, 33,126 tons of stone were placed in construction, costing £17,901 2s., and 2,786 tons placed in repairs, costing £1,643 5s. 8d. Total stone tipped to 30th June, 1931, 1,064,382 tons, costing £305,991 15s. 6d.

Northern Breakwater.—During the year 2,452 tons of stone were tipped in repairs, costing £1,157 16s. 3d.

Haulage and Shipment of Coal.—Statements "A," "B," and "C" indicate traffic and shipping details of the port during the year.

Jetties.—No. 1 Jetty: Defective piles, wales, braces and girders were renewed, and the superstructure was treated against white ants at a cost of £902 10s. No. 3 Jetty: Several defective piles were replaced, and general maintenance effected at a cost of £255 13s. 8d. No. 4 Jetty: General maintenance was carried out at a cost of £148 19s. 8d.

Unemployed Relief Works.

Levelling Factory Sites.—An expenditure of £7,497 8s. 6d. was incurred from Unemployment Relief Funds in levelling an area between Tom Thumb Hill and the power-house for use as future factory sites. One hundred men were employed in fortnightly shifts.

Site for Marshalling Yards.—Fifty men were employed in fortnightly shifts in levelling an area for proposed marshalling yards near the base of the northern breakwater. The expenditure from Unemployment Relief Vote amounted to £3,094 13s. 5d.

Road to No. 4 Jetty.—A road 30 chains long was constructed between the jetty owned by Australian Iron and Steel, Ltd., and No. 4 Jetty, at a cost of £1,798 8s.

Subway to No. 1 Jetty.—A timbered subway for access to No. 1 Jetty was constructed under the railway lines at the base of the jetty at a cost of £477 4s. 1d.

Coal Loading and Shipping Undertakings.

During the year the coal loading and shipping charges levied at this port were subject to a rebate of 5½d. per ton on coastal and interstate shipments, and 10½d. per ton on shipments outside the Commonwealth other than New Zealand.

These rebates, which were to take effect from 2nd June, 1930, until 2nd August, 1931, but were subsequently extended to cover a period up to 31st December, 1931, were granted for the purpose of assisting the coal industry and its employees, and with a view to the development of the trade with consumers outside the State.

MORUYA RIVER.

Repairs to the Northern Breakwater and Southern Training Wall were carried out from Unemployment Relief Funds. One thousand nine hundred tons of large stone were placed on the Northern Breakwater and 885 tons on the Southern Wall at a cost of £1,278 9s. 8d.

OTHER PORTS.

At far southern ports, from Kiama to Eden, an amount of £754 8s. 5d. was expended on minor repairs and renewals to jetties and moorings.

WENTWORTH WHARF.

Maintenance and repairs to Wentworth Wharf were effected at a cost of £53 16s. 10d.

UNEMPLOYMENT RELIEF WORKS (HARBOURS AND RIVERS).

During the year a total amount of £25,724 11s. 8d. was expended from Unemployment Relief Funds on various works, including the larger works referred to under the above headings.

In addition, an amount of £543 0s. 10d. from Federal Unemployment Relief Funds was spent on snagging the Darling River.

ROADS.

Formation and surfacing of roads in the Western Division of the State involved an expenditure of £91,661 from the Federal Aid Roads Vote established in 1927, the following work being carried out :—

	Year 1930-31.	Total, inclusive of previous years.
	Miles.	Miles.
Clearing	56	376
Forming	251	541
Ballasting, gravelling, or sand surfacing	44	119
Bridges	4	15

In addition to the foregoing, £13,959 was expended from Revenue Votes in maintaining formed roads in the west.

Including £6,350 granted to municipal councils, £25,100 was expended on minor road works in the Western Division in relief of unemployment, as follows :—

District.	£	£
Bourke	7,282	
Broken Hill	11,433	
Dubbo	3,015	
Hay	3,370	
		25,100

Other expenditure under the heading of " Roads " included Main Roads Grants to Western Division municipalities, totalling £3,150, and £614 from Lands Department funds for Soldiers' Settlement Roads within the Freemantle Estate, Bathurst District; which work was carried to completion at a total cost of £10,646, including Freemantle Bridge, £1,862.

Relief Works.—Under the heading of Relief Works, £138,456 was expended on roads and £90,033 on levelling of Crown Lands and other works, the major undertakings being :—

	£
Centennial Park levelling	7,535
Ku-ring-gai Chase roads	7,315
National Park roads	7,545
Coulston Creek road (Newcastle District)	5,956
Goondah-Burrinjuck-road	5,738
Lidcombe Hospital roads	5,363
Sydney University roads	5,154
Newcastle Central Park (aerodrome levelling)	5,996
Levelling Crown Lands and road construction incidental thereto at Bunnerong, Daceyville, Matraville, Maroubra, and Randwick	98,515

BRIDGES.

Maintenance of existing departmental structures involved an expenditure of £28,341; maintenance and repair work to the extent of £3,917 was carried out for the Main Roads Board; the departmental contribution towards the cost of the combined railway and vehicular bridge over the Clarence River in course of erection by the Railway Department was £12,127 for the year; while new works accounted for £10,017. The expenditure on Unemployment Relief Works included in the foregoing was £6,625.

The new works were as follow :—

Milperra Bridge, over George's River, at Milperra, consisting of one 91 feet composite truss span and five approach spans, three of 30 feet and two of 28 feet, on timber piers, was erected by contractor John Bailey at a total cost of £5,969, of which £2,336 was expended during the year. Funds were provided by the Local Government Department, Bankstown and Liverpool Councils, and Arthur Rickard & Co. Ltd.

Martindale Bridge, over the Goulburn River, at Martindale, a low-level reinforced concrete structure of eight 30 feet spans, was erected by the State Monier Pipe and Reinforced Concrete Works for £6,421, of which £2,020 was expended during the year. In this case funds were provided by Public Works Department, Local Government Department, and Muswellbrook Shire Council.

Freemantle Bridge, within Freemantle Soldiers' Settlement Area, Bathurst District, comprising two 30-feet and two 25-feet timber beam spans on concrete piers and abutments, was carried out by contract with Mr. H. H. Woodward for £1,862. The expenditure for the year was £1,412.

Condobolin Stock Bridge, over Lachlan River, at Condobolin, a low-level structure of three 25-feet spans, was erected by contractor C. O'Brien at a cost of £907. Of this sum £535 was provided by the Department and the balance by the Condobolin Municipal Council, Lachlan Shire Council, and Condobolin Pastures Protection Board.

Bethangra Bridge, Murray River, was carried to completion during the year, full particulars being given under the heading of River Murray Commission expenditure.

Federal Aid Bridges.—Seven minor bridges on Federal Aid Roads were put in hand, the expenditure for the year being £3,342.

Bridge Works Investigated.—

Bonley Creek	...	...	Road, Wilcannia-Menindie. Plans and specifications prepared.
Salt Hole Creek	...	...	Road, Broken Hill-Wompah. Plans and specifications prepared.
Indi Bridge	...	...	Over Murray River, above Bringenbrong. Tenders invited for supply of material, &c., and preparations made for putting work in hand by day labour.

PUBLIC WATERING PLACES.

A sum of £32,008 was expended in furthering the general scheme for improvement of watering facilities in the West. Fourteen new public watering places were established; tanks and drains were cleaned out and extended; windmills and watering appliances installed and cottages erected with a view to attracting good types of tenants. Expenditure on unemployed relief works included in the foregoing was £13,152.

The major improvements were as follow :—

Name.	£
Arumpo Road Euston-Pooncarie : new bore	558
Belarabon Road Mossgiel-Barnato : 18,000 cubic yards tank excavated and fencing provided.	821
Mena Murtee Road Wilcannia-White Cliffs : new bore	411
Campbell's Creek Road Cockburn-Fowler's Gap : new bore	411
Eldee Creek Road Cockburn-Fowler's Gap : new bore	805
Osaca Road Milparinka-Wanaaring : new bore	869
Toulby Gate Road Toulby Gate to Culgoa River : new bore	570
Birrigoolpa Road Milparinka-Wanaaring : new bore in hand	625
Morven Tank Road Balranald-Oxley : cleaning tank and erecting fences	574
Ivanhoe Additional excavated tank	1,489
Horse Lake Cleaning out tank	553
Moora Tank Road Euabalong-Nymagee : 8,000 cubic yard tank excavated.	1,864
Twenty-six Mile Tank Road Ivanhoe-Wilcannia : 8,000 yard tank (in hand)	992
Crown Pine Road Nyngan-Brewarrina : existing tank enlarged	941
Womboin Tank Road Nyngan-Brewarrina : 8,000 yard tank (in hand)	635
Willybingbone Road Nyngan-Brewarrina : 8,000 yard tank (in hand)	648
Bundabulla Road Brewarrina-Goodooga : 8,000 yard tank (in hand)...	1,021
Hospital Creek Road Brewarrina-Goodooga : 8,000 yard tank (in hand)...	1,418

PUNTS AND FERRIES.

The maintenance of punt and ferry services under the control of the Department involved an expenditure of £9,008 in addition to which a sum of £6,112 from Main Roads Board funds was expended by the Department in maintaining similar services on behalf of the Board.

RIVER MURRAY WATERS AGREEMENT.

At a conference of the contracting parties to the River Murray Waters Agreement held in Sydney on 4th February, 1930, the following decision was reached :—

"That only such works at the Hume Reservoir as are essential for a capacity of 1,250,000 acre-feet of water be carried forward continuously to completion, and that construction be then suspended. The question of extension beyond the 1,250,000 acre-feet storage for either irrigation or hydro-electric purposes to be further considered on a date to be mutually agreed upon by a majority of the contracting parties."

The recommendation of the River Murray Commission that two diversion weirs be constructed on the Murrumbidgee River was agreed to by a majority of Ministers. The questions of works on the lower Murray to protect the river from salinity and the matter of allocation of maintenance costs were discussed at the conference and it was decided to refer these three matters to the contracting Governments for consideration and determination as to what action should be taken.

At the Hume Reservoir the temporary spillway section, 480 feet in length, was raised 5 feet to R.L.558 to give a storage of 150,000 acre-feet. The remainder of the spillway section was practically completed to the temporary crest level of R.L.606. The outlet section varies from R.L.598 to R. L.618, the ultimate level for the $1\frac{1}{4}$ million acre-feet capacity being R.L.635.

Concrete placed during the year amounted to 28,518 cubic yards, the total placed to date being 382,845 cubic yards.

The spillway gates contract was completed, twenty lower guide frames were concreted in position and the remainder of the material stored on the works and at the contractors' yards.

The Bethanga Bridge contract was completed and the bridge opened for traffic on 9th August.

Work on the road deviations was re-commenced and the Wagga-road to Mullengandra section was about two-thirds completed.

In order to avoid dismissals a rationing scheme was adopted under which each man loses one week in four.

Work on Lock No. 15 construction and lock site surveys is still held up due to lack of funds.

The expenditure by the department from the River Murray Commission funds was £141,020 for the year making a total to date of £2,984,903.

A detailed report of the operations of this department as Constructing Authority for New South Wales for the year, ended 30th June, 1931, is printed at the end of this report, Appendix "A."

R. VOWELL, M.Inst.C.E., M.I.E.A.

Chief Engineer for Harbours Roads and
Bridges, and National and Local
Government Works.

Chief Engineer for New South Wales,
River Murray Waters Act.

12th October, 1931.

APPENDIX A.

RIVER MURRAY WATERS ACT.

ANNUAL REPORT FOR YEAR ENDED 30TH JUNE, 1930-1931.

A.—Hume Reservoir.

1. Investigation and Designs.
2. Land Acquisition.
3. Construction.
 - (a) Road of Access.
 - (b) Quarry.
 - (c) Plant.
 - (d) Gravel.
 - (e) Concrete.
 - (f) Outlet Works.
 - (g) Condition of Stored Water.
 - (h) Release of Stored Water.
 - (i) Spillway Gates.
 - (j) Bethanga Bridge.
 - (k) Road Deviations.
 - (l) Supply of Electricity to Victoria.
 - (m) General.

B.—Locks and Weirs.

- (i) Surveys and Borings.
- (ii) Lock and Weir No. 10 Wentworth.
- (iii) Lock and Weir No. 15—Euston.

A. HUME RESERVOIR.

(1) Investigations and Designs.

Following a decision to construct the reservoir to 1½ million acre-feet capacity, consideration was given to the form of the crest of the spillway for that storage; the River Murray Commission approved of the proposal submitted. Preliminary consideration was given by the gauging staff of the Water Conservation and Irrigation Commission of New South Wales and the State Rivers and Water Supply Commission of Victoria to the question of the systematic recording of siltation in the storage basin.

(2) Land Acquisitions.

The land resumed amounted to 481 acres making a total area of 11,193 acres resumed to date.

(3) Construction.

(a) Road of Access.—Maintenance has been carried out as required.

(b) Quarry.—The output for the year was 3,957 cubic yards consisting mainly of 1,546 cubic yards of spalls and 2,326 cubic yards of plums for use in the Main wall. The crushed metal used for concrete, viz., 5,504 cubic yards was all obtained from the reserve dump.

(c) Plant.—A new belt was installed at the New South Wales end of the conveyor and the old belt transferred to the Victorian end replacing the original one now worn out.

On 19th August, 1930, the Bucyrus dragline excavator recently used for loading gravel from the river bed was placed out of commission.

(d) Gravel.—Due to a rise in the river, gravel winning operations ceased on 19th August. The output was 25,077 cubic yards. Since then supplies for concrete have been drawn from the reserve dump.

(e) Concrete.—The North Wing wall is at R.L. 614 to R.L. 618 with the exception of a gap left for the belt conveyor. The outlet section—290 feet long—varies from R.L. 598 to R.L. 618.

The temporary spillway section—480 feet long—was raised from R.L. 553 to R.L. 558 to give a storage of 150,000 acre-feet.

At the southern end of spillway the levels of a portion of the wall 232 feet in length vary from R.L. 590 to R.L. 606, the South Wing wall is at R.L. 638.

The roof has been constructed over the three hydro-electric valves and the stairway down the face of the North Wing wall and the Main wall has been completed with the exception of the handrail.

The core wall directly behind the North Wing wall was brought to R.L. 618.

Concrete was placed as follows :—

	c. yds.
Main wall.....	23,950
North Wing wall	4,290
South Wing wall	3
Core wall	109
Valve houses	158
Stairways	8
	<hr/> 28,518

Total placed to date—382,845 cubic yards.

(f) Outlet Works.—All valves and sluices were in operation during various times in the year. The winches for operating the stoney sluices are in temporary positions over the wells.

All valves were operated throughout full range at intervals not exceeding four weeks.

(g) Condition of Stored Water.—A recurrence of the algae trouble was experienced during the Summer, but the water was not so badly infected as in the previous year.

11 tons 4 cwt. 2 qrs. of copper sulphate were dissolved in the reservoir, and this combined with heavy rains effectively cleared the infection.

(h) Release of Stored Water.—The discharge of water was regulated to suit the needs of the Water Conservation and Irrigation Commission of New South Wales, and the State Rivers and Water Supply Commission of Victoria.

During the latter part of the year the valves were kept fully open to assist in discharging the flood waters in the reservoir.

(i) *Spillway Gates*.—The Contractors have delivered the whole of the material for the Spillway gates contract with the exception of seven gates stored at the Contractor's Works at the request of the State Rivers and Water Supply Commission.

Twenty lower guide frames have been concreted in and passed by the Contractor's representative.

Pending use, the remainder of the material has been carefully stored in the workmen's barracks and recreation sheds.

(j) *Bethanga Bridge*.—The bridge was completed and opened for traffic on the 9th August, the temporary ferry service being discontinued.

The approach road through Heywood's paddock and along the old quarry tramline has been constructed and is being maintained.

(k) *Road Deviations*.—Work on road deviations was recommenced in October, 1930, and the position at 30th June 1931, was as follows:—

Wagga Road to Mullenjandra.—Total length, 1,048 chains.

Clearing	1,048 chains completed.
Fencing	997 chains completed.
	410 chains partially completed.
Metalling	314 chains completed.
Gravelling	262 chains of first coat spread and rolled.
Culverts	All completed.
Bridges.....	At 8 mile, Bowna and Table Top Creeks completed and at Mullenjandra Creek all piles driven, girders and corbels placed and four spans of decking completed.

The whole of the work has been delayed by the continuous wet weather.

Mullenjandra to Cumberoona.—A line has been surveyed and plans prepared. Work has not yet been commenced on the section.

(l) *Supply of Electricity to Victoria*.—Current for power and lighting was first supplied to the Victorian Works on 9th September, 1930, and the system has operated satisfactorily ever since. Direct current at 500 and 230 volts is supplied.

(m) *General—Gauging Station*.—On the gauging site in Heywood's paddock about 1 mile below the weir, a cableway was erected. Later the Victorian anchorage of this cableway was raised 9 feet to give greater clearance above flood waters.

Rationing of Labour.—With the completion of gravel winning operations in August, 1930, there was a surplus of labour and in order to avoid dismissals a rationing scheme was adopted under which each man loses one week in four.

The average number of men employed was 258; the health of the community has been good throughout.

Floods.—During June very heavy floods occurred, the maximum discharge registered at Heywood's gauge being 51,000 cusecs. On 21st October, the reservoir reached its maximum height for the 1930 winter of R.L. 553 ft. 7 in., and on 27th June, 1931, during the flood period the reservoir reached a height of R.L. 568 ft. 9 in. or 10 ft. 9 in. over the temporary spillway.

B. LOCKS AND WEIRS.

(1) *Surveys and Borings*.—

(a) *Murray River*.—No work was carried out during the year under review.

(b) *Murrumbidgee River*.—A flying survey for a modified scheme of weirs on the Murrumbidgee was carried out by the Water Conservation and Irrigation Commission, and a scheme was submitted by this Authority for the consideration of the River Murray Commission.

(2) *Lock and Weir No. 10 at Wentworth*.—Eight hundred tons of steel sheet piling were sold to the South Australian Government, and minor sales of plant and buildings made.

The Lock Regulations were gazetted.

The Lock was operated 175 times for the passage of 108 steamers towing 102 barges, the remainder being for small boats.

The traffic return shows:—

2,347 tons of wool.
19 tons of fruit.
3,653 tons of general.
2,826 tons of construction material.
381 passengers.

(3) *Lock and Weir No. 15 at Euston*.—All plant and buildings have been maintained in good order. All plant was transferred from low-lying to high ground to escape the floods.

A derrick boat was transferred from No. 10 Lock to assist in the transfer of this plant.

(Sgd.) R. VOWELL, M.Inst. C.E.,
Chief Engineer for New South Wales
River Murray Waters Act,
12th August, 1931.

ANNUAL REPORT—PORT KEMBLA DISTRICT, 1930-31.

Port Kembla Traffic and Shipping Returns.

STATEMENT A.

<i>Coal and Coke Shipped at Port Kembla.</i>		Tons.
Cargo coal		63,965
Cargo coke		50,396
Bunker coal		92,167
Total (all Jetties, including A.I. and S. Jetty.)		206,528

Traffic (Other than for Shipment).

	tons.	cwt.	grs.
Inwards haulage	36 078	19	1
Outwards haulage	66,158	18	3
Total	102,237	18	0

SUMMARY OF ACCOUNTS ISSUED.

STATEMENT B.

Port Kembla Shipping.

	£	s.	d.	£	s.	d.
Shipping— Cargo	3,583	7	6			
„ Bunkers	3,614	14	1			
Berthing	1,353	11	3			
Mooring ropes	340	5	11			
Launch services	595	5	0			
Gangways	109	0	0			
Anchorage	4	5	0			
Haulage, waggon hire, loco. hire, &c.	1,656	11	4			
Electric crane—5 ton	440	10	0			
„ 2 ton	244	17	7			
Way leave	199	8	9			
Waiting time	35	17	6			
Sale of old belting	60	15	0			
Sale of water	251	5	0			
Telephone calls	4	6	8			
Miscellaneous revenue	19	18	11			
Recoupment by Treasury of rebate allowed on shipping	5,156	7	2			
				17,670	6	8
<i>Navigation Department—</i>						
Harbour dues	5,441	19	1			
Tonnage rates	2,770	14	9			
				8,212	13	10
<i>Port Kembla Electricity Undertaking—</i>						
Southern line	20,113	3	8			
Western line	25,439	0	9			
Local line	15,420	8	5			
Gerringong township	484	17	0			
Rents receivable	240	1	7			
Miscellaneous	419	13	0			
Motor vehicles	210	16	10			
				62,328	1	3
<i>Resumed Properties Department—</i>						
Rent of cottages	794	8	0			
Rent of land	1,435	17	0			
Camping area	39	18	5			
Sanitary fees	40	17	4			
				2,311	0	9
<i>Port Kembla Harbour Improvements—</i>						
Sale of spalls	5,163	0	5			
Outside services	429	12	5			
				5,592	12	10
<i>Wollongong Shipping—</i>						
Shipping coal	67	11	6			
Coal in bin	81	3	5			
				148	14	11
<i>Stock</i>				2,350	13	1
<i>Miscellaneous Votes—</i>						
Boat fees	15	15	0			
Miscellaneous services	48	4	4			
Sundries	25	0	3			
				88	19	7
Total				£98,703	2	11

STATEMENT C.

PORT KEMBLA.
Trade and Shipping Returns, 1930-1931.

Vessels entering Port Kembla.	Arrivals.	Registered Tonnage.
Overseas	96	325,248
Coastal	128	24,752
Interstate	151	186,650
Total	375	536,650

Principal Exports.

Item.	Tonnage.	Value.
		£
Cargo coal	63,965	63,965
Bunker coal	92,167	92,167
Coke	50,396	50,396
Copper	7,415	348,505
Bluestone	282	9,235
Slag .....	.....	.....
Fertilisers	32,178	113,775
Fluxes, &c. ....	.....	.....
Manufactured metals	3,231	313,064
Finished products of iron and steel	21,768	129,699
Total	271,402	1,120,806
	266,878	
	64,574	

Principal Imports.

Blister copper	11,010	517,470
Ore	1,002	5,010
Concentrates	642	8,988
Matte	1,140	15,675
Phosphate rock	19,935	44,875
Sulphur	4,290	24,438
Pyrites .....	.....	.....
Fertiliser (by rail)	418	3,823
Bags and packing materials by rail	500	14,060
Lead	331	6,262
Other metals	202	13,137
Serap copper	343	17,836
Slimes	164	31,488
Iron ore	187,055	158,314
Total	227,032	861,376

Financial Statement.

Item.	Revenue.			Expenditure.		
	£	s.	d.	£	s.	d.
Haulage and shipment.....	17,670	6	8	(a) 20,367	15	7
Electricity supply	62,117	4	5	(b) 84,073	15	9
Total	£ 79,787	11	1	104,441	11	4

(a) Haulage and Shipment.—Interest on capital debt provided for since and including 1928-29.

(b) Electricity Supply.—Initial provision for contribution to Capital Assets Renewal made in year 1929-30. Interest on capital debt provided for since and including 1928-29.

STATEMENT D.

PARTICULARS OF RIVER ENTRANCES OF NEW SOUTH WALES.

1930-31.

Name of Port.	Depth on Bar prior to commencement of work. Position variable.	Sailing distance from Sydney.	Total length of River.	Limit of Navigation for Boats drawing 4 feet.	Catchment Area of River.	Area of Tidal Compartment.	Proposed width of River Entrance between Break-water.	Depths during the year 1930-31 at Low Water Spring Tides.						Anticipated Depth on Completion of Scheme.	
								Maximum.		Average.		Minimum.			
								Bar.	Cross-ing.	Bar.	Cross-ing.	Bar.	Cross-ing.		
	ft. in.	Sea mls.	St. mls.	St. mls.	Sq. mls.	Acres.	Sq. mls.	ft.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft.
Tweed	3 0	372	46	24	418	5,000	8	500	8 6	10 9	6 4	9 8½	3 7a	8 4	9
Richmond	7 0	328	149	68	2,683	6,800	10½	1,000	12 0	11 0	10 0½	10 7	6 0b	9 6	12
Clarence	8 0	294	247	67	8,505	34,000	53	1,400	12 0	12 0	10 9	10 8	9 0	9 6	18
Bellinger	3 9	228	76	15	479	1,640	2½	500	7 3	7 3	4 7	4 3½	1 9c	2 9i	9
Nambucca	4 9	219	58	9	552	2,730	4½	500	7 0	5 0	6 2	4 8	3 9d	4 0	9
Macleay	5 0	208	214	39	4,581	3,550	6	700	7 9	8 0	7 0	8 0	5 9	8 0	12
Hastings	5 0	172½	110	19	1,389	6,400	10	650	10 0	9 9	8 10	8 4½	6 9	7 0	10
Camden Haven	4 6	159½	18	13	238	7,240	11½	400	7 9	8 0	6 5½	7 1½	4 3e	6 0	8
Manning	8 0	141	141	29	3,164	6,800	10½	800	7 0	8 6	5 10	8 6	4 0	8 6	12
Cape Hawke ...	2 3	125	46	17	514	21,930	34½	400	6 0	9 0	4 2	8 1	2 0f	6 0j	9
Lake Macquarie	...	50	...	...	291	26,000	40½	...	5 3	5 9	4 5	4 3	3 8	3 8	...
Crookhaven (in- cluding Shoal- haven River).	11 0	71	205	22	2,801	2,808 6,533	4½ 10½	...	13 6	8 6	13 6	8 6	13 6	8 6	12
Bateman's Bay	4 0	129	70	24	696	3,750	6	...	10 6	...	7 11½	...	6 0g	...	10
Moruya	6 0	139	93	4	609	1,550	2½	...	9 3	10 0	8 6	7 4	6 0h	2 6k	9
Wagonga .....	...	158	9	5	52	1,650	2½	340	7 6	7 0	5 9	6 11	4 0	6 0	10

a—Tweed River, Minimum bar, 1 day only.
 i—Richmond " " " 1 " "
 c—Bellinger " " " 1 " "
 d—Nambucca " " " 1 " "
 e—Camden Haven " " " 1 " "
 f—Cape Hawke, " " " 1 " "
 g—Bateman's Bay " " " 1 " "
 h—Moruya. " " " 1 " "

i—Bellinger River, Minimum crossing, 1 day only.
 j—Cape Hawke " " " 4 days "
 k—Moruya " " " 1 day "

STATEMENT E.

DOCK TRANSACTIONS.

Year ending 30th June, 1931.

	Terranora Dock, Tweed River.	Riley's Hill Dock, Richmond River.	Ashby Dock, Clarence River.	Cundle Dock,* Manning River.
No. of Government vessels docked	Nil.	9	7	Nil.
Tonnage of Government vessels docked	Nil.	341	746	Nil.
No. of private vessels docked	7	Nil.	1	1
Tonnage of private vessels docked	391	Nil.	92	63
Revenue received during year	£74 11s. 3d.	Nil.	£20 14s. 0d.	£9 8s. 6d.
Expenditure, docking private vessels	£33 7s. 4d.	Nil.	£19 12s. 11d.	£49 12s. 5d.
Cost—Dock maintenance and repairs	£150 6s. 0d.	£312 9s. 8d.	£522 9s. 4d.	£76 3s. 7d.

* The control of Cundle Dock was handed over to the Main Roads Board on 14th October, 1930.

Electrical Engineering Branch.

Annual Report, 1930-31.

I. INTRODUCTION.

The Branch's work falls into four main groups:—

1. Hydro-electric investigations.
2. Construction, operation and maintenance of the Burrinjuck Hydro-electric System.
3. Construction, operation and maintenance of the Port Kembla Electricity Supply System.
4. Electrical engineering assistance to other Departments and other Branches of this Department.

II. HYDRO-ELECTRIC INVESTIGATIONS.

No field work was carried out during the year, but further investigation of various proposals, more particularly in connection with Burrinjuck, was completed.

Hume Reservoir.—Further negotiations took place between the Department and the Electricity Commission of Victoria with regard to the permanent use of the stored waters for the generation of electricity. The question of the Constructing Authority, and the control and maintenance of the Power Station when built has been discussed. The matter has not reached finality.

Wyangala Dam Hydro-Electric Development.—The two 7-foot diameter steel outlet pipes have been placed in position and concreted.

Satisfactory rock foundation was cleared at the power station site and arrangements were made with the Water-Conservation and Irrigation Commission for stepping the downstream face of the Dam for future connection.

Satisfactory rock foundations for the screen structure on the upstream face was located and the concreting of this and the screen structure is proceeding.

Stream Gauging.—Stream gauging was continued throughout the year by the Water Conservation and Irrigation Commission on forty-six stations established for hydro-electric investigation. In the Northern District twenty-four stations were visited and 114 discharge measurements made.

Maximum discharges were obtained at two stations and minimum discharges at six stations, thus enabling the rating tables of these to be extended.

No high floods occurred in this area during the year.

In the Southern District seventy-seven gaugings were made. Heavy floods occurred in this District in June and maximum gauge readings were obtained on the Tumut River and Jounama Creek at Talbingo and on the Corang, Swampy Plains, Goodradigbee and Mongarloe Rivers. Maximum discharge measurements were made at the four first mentioned stations and their rating curves thereby extended.

III. BURRINJUCK ELECTRICITY SUPPLY.

Construction.

No. 1 Power Station.—No major construction work was effected.

No. 2 Power Station.—A start was made on the construction of the hydraulic section of No. 2 Power Station at the end of July, 1930. The whole of the excavation for the pipe lines and the necessary cutting of the downstream face of the Dam to form a vertical face for the connection of the reinforced concrete pipe, were completed. The greater portion of the foundation concrete was poured and preparation has been made for starting the reinforced concrete pipe as soon as discharges have ceased.

All materials including crushed metal, sand and cement, reinforcing steel and timber forms are on the site, and all concrete and general construction plant is ready for operation.

The design and specification for the steel section of the pipe lines were prepared but the contract has not yet been let.

Transmission Lines, Substations, &c.—No extensions to the 66 kV systems were made.

Investigations into the use of 66 kV single-bushing transformers with earth return were carried out and the results have been sufficiently favourable to warrant the ordering of equipment for a substation of this type.

An 11 kV line, 32.5 miles in length, from Cootamundra substation to Temora, the reticulation of Stockinbingal, and tap lines and transformer poles to supply several rural consumers en route, were constructed.

A switch structure at Jugiong was equipped with switchgear and transformers from which an 11kV line was erected to supply two pumping stations for the South-West Tablelands Water Supply and the town of Jugiong. The total length of lines is approximately 9 miles. The town of Jugiong was reticulated. Tap lines and transformer poles to supply several rural consumers in this district were constructed.

The 6.6 kV line from Marilba substation to Binalong was extended to Galong, which township was reticulated.

Street lighting systems were constructed in the towns of Darby's Falls, Wallendbeen, Stockinbingal, Galong, Jugiong, Binalong and Bowning.

Operation.

Generation.—The plant ran continuously throughout the year. The minimum level of the storage was R.L. 1,141, giving a head on the turbines of 173 feet, and the maximum was R.L. 1,186.

General rain on the Catchment in the early part of June culminated in heavy falls which filled the Storage by 24th June, and caused a flood which rose to 6.1 feet over the spillways giving a discharge of 57,000 cusecs.

The flood level at the Power Station rose about 20 feet but was still some 7 feet 6 inches below the main entrance level.

Beyond a small amount of scour along the tramway track, and the deposit of a bank of boulders at the lower end of the tail race, no material damage was done. The deposit at the end of the tail race raised the tail water level some 5 feet.

Flood water outside the building reached about 15 feet above the turbine room floor, but very little seepage occurred. The leakage was easily handled by the occasional operation of one of the sump pumps.

The hoisting chains for the inlet screens and baulks were unsatisfactory and the winch was altered by substituting a drum and steel cables for the chains and gypsy wheel. One permanent baulk was placed, but some alteration is necessary to the second screen before its baulk can be put into position.

The 9 miles of Shire Road between the Main Southern Road and Waterview, was metalled and stood the heavy rainfall in June very well. On the continuation down the mountain where the old railway was converted to a road, some slips occurred at the heavy cuttings, necessitating a considerable amount of maintenance.

The system maximum half hour demand reached 4,000 kW. The generated energy totalled 18,360,006 kWh and the annual load factor was 52.4 per cent.

The shunt reactor has operated successfully in neutralising the leading kVA due to the capacity effect of the long transmission lines. A new tank was supplied by the contractors.

The sluices at the Dam have been converted to electrical operation and this has effected a great saving in the labour for operating the sluices.

Distribution.—With the exception of one serious failure affecting the whole system and minor failures affecting principally Cowra, Wyangala Dam and Temora, the operation of the system has been satisfactory.

Lightning arresters of an obsolete type have caused short period interruptions in the supply due to the apparatus failing to limit the current during lightning storms. This type of arrester is being replaced by arresters of modern design.

The energy sold increased by 25 per cent. approximately, totalling 15,225,915 kWh.

Commercial.

Bulk Supplies.—Negotiations were opened with the Burrowa Electric Lighting Franchise (Registered), and were later closed as the provision of supply from Burrinjuck was considered uneconomical.

An agreement was executed with the Grenfell Municipal Council.

Supplies were provided to Temora Municipal Council in July, 1930, and Junee Water Supply in February, 1931.

Retail Supplies.—Investigations were made in a number of districts, principally along the Lachlan Valley and in the Burrowa district.

Negotiations were opened with rural and township residents of Koorawatha, Gundagai, Jugiong, Jeir and Cootamundra districts. The principal townships involved were Adelong, Batlow, Koorawatha and Greenethorpe.

Guarantees were executed by township residents of Galong (Extension) and Jugiong, and supplies were provided to such residents of Darby's Falls in July, 1930, Stockinbingal and Galong in October, 1930, and Jugiong in December, 1930.

Supplies were provided to a number of rural residents, after completion of the requisite agreements.

Agreements in connection with street lighting were executed by the relevant Municipal and Shire Councils and such services were provided in the townships of Darby's Falls in March, 1930, Wallendbeen in April, 1930, Stockinbingal in September, 1930, Galong in October, 1930, Jugiong, Binalong and Bowning in March, 1931.

Trading.—The revised method of handling and keeping retail accounts was placed into operation and has proved satisfactory.

A revised method of dissecting trading costs to enable closer analysis of the various sections to be made, was inaugurated.

The general trading showed a marked improvement but the necessity of meeting the charge for the overseas transmission of interest converted what would have otherwise been a substantial nett profit into a nett loss.

IV. PORT KEMBLA ELECTRICITY SUPPLY.

Construction.

Power Station.—Owing to the general slackness of trade and the falling off in demand for electricity, the work of erecting the 5,000 kW turbo-generator which was purchased from the Adelaide Electric Company has not been put in hand. The plant has been stored at the Power Station.

The work of re-arranging the step-up substation has proceeded. Owing to the necessity of maintaining a continuous service to the high tension feeders, this work has necessarily been slow.

Transmission Lines, Substations, &c.—The construction of 29 miles of 11 kV transmission line to Camden was completed.

One substation for conversion from 33 kV to 11 kV was erected at Yerrinbool for supplies to Picton, Camden and rural consumers.

One substation for conversion from 33 kV to 415-240 volts was erected at Peterborough for supplies to residents on the southern side of Lake Illawarra.

An extension of the reticulation of the village of Jamberoo was carried out.

Operation.

Generation.—The operation of the power station plant during the year was satisfactory. No major failures of plant occurred.

kWh generated and purchased	...	...	...	...	...	...	13,450,179 kWh
kWh output	...	...	...	...	...	...	12,815,468 „
kWh used in station	...	...	...	...	...	...	761,690 „
Maximum half-hour demand	...	...	...	...	...	...	4,845 kW.
Coal used	...	...	...	...	...	...	14,288 tons
Coal per kWh generated	...	...	...	...	...	...	2.41 lb.

The agreement for the interchange of power between the Department's power station and that of Australian Iron & Steel Limited has been maintained during the year.

Distribution.—With the exception of a number of minor failures, the operation of the system has been satisfactory.

The energy sold decreased by 5 per cent. approximately, totalling 10,760,375 kWh.

Commercial.

Bulk Supplies.—Agreements were executed by Camden and Picton Municipal Councils, Southern Portland Cement Limited (Emergency Supply), and Australian Iron & Steel Limited (Emergency Supply).

Supplies were provided to Wingecarribee Shire Council (Robertson and Burrawang), Australian Iron and Steel Limited (Emergency Supply) and Southern Portland Cement Limited (Emergency Supply).

Retail Supplies.—Investigations were made in the South Shoalhaven and Wollondilly Districts.

Negotiations were opened with the rural and township residents of Bomaderry and Yerrinbool Districts. The principal townships involved were Greenwell Point, Terrara, Bargo, Douglas Park and Tahmoor.

Guarantees were executed by township residents of Jamberoo.

An agreement in connection with the street lighting of Jamberoo was executed by the Municipal Council.

Trading.—An investigation into the existing methods in keeping retail accounts was effected and revised methods which should occasion considerable economies are to be placed into operation from 1st July, 1931.

An analysis of the bulk and industrial supply rates was made and standard rates were evolved. Advice to the respective Shire and Municipal Councils in connection with the determination of existing agreements and the substitution of the revised bulk supply rates were despatched.

Negotiations were opened with two of the existing industrial consumers in connection with the substitution of the revised industrial supply rates. No action was taken with regard to the balance of the industrial consumers.

The general trading was unsatisfactory, mainly due to the effect of the depression on the industrial consumers and the necessity of meeting the charge for the overseas transmission of interest.

V. WORK FOR OTHER BRANCHES.

Water Supply and Sewerage Branch.

Assistance has been given to the Water Supply and Sewerage Branch by reviewing specifications and making recommendations with respect to the electrical portion of electrically operated pumping plants and associated apparatus. Assistance has been given in conducting pumping plant tests.

Junee Water Supply.—During the year the Tenandra Pumping Station for the Junee Water Supply was put into service.

South-West Tablelands Water Supply.—A system for the remote control of No 2 Pumping Station and the electrical interlocking between the various units at No 1 Pumping Station at Jugiong has been developed. The remote control system enables the pumps at No 2 Pumping Station to be started and controlled from No 1 Station.

An electrically operated system of water level indication has been ordered to indicate at both Pumping Stations the water levels in the break pressure tank and in the reservoir at Cowang Gap.

A system of lightning protection has been arranged for the break pressure reservoir.

Orange Water Supply.—A transmission line and substations were erected by the Municipal Council to the Department's designs to supply the two new water pumping stations which are about 2 miles apart. It has been arranged for the pumps at No. 1 Station at the Dam to be started from No. 2 Station at the Filtration Plant.

Wellington Water Supply.—In connection with the Wellington Pumping and Filtration Plant, control and main wiring circuits were designed. The erection was carried out by the Council under the supervision of the Department.

Scone Water Supply.—A transmission line, remote control and water level indicating circuits and a substation were erected under the supervision of the Department.

Katoomba Water Supply.—A substation, extensions to mains and the erection of remote control and water level indicating circuits were designed and supervised by the Department. The work was carried out by the Municipal Council.

In addition to the works referred to above, assistance in regard to design and supervision was given in connection with the following water supply and sewerage schemes.

Water Supply Schemes—

Cargelligo Water Supply.
Tenterfield Water Supply.
Broken Hill Water Supply.
Mudgee Water Supply.
Casino Water Supply.

Goulburn Water Supply.
Grenfell Water Supply.
Condobolin Water Supply.
Bourke Water Supply.
Moama Water Supply.

Sewerage Schemes—

Forbes Sewerage.
Cessnock Sewerage.
Wagga Wagga Sewerage.

Lismore Sewerage.
Newcastle Sewerage.

Harbours and Rivers Branch.

Cook's River Dredging.—Assistance has been given in connection with the electrical equipment of the dredges operating in Cook's River. Arrangements were made for the dismantling of the overhead power line at Undercliffe Bridge and for its re-erection near Unwin's Bridge. This work of re-erecting the line was not completed owing to lack of funds.

Byron Bay Jetty.—The maintenance of the electrical installation on the jetty has been supervised.

River Murray Works.—Arrangements were made and a direct current power line constructed to supply the works on the Victorian side from the New South Wales power station enabling the generating plant in Victoria to be shut down.

Reports and estimates were prepared on a proposal to use the available water power for the completion of the construction works.

VI. WORK FOR OTHER DEPARTMENTS.

Local Government Department.

All electricity franchise agreements submitted to the Local Government Department have been reviewed and assistance has been given in connection with electricity loan proposals made by Local governing bodies.

Plans and estimates were prepared for the reticulation of the town of Moama and arrangements made between this State and Victoria for a bulk supply by the Victorian Electricity Commission at the border.

Government Tourist Bureau.

Assistance has been given from time to time during the year in connection with electrical engineering matters for the various tourist resorts under the control of the Tourist Bureau.

Health Department.

Morisset Mental Hospital.—A transmission line and two substations for the electrical supply to the main group of buildings at the Morisset Mental Hospital.

State Metal Quarries.

Arrangements were made for power feeders to supply an electrically operated shovel at the Bombo State Metal Quarry.

Assistance was also given with regard to extensions of the switchboard at the Kiama State Metal Quarry.

Education Department.

The maintenance of the electric motors at the Education Department's Carpentry Workshops, Drummoyne, has been arranged for.

Agricultural Department.

A transformer and switchboard were ordered for the power station at the Hawkesbury Agricultural College.

Assistance was given in the selection of motors for Griffith Experimental Farm.

V. J. F. BRAIN,
Chief Electrical Engineer.

8th October, 1931.

Sydney Harbour Bridge Branch.

Report for the year ended 30th June, 1931.

I have the honour to submit the following report on the work of the Branch for the year ended 30th June, 1931 :—

1. CONSTRUCTION OF THE NORTHERN APPROACH BY THE SYDNEY HARBOUR BRIDGE BRANCH.

After the curtailment of loan expenditure in the previous year and the consequent leeway to be made up the work was expedited, but, on account of the large amount of unemployment, rationing was introduced in September with a view to absorbing some of the unemployed. The hours were reduced to 35½ per man per week, worked in 4 days, additional men being engaged so that the work could be kept going for 5 days per week. In January, the hours were reduced to 33 per man per week but in April the hours were increased to 35½ as an offset against lost time due to wet weather.

The principal features in the progress of the northern approach were the construction of Kirribilli Station and the Shore local viaduct.

(a) *Excavation.*

A total of 27,361 cubic yards were excavated, the principal items being the regrading west of Kirribilli Station, 5,297 cubic yards; and the regrading of the roadway intersection near Alfred-street, 4,614 cubic yards.

(b) *Concrete.*

The concrete poured amounted to 27,029 cubic yards, 12,763 cubic yards being plain concrete and the balance reinforced concrete.

(c) *Waterproofing.*

The waterproofing carried out totalled 6,314 square yards, being horizontal and vertical mastic over the Shore local viaduct, Kirribilli Station and the Junction-street flat top construction. To protect this waterproofing 1,076 cubic yards of concrete and brickwork were placed.

(d) *Brickwork.*

The platform walls of North Sydney Station were built and, together with the other brickwork carried out, a total of 936 cubic yards were laid.

(e) *Steelwork.*

The broad flange beams of the Junction-street viaduct and the Shore local viaduct were placed, and at the end of June about twenty-five per cent. of the steelwork of North Sydney Station had been erected.

In all there were 1,634 tons of steelwork erected.

(f) *Plastering.*

Two coat rendering was done on various parapets, pier faces, 120-feet arch, and Walker-street footbridge. These are all of an ornamental character, with dentils, plaques and panels, where the superficial area conveys no hint of the complicated line work, edgings, mitres, &c.

The total area was 5,580 square yards.

(g) *General.*

A considerable amount of water service work, drains, &c., were laid, including 30-inch monier pipes under North Sydney Station and the 6-inch fire service to Kirribilli Station.

There were about 2,000 feet of fencing, both permanent and temporary, erected.

Portion of the platform awnings of Kirribilli Station was erected, the total area of fibrolite roofing being 5,374 square feet.

A total of 2,763 lineal feet of kerbing and guttering, equivalent to 282 cubic yards of concrete, were poured.

Large areas of footway and roadway surfacing were carried out.

A commencement was made with the plate-laying, the track through North Sydney Station being located in its permanent position and some of the ballast being placed in the tunnels.

In addition to the above there were various deviations of services for gas, water, P.M.G. cables, and electric cables.

The steel arch being carried out by Clyde Engineering Co. was commenced about the end of 1930 and at the end of June the two ribs were erected.

2. CONTRACT OF DORMAN, LONG AND CO., LTD.

(a) *Concrete and Masonry.*

Pylon construction, which at the end of June, 1930, was at the slab level 155.50, was restricted to the building of the overhanging side balconies from July until September, 1930, as the cable supporting the arch prevented work on any other section. This did not cause any serious delay as the corbelled masonry required a lot of steel formwork and was of necessity slow work. From the beginning of September until the middle of November, the cranes used for setting masonry were occupied most of the time lowering the anchorage cables to the ground preparatory to the re-winding them, but from then on excellent progress has been made.

The pylons on both sides of the harbour are now above the level of the intersecting arches. The work round this level required a lot of accurate setting of masonry arch rings and careful formwork for the concrete vaults. This work is now stripped and looks well from both the constructional and architectural viewpoints. Dawes Point is further advanced than Milson's Point, and at 30th June, the approximate level of the pylon at Dawes' Point was R.L. 237, and at Milson's Point R.L. 223. The finished level for the masonry on both pylons is R.L. 285, and the set back concrete cover is another five feet higher.

After a considerable amount of laboratory research on coke concrete a mix was decided on, which gave a strength, using the high grade cement now produced by all the cement manufacturers in New South Wales, equivalent to that obtained a couple of years ago with blue-metal concrete and of only 60 per cent. the weight. Satisfactory supplies were obtained from the metallurgical coke used by Australian Iron & Steel Ltd., and a start was made to concrete the roadway deck of the northern approach spans on 11th September, 1930. This work, held up from time to time as the output of the plant at Port Kembla was not large enough to keep pace with the demand, was completed on 14th November.

A start was made with the southern approach spans deck on 13th March, 1931, but, as a further satisfactory source of coke supplies had been found at Bellambi, this section, although larger, was completed in a month.

Trough plates for the main arch roadway were all riveted in position on the northern half during May, 1931, so that on 1st June, a start was made to place coke concrete from the centre of the arch northwards. Supplies of coke came forward as required and this section (i.e., the half arch) was completed at end of June, except for portions which cannot be completed until the falsework for the cranes erecting the pylon at Milson's Point is dismantled.

The Neuchatel Asphalte Co. Ltd., who are the sub-contractors for the laying of the roadway and footway pavement, made a start on the roadway of the northern approach spans on 20th November, 1930. The material used is rock asphalt. This was heated on the site and steady progress maintained until the completion of this section early in January, 1931.

The pavement of the roadway of the southern approach spans was started on 13th May, 1931, after the heating plant had been brought round from Milson's Point. Weather conditions prevented continuous work but good progress was made when possible and at the end of June, the asphalt was laid from the south end of contract to the south pylon.

To obtain a suitable pavement for the footways several trial strips were laid and finally a soft sheet asphalt was decided on as it was found necessary to utilise a material which would be elastic enough in cold weather to follow the rapid temperature movements of the steel trough plates. The first section started was the western footway of the northern approach spans and both this and the eastern footway were completed in three weeks during February.

On 23rd March, the first delivery of railway transoms was made to the northern approach spans. These were stacked on the completed surface of the roadway and adzed there. A careful survey of the railway stringers had to be made and the transoms notched to individual dimensions to give an even grade on the top when the transoms were seated on the stringers. These transoms were painted with one coat of oil and three coats of paint before being placed in position and bolted down.

On the northern approach spans, the railway tracks are on the curve necessitating timber and steel super-elevation packs, and the seatings for these were adzed on spans Nos. 6, 7 and 8. The transoms for spans Nos. 6, 7, 8 and 9 were bolted in position, and the transoms for span No. 10 were adzed on the deck.

Timber planking 8 in. x 1½ in. for these spans has been delivered. Those planks sufficiently seasoned have been painted, and on the west side of spans Nos. 6 and 7 they have been spiked in position on the transoms.

The railway decking on the southern approach spans is not so far advanced as at Milson's Point. The transoms for span No. 1 are adzed, painted and bolted in position; for span No. 2 they are adzed and being painted, and for span No. 3 they are being adzed at present.

Small sub-stations have been built in both pylons, and the Chief Electrical Engineer of the Railway Department has now brought the high tension electric cables in and connected them up, giving a supply of electricity for working the painting gantries, and as a source of supply for general lighting and power on the finished structure.

Stairways have been constructed in both pylons, and these are now in use, and are the only means of access from the ground to the deck.

During the year the following work was carried out under the various contract schedule items:—

No. 1 concrete	...	...	...	...	...	...	9,936 cubic yards.
Granite masonry	...	...	...	...	...	...	3,866 cubic yards.
Four-cut work on granite masonry	...	...	...	...	...	...	45,870 square feet.
Coke concrete	...	...	...	...	...	...	3,119 cubic yards.
Asphalt on roadway	...	...	...	...	...	...	11,853 square yards.
Asphalt on footways	...	...	...	...	...	...	3,621 square yards.
Timber	...	...	...	...	...	...	12,975 cubic feet.

(b) *Fabrication of Steelwork.*

There were 3,208 tons of steel delivered to the workshops during the year, of which amount 997 tons came from England and 2,211 from Australia.

The last shipment of steel from England was delivered to the workshops per s.s. "Mahia" on 6th November, 1930.

Shipments of steel from Newcastle, New South Wales, have continued throughout the year.

The total amount of steel, &c., delivered to the workshops to date amounts to 52,108 tons, of which total 41,353 tons came from England and 10,755 tons from Australia.

The first shipment of 100-lb. rails was received at the workshops on 15th June, 1931.

The total tonnage of steelwork fabricated during the year ended 30th June, 1931, was 12,343 tons, comprising practically the five central panels of the arch, all of the hangers and cross girders suspended from the hangers, deck lateral system, railway stringers, roadway stringers and joists, footway spans, roadway parapets and roadway troughs—practically the whole of the deck steelwork.

In addition to the above steelwork, the main painting gantry and six auxiliary painting gantries were fabricated.

The graph herewith shows the quantities of material delivered, fabricated, erected in place, and completely riveted since the first steel delivery.

(c) Erection of Steelwork.

The main arch was erected by cantilevering out from each shore, the structure being held back by 128 wire cables attached at the tops of the end posts.

The scheme of erection in the early cantilever stages consisted of attaching numbers of cables to the tops of the end posts to balance the arch, the number of cables being increased as the load on the arch increased. The solid mass of the abutment tower formed a support for the temporary raking strut between the top of the end posts and the top of the abutment tower, against which the cables strained back.

This "temporary raking strut," rigidly supported at its base, formed a steady support for the arch, and enabled the stress per cable to be considerably increased in excess of the amount necessary to balance the arch. The frictional resistance of the cables round the tunnel face was thereby increased, and the possibility of the cables slipping in the tunnels under the action of wind and temperature on the structure became negligible.

For the first few panels of the arch it was impracticable to use temporary sway frames at each vertical, as was done later, and if the arch had only been hanging from cables without the raking struts, the relative deformation of one arch truss in regard to the other, when the jib of the creeper crane was traversed and a heavy member lifted directly over one truss would have been sufficient to produce heavy bending stresses in the bottom lateral bracing, sufficient to bring about collapse of the structure. Many of the members lifted in the first few panels of the arch weighed about 100 tons. The main jib and its carriage, with the member lifted, weighed about 400 tons, a heavy eccentric load. By means of the rigid support formed by the raking struts, the deformations were reduced to a minimum, and the lateral members were not overstressed in bending.

The raking strut with its rigid base was vital in the early stages of the erection scheme, and without the rigid support formed by the abutment tower its use would have been impracticable.

At the 30th June, 1930, the erection of the southern half-arch had advanced to the first triangle of the eleventh panel, that is, the lower chord had been erected up to panel point "4," leaving two further panels to be erected before closing.

On the north side the erection of the half-arch had advanced to the eleventh panel, leaving three panels of the lower chord to be erected before closing.

The cables required for the anchorage were threaded into position round the cable tunnel, through the tunnel saddle and pylon saddle, and the free ends were laid over the front wall of the abutment tower. Each cable is 2.76 inches in diameter, approximately 1,200 feet long from end to end, and is made up of 217 wires, one centre wire .20 inches diameter, and 216 wires each .16 inches diameter. The ultimate strength of a cable is 360 tons as a minimum; the final load carried per cable was 125 tons. The cables were prepared for attachment by cutting to the correct length and fitting with a cast steel socket. To connect the cable to the socket, the cable was passed through the socket, the wires were opened up and cleaned, some wires being bent over at the ends, and the socket forced upwards on the cable until the opened wires filled the bell-shaped mouth of the socket. The whole of the socket, with its contained wires, was heated by blow-lamps, and molten white metal of composition lead 86 per cent., antimony 11 per cent., tin 3 per cent., was then poured into the socket. When solidified, the socket connection developed the ultimate strength of the cable itself. All socketing of cables was performed in sheds erected on the end of the pylon cross-girder.

The final anchorage consisted of 128 cables, arranged at the end post in eight horizontal rows of 16 cables each. The cables had two 3-inch bolts per cable, fitted with special thread, nuts, and spherical-seated washers. The bolts passed through the socket flange, and on either side of a pin 11 inches in diameter, which was grooved to allow the passage of the bolts. At the back end of the pin, the bolts passed through a rectangular forged steel saddle, and projected beyond the saddle a sufficient distance to allow the nuts to be slackened off when the cables had to be removed after the arch had met at the centre. The 11-inch diameter pins were seated on large fan-shaped built-up steel link plates, five links in each set, which sets in pairs were connected to the top chord by means of two pins 27 inches in diameter, each 6 ft. 1 in. long. The pins passed through holes 27 inches diameter in the webs of the top chord, which were heavily reinforced by pin plates. The weight of the link plates is taken by the joist on the end of the end post bracket.

As the erection proceeded, panel by panel, only sufficient cables were attached and tensioned up to balance the arch and to ensure that the permissible load on the raking strut would not be exceeded under changes of temperature. Eventually, at the seventh panel, the whole of the 128 cables were in action, and the raking strut was no longer required.

When attaching cables, first the anchor bolts and saddles were put in position, and the cable socket was threaded on to the ends of the bolts to a calculated distance, so that the stress in each cable was about 10,000 lb. In order to tension up the cables, hydraulic jacks are used, operating on the back ends of the bolts behind the saddles shown. The jacks thrust against a cross-head bolted on the ends of the bolts and pushed back against the saddle, so that the nuts on the saddle were relieved of stress. When tensioning, the whole cable was jacked up in this way, the bolts moving through the saddle, and the nuts were turned by hand following the movement of the jacks, until the desired load was in the cable, as measured by the pressure gauge on the jack.

The tension was checked from time to time by vibrating the cables over the length of 133 feet between the end post and pylon saddle. According to the properties of the cables, its span, weight per foot, &c., the stress in the cable is related to its rate of vibration per minute. This formed a check on the equal distribution of load in the cables.

The heavy members of the first panel on the Dawes' Point side were landed within reach of the creeper crane by the "Titan" floating crane.

The first member lifted into place was the section of the first panel of the lower chord adjacent to the western bearing at Dawes' Point. This member was put in place on the 26th October, 1928. It weighed 88 tons. The arch trusses were completed on 10th September, 1930.

The corresponding member of the eastern truss at Dawes' Point, was placed in position on 7th November, 1928.

The arch was cantilevered out panel by panel, the cables supporting the steelwork as it was built out.

When thirteen and a half panels had been erected on each side, the weight of steelwork in each half arch was 13,670 tons, supported by 128 cables, the tension on each cable 107.2 tons, the total pull on each system of cables being 27,440 tons, and the thrust on each of the four main bearings being 17,660 tons.

To offset the stretch of the cables and the deformation of the structure as erection proceeded, and to allow a sufficiency between the lower chords for the meeting on the centre pins, the end posts of the arch were set back at the top with a rake of 30 inches from the vertical. At the completion of the cantilever stage of the two half arches of thirteen and a half panels each, this backward rake was reduced, by the stretch of the cables and the deformation of the structure to 18 inches on the south side and 14½ on the north side; the gap between the ends of the lower chords at the centre to allow for the meeting of these chords on the centre pins was 31½ inches on the east, and 31½ inches on the west side. These gaps were affected by temperature and could have been 4 ft. 3 in. at minimum temperature due to contractions of the cables and steelwork, and 1 ft. 9 in. under maximum temperature conditions, due to elongation of the cables and steelwork.

On 7th August, 1930, the bottom chord of the fourteenth panel of the northern half-arch was erected and a short plank gave access across the harbour for the first time. Mr. Holt, of this Branch, was the first person to cross from shore to shore; Mr. Ennis, Director of Construction for the Contractors, was the first person to walk across the gap at the centre of the arch.

Both half-arches were finished off identically at the centre joint, the lower chord on each side was fitted with a heavy forged steel saddle to enclose a pin 8 inches in diameter. Before closure was commenced the 8-inch pins were set-screwed into the saddles on the southern side, and to provide for the half-arches being out of alignment horizontally and vertically, lateral adjustment was provided by means of 10-inch square locking bolts.

The fabricated steelwork of each lower chord at the centre joint was machined to receive the steel forgings which enclosed the centre pins 8 inches in diameter.

On the northern half-arches, each steel forging was carried by two of the four web plates, and between each forging a heavy steel diaphragm was built, having an opening 10 inches square, into which the locking bolt from the truss opposite could engage.

On the southern half-arches the 8-inch pins in two lengths were set-screwed into the steel forgings, and the locking bolt, 10 inches square with tapered point, was placed in the centre between the two 8-inch horizontal pins, and could be thrust forward by an hydraulic jack into the opening of the diaphragm, which would bring the opposite half-arches into line and level.

To close the gap of about 31½ inches between the half-arches, the nuts on each pair of link bolts connected with a cable were run forward one by one in successive fleets of 3 inches, 4 inches, 5 inches, and 6 inches, respectively. A fleet forward of 3 inches at each end of the arch closed the centre gap by nearly 12 inches.

Each cable was adjusted independently by means of a high-pressure jacking equipment working up to a pressure of 4 tons per square inch; and to ensure that each cable was let out the exact amount determined on for each fleet, special gauges were used to measure the distance the nuts had to be moved back on the 3-inch link bolts.

For the first three fleets the hydraulic jacks operated against the back face of the saddle and pushed the 3-inch bolts upwards by thrusting against a cross-head attached to the ends of the bolts. For the later fleets extension bolts were fitted over the ends of the 3-inch bolts when the outstanding length of these was too short for the jack.

The work was carried out in two twelve-hour shifts until contact was made on the centre pins, which took place after the first and the second fleet of 3 inches and 4 inches respectively had been completed on all the 128 cables at each end of the bridge, and the third fleet of 5 inches was in progress, 37 cables being let out on the north side and 55 on the south side.

At 11 a.m. on the 19th August, when the gap was 4½ inches between the eastern and 4½ inches between the western lower chords, the locking bolts were forced home by the hydraulic jacks, to bring the half-arches into correct line and level. Immediately prior to the jacking, the half-arches—mostly caused by temperature—were about 3½ inches out of line horizontally and 2 inches vertically, the sun influencing the half-arch and cables on the northern side more than on the southern, and the eastern truss very slightly more than the western truss.

The fleeting forward of the nuts was continued until, at 10 o'clock p.m., August 19th, at a mean temperature of 62 degrees Fah., full contact was made on the pins. Messrs. J. A. Holt, B.E., and G. A. Stuckey, M.E., of this Branch, were at the centre when contact was made. The circumstances proved ideal, as the temperature continued constant throughout the night, until it began to increase with the sunrise, which ensured that the half-arches did not draw apart, as would have happened had a fall in temperature caused the cables to contract. Once full contact was made, as the slacking of the cables continued, the half-arches bore on the centre pins with an ever-increasing intensity.

The arch was now in the three-hinged condition except for the residual tension still in the anchorage cables; the rakeback of the end posts at this stage had been reduced to $5\frac{3}{8}$ inches on the south and $5\frac{5}{8}$ inches on the north side; the half-arches had dropped 4 ft. $1\frac{1}{2}$ in. at the centre, due to the fleeting forward; and immediately prior to meeting, the centre pins were 348 ft. 6 in. above the level of the centre of the pins in the main bearings at the abutments.

The third, fourth, and fifth fleets of the nuts were completed when the tension in the cables was reduced sufficiently to admit of their being detached from the link plates at the ends of the top chords.

This was carried out by means of a special frictional gripping device attached to the cables some 20 feet behind the arch, and then by pulling on this grip with the 25-ton crane through a heavy block-and-tackle purchase, and working in conjunction with the hydraulic jacks, the cable bolts being released from the link pins, and the cables were allowed to slide back until the socketed ends rested against the pylon saddles.

When this operation was completed at one set of link plates, there was practically no tension at the other end of each cable, which was removed from the link plates and run down to the pylon saddle by means of a light electrically-driven winch.

Whilst the cables were being disconnected from the link plates, the erection of the centre posts, top chords, and top lateral bracing of the 14th panels was undertaken.

During the erection of the half-arches the structure consisted of two cantilevers, in which the top chords were in tension. In order to withstand the high-tension erection stresses, the four vertical webs of the top chords of the first five panels were strengthened by means of additional plates attached thereto by specially fitted pins and bolts. The weight of this additional erection material was 798 tons.

Before the final jacking operations were undertaken to change the arch from the three-hinged to the two-hinged condition, it was necessary for each member of the arch to have its final effective section, so that, while the cables were being disconnected, the pins and bolts connecting the temporary tension plates in the five end panels were driven out, so that the temporary erection material would not take any of the jacking stress.

The arch was converted into the two-hinged condition by jacking the top chords apart at the centre top chord joint.

The permanent joint at the centre of each top chord consists essentially of four forged steel saddles enclosing two pins, each 10 inches in diameter. The saddles and pins were hung in the gap between the chords in a special frame before the four hydraulic and eight screw-jacks were assembled. As the force was applied by the hydraulic jacks, the screw jacks were made to follow up the motion, as the gap between end plates of the chords opened out. The difference between the overall width of the permanent saddles and pins, and the distance between end plates of the two chords after jacking, was to be made up by parallel fitted filler packs measured off and machined out of forgings provided for the purpose.

The calculated thrust depended upon the elasticity of the structure, the loads upon it, and the temperature of the structure. The members of the arch had to be brought into their proper elastic condition, and to effect this the temporary reinforcing plates in the first five panels of the top chords on each side were disconnected; as the cables were being removed, the tension in the chords was relieved sufficiently to allow this to be done.

The cables were removed as rapidly as possible, careful note was made of the load imposed on the structure by the erection equipment, and thermometer stations had been established at twenty-four points throughout the structure. Meanwhile the jacking equipment was assembled in the space between the ends of the top chords at the centre.

This consisted of four hydraulic jacks, each 950 tons capacity, two operating near the top and two near the bottom flange of each top chord. Each jack was made of 3 per cent. nickel steel, $2\frac{1}{2}$ inches thick, and worked at a pressure up to 4 tons per square inch. Two screw jacks were placed alongside each hydraulic jack to follow up the movements of the latter, eight hydraulic and sixteen screw jacks being employed in all for the jacking. The screw jack consisted of a central cylinder into which left and right hand buttress-threaded rams were screwed. By rotating the central cylinder with capstan bars, the required movements were obtained. The hydraulic pressure on each truss was supplied from two hand-operated pumps with the necessary gauges. Each jack and gauge had been calibrated in the 1,250-ton testing machine provided by the contractors under the specification for testing model members for the bridge.

On Monday, 8th September, the cables had been all removed except 37 on the southern side and 15 on the northern side, and some of these were hanging slack. The day was cloudy and extraordinarily well suited for the performance of the final jacking operation, on account of the equable temperature and the extremely small variations in the temperature of the various members of the structure as indicated by the 24 thermometers. It was accordingly decided to perform the jacking before the remaining cables were released, as the possible error involved in the calculation of the effect of the weight of the cables was less than that which would have been caused in determining the mean temperature and its effect had no such perfect temperature conditions prevailed. The jacking force as calculated for a temperature of 60.5 degrees Fahrenheit was 3,272 tons per truss, corrected by — 22 tons for the cable effect, and so at 5.15 p.m. the 3,250 tons force was applied by the jacks to each arch truss.

During the operation the chords were forced apart a total distance of about $5\frac{1}{2}$ inches. The total gap on completion of the jacking was $29\frac{9}{16}$ inches on the eastern truss, $29\frac{25}{32}$ inches on the western truss. The space occupied by the saddles was filled with fitted packs in pairs. These were machined to size, and on the morning of 10th September the packs were fitted in position, the load on the jacks released, and the jacks removed.

From the time the lower chords met on the 8-inch pins until the top chords were jacked up and all cables removed, the centre of the lower chord rose upwards a distance of 1 foot $1\frac{1}{2}$ inches, the elevation of the centre pins at a temperature of 65 degrees Fahrenheit being 349 feet $7\frac{1}{2}$ inches above the level of main bearing pins. With total dead load the structure should assume its geometrical form; the elevation of the lower chord centre joint should be 350 feet above the level of the main pins at a temperature of 72 degrees Fahrenheit.

The work of suspending the deck from the arch trusses proceeded rapidly and, except for odds and ends, is now completed, and the northern half covered with coke concrete.

During the last week in June, 1931, the last footway span between the pylon and the main span on the south-west corner was erected. This lift constituted the last bridge member, excluding overhead wiring brackets, chord footways, manhole covers, &c., to be erected in position.

On the 27th June the 25-ton cranes which were erected for dismantling the creeper cranes were taken down.

From the foregoing it will be seen that the following operations were carried out during the year :—

- (1) The remaining five panels of the arch were erected.
- (2) The half arches were lowered to close on the pins.
- (3) The conversion from the three-hinged to the two-hinged condition was effected.
- (4) The whole of the hangers and all of the steelwork for the deck suspended from the hangers were erected as the creeper cranes receded.
- (5) The anchorage cables were detached from the arch and removed from the anchorage tunnels.
- (6) The pylon saddles were dismantled and taken down.
- (7) The 798 tons of temporary reinforcing plates were removed from the first five panels of the top chords.
- (8) The creeper cranes were dismantled and removed to the workshops.
- (9) The main painting gantry and six auxiliary gantries were erected in position beneath the deck of the main span.
- (10) The pylon stairways in the north and south pylons were erected to the 155.50 level.
- (11) The overhead wiring structures on the approach spans were erected in position.

A total of 13,067 tons of steelwork was erected during the year.

During the year 294 tons of rivets were delivered, making the total rivet deliveries 2,719 tons.

The attached diagram shows the progress of construction at each three-monthly period since 30th September, 1926.

(d) *Painting.*

During the year the application of the first field coat was completed on the north and south approach spans and on the main span excepting for the outside surfaces and the inner floors of the upper and lower chords together with the lower portions of the cross girders of the deck; these lower portions being left to be painted from the painting gantries.

A start was made with the application of the finishing coat during October, 1930, on the northern approach spans, and during the year practically the whole of the northern approach spans received the finishing coat excepting for the roadway and footway parapets and handrailing.

Work is still proceeding with the application of the finishing coat on the southern approach spans and is now three-parts complete.

During the year there were delivered :—

4,160 gallons of shop paint,
3,119 gallons of 1st field coat,
4,375 gallons of 2nd field coat,

making the total deliveries to date :

15,920 gallons of shop paint,
6,243 gallons of 1st field coat,
4,375 gallons of 2nd field coat.

3. CONSTRUCTION OF THE SOUTHERN APPROACH BY THE SYDNEY HARBOUR BRIDGE BRANCH.

The general remarks dealing with the northern approach apply also to the southern approach.

(a) *Excavation.*

The crescent subways excavation, grading the bridge highway, and the various regradings of the approaches constitute the main activities under this heading.

A total of 39,934 cubic yards were excavated. All the spoil was dumped in position as arch backfill, embankment viaduct, &c.

In addition, a considerable quantity of spoil was obtained from the City Railway Construction.

(b) *Concrete Work.*

During the year, 31,162 cubic yards of concrete were placed, of which 12,459 cubic yards were plain concrete, the balance being reinforced concrete. The principal items were the flat top construction, including walls and floor, Argyle-street arch, and the 70-feet arch at the end of Contract.

(c) *Waterproofing.*

A considerable quantity of waterproofing was carried out, there being 8,541 square yards of mastic, both horizontal and vertical, and 7,649 square yards of bituminous sheeting laid during the year. To protect this waterproofing material and the balance of that laid previously 19,116 square yards of brickwork were laid, equivalent to 1,975 cubic yards of brickwork.

(d) *Brickwork.*

Various retaining walls were carried out in brickwork, the total amount being 1,124 cubic yards.

Sydney Harbour Bridge Rate Levy—Payments and Outstanding Amounts at 30th June, 1931.

	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	Total.	Payments to 30th June, 1931.	Balance Outstanding 30th June, 1931.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
City Council	74,035 19 0	91,666 4 1	92,149 5 0	92,512 6 1	124,928 15 1	126,967 1 4	125,980 6 11	126,028 5 7	126,580 7 8	980,848 10 9	840,613 11 4	140,234 19 5
Hornsby Shire Council	3,072 18 6	3,203 11 0	3,326 17 9	3,348 5 6	3,879 2 1	3,826 11 8	3,759 15 2	4,782 5 6	4,663 0 7	33,862 7 9	28,534 16 9	5,327 11 0
Kuring-gai Municipal Council	6,259 11 2	6,625 0 7	7,703 0 5	7,739 4 8	7,917 16 7	12,075 10 2	12,406 7 10	12,652 12 8	12,616 18 3	85,996 2 4	75,379 4 1	10,616 18 3
Lane Cove Municipal Council	2,400 6 10	2,440 14 1	2,440 0 6	3,012 1 11	3,027 18 10	3,014 15 11	3,740 18 11	3,817 13 5	3,761 12 11	27,656 3 4	25,483 17 10	2,172 5 6
Manly Municipal Council	5,051 12 1	6,362 16 8	6,437 19 6	6,494 8 4	7,611 12 11	7,580 19 3	7,543 9 11	8,148 13 8	7,554 14 3	62,786 6 7	54,019 17 8	8,766 8 11
Mosman Municipal Council	5,357 7 6	5,854 17 3	5,850 3 4	5,900 4 0	6,737 13 11	6,709 11 4	6,230 18 6	8,457 7 8	7,868 19 0	58,967 2 6	52,702 18 11	6,264 3 7
North Sydney Council	9,646 10 2	9,699 12 4	10,943 12 1	10,838 14 3	16,700 8 5	12,599 7 1	12,377 14 5	12,319 2 0	12,914 16 10	102,039 17 7	91,839 11 0	10,200 6 7
Warringah Shire Council	3,919 10 7	4,721 3 1	5,647 6 8	7,032 19 1	7,103 4 8	7,812 6 9	8,554 4 1	8,991 0 10	8,790 19 3	62,572 15 0	52,911 10 6	9,661 4 6
Willoughby Municipal Council	5,024 10 2	5,294 11 4	5,389 14 5	7,831 11 10	7,824 7 7	7,782 7 10	9,049 10 1	9,240 19 8	9,153 8 4	66,591 1 3	59,020 5 3	7,570 16 0
Total	£ 114,768 6 0	135,868 10 5	139,887 19 8	144,709 15 8	179,731 0 1	188,368 11 4	189,643 5 10	194,438 1 0	193,904 17 1	1,481,320 7 1	1,280,505 13 4	200,814 13 9

Sydney Harbour Bridge—Expenditure to 30th June, 1931.

	To 30th June, 1923.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	Totals.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Main Bridge—Salaries, &c.	*17,058 7 4	1,581 5 9	15,821 18 8	12,703 0 0	16,120 17 10	22,093 10 4	31,979 14 1	29,548 0 8	28,490 0 3	175,396 14 11
Dorman, Long & Co.'s Contract .....	.....	.....	6,769 4 2	100,029 14 6	450,265 2 1	674,409 5 11	603,760 0 3	1,000,969 16 8	731,448 7 3	3,567,651 10 10
Dorman, Long & Co.—Wages Variation .....	.....	.....	.....	10,101 13 5	38,827 8 8	64,493 11 2	84,633 14 6	141,638 3 5	122,406 19 3	462,101 10 5
Dorman, Long & Co.—Excess Overhead .....	.....	.....	.....	.....	.....	.....	12,035 14 11	7,663 18 11	8,209 6 3	27,909 0 1
Dorman, Long & Co.—Painting Cranes .....	.....	.....	.....	.....	.....	.....	.....	1,312 10 0	.....	1,312 10 0
Approaches .....	.....	91,651 13 6	103,503 3 2	89,133 18 6	86,261 7 1	263,391 13 7	335,836 19 9	169,486 6 6	367,734 9 0	1,506,999 11 1
Resumptions .....	.....	46,195 0 0	73,753 8 7	245,382 3 5	278,799 7 2	432,175 11 7	123,898 15 2	12,156 5 0	39,897 9 3	1,252,258 0 2
Lavender Bay Station .....	.....	43,720 18 0	58,704 9 2	3,274 5 6	4,535 19 4	Cr. 28,469 4 3†	559 7 6	2,700 5 3	Cr. 310 15 5	84,725 5 1
Interest on Expenditure .....	.....	.....	.....	22,619 19 3	35,266 13 1	68,572 19 11	273,519 3 4	283,336 6 3	365,616 15 5	1,048,931 17 3
Road at Moruya .....	.....	.....	.....	.....	150 0 0	.....	.....	.....	.....	150 0 0
Exchange on Remittances, &c. ....	.....	.....	.....	.....	.....	.....	.....	.....	9,510 10 6	9,510 10 6
Total	£ 17,058 7 4	183,158 17 3	258,552 3 9	483,394 14 7	910,076 15 3	1,496,667 8 3	1,466,223 9 6	1,648,811 12 8	1,673,003 1 9	8,136,946 10 4

* This amount includes all costs involved from the inception of the work in 1900 to 30th June, 1923.

† A credit of £31,395 Os. 10d. was received from the Railway Department in June, 1928, in adjustment of amounts over-debited during previous years.

(e) *Steelwork.*

During the year 389 tons of steelwork were placed, being principally broad flange beams and rolled steel joists in the flat top construction and pedestrian subway at Argyle-street.

(f) *Plastering.*

A commencement was made with the plastering work and at the end of June over 600 feet of the west retaining wall parapet and about 120 feet of that of the east retaining wall had been plastered.

(g) *General.*

Considerable progress was made with placing the reinforced concrete racks for the signal and electrical engineers' equipment, in all 3,660 feet being completed.

In the vicinity of Scots Church an area of widened York-street was penetrated to act as a temporary surfacing until the backfilling over the tunnels has settled.

The area penetrated was 1,420 square yards. The area of tar dressed footways carried out in the same locality was 348 square yards.

Demolition of several buildings in Kent-street between Gas Lane and Napoleon-street took place so that the street could be widened. The Grafton Bond and Noyes Bros. buildings were being cut back by the Building Construction Branch to the new alignment.

In addition there was considerable fencing erected, and services temporarily and permanently deviated.

4. FINANCIAL REVIEW.

(a) *Land Tax.*

To defray one third of the capital cost of the construction and land resumptions and provide for the maintenance and lighting of the roadways and footways of the Sydney Harbour Bridge and Approaches from Waverton Station on the northern side of the Harbour to Wynyard Station on the southern side, a land tax of one half-penny in the pound was imposed upon the Unimproved Capital Value of all rateable land within the City of Sydney, the Municipalities of North Sydney, Mosman, Manly, Lane Cove, Ku-ring-gai and Willoughby, the Shire of Warringah and portion of the Shire of Hornsby.

The tax was first imposed in 1923, the details of the rate levy for the years 1923-31 are as shown on the table attached. Of the total of £1,481,320 7s. 1d. due to 30th June, 1931, a total of £1,280,505 13s. 4d. had been received and paid into the Special Deposit Fund, leaving a balance of £200,814 13s. 9d. to be paid before 31st December, 1931.

The table on page 39 shows the details of rates due since the tax was first imposed, the payments to 30th June, 1930, and the balance outstanding at that date.

(b) *Expenditure.*

The total expenditure to 30th June, 1931, is shown in the table on page 39. The cost to date of the Bridge and Approaches, including land resumptions, accrued interest and all other charges, is £8,136,946 10s. 4d., of which interest on expenditure is £1,048,931 17s. 3d., and resumptions £1,252,258 0s. 2d. Had it not been for the financial crisis it had been expected that the major portion, if not the whole, of the cost of the resumptions would be recouped by the sale of the residues, but this cannot be hoped for at present, and therefore the most advantageous course seems to be to hold the residues for a few years and then place them on the market.

For the Contract of Dorman, Long and Co. Ltd. wages variations due to alterations of awards and the introduction of the shorter working week and the excess overhead consequent thereon has risen to almost 14 per cent. of the total payment. This percentage is higher than previously on account of the greater margin above ordinary award wages due to men being engaged upon the main span.

5. STAFF.

The number of men employed on the Sydney Harbour Bridge and Approaches, excluding subsidiary contracts, at 30th June, 1931, was 1,509, employed as under:—

Approaches—Public Works Department	893
Civil Engineering	174
Painters	66
Workshops at Milson's Point	83
Erection of Steelwork	125
Moruya Quarry	168
Total	1,509

I again wish to express my appreciation of the excellent manner in which the staff of the Sydney Harbour Bridge Branch have carried out their duties during the past year.

J. J. C. BRADFIELD,
Chief Engineer,
Sydney Harbour Bridge.

23rd October, 1931.

Government Architect's Branch.

Annual Report for year 1930-31.

The certified expenditure is set forth hereunder :—

Vote or Account.	1930-31.		
	£	s.	d.
Loans	47,008	6	11
Consolidated Revenue	46,351	14	6
Special Deposits	7,437	0	9
Unemployment Relief	137,613	11	11
Other Departments	86,747	8	9
Special Purposes (Revenue) Fund	8,734	8	5
	£333,892	11	3

In addition to the foregoing, work totalling £200,081 4s. 5d. has been supervised for the Department of Education.

UNEMPLOYMENT RELIEF WORK.

The main volume of work carried out by the Branch during the year under review has been as a result of allocations made available by the Unemployment Relief Council. The various works have been put in hand as a matter of urgency and local unemployed absorbed as far as possible. Building works have been carried out all over the State, with the result that the relief has been State-wide.

Among the principal works which have been carried out under this head are the following :—

STATE HOSPITALS.

Coast Hospital.

Medical Officers' Quarters—Estimated cost, £6,000.—A building of brick construction providing accommodation for a resident medical staff of fourteen doctors. The design is simple in character with a carefully selected face-brick finish and tile covered roof which present a handsome appearance. The comfort of the staff has been studied in the provision of hot water to the bathrooms and elsewhere to meet the severe conditions experienced at times.

Laundry—Estimated cost, £2,405.—To relieve the heavy demands on this service section of the Institution, a remodelling scheme has just been completed including the installation of modern machinery improvements.

Lidcombe State Hospital.

Infectious Unit—Estimated cost, £8,900.—This building to accommodate thirty-six patients is of timber and fibro-cement construction with galvanised iron roof, and comprises four six-bed wards, twelve single-bed wards, and commodious verandah accommodation with Duty Room and Sanitary Annexes. The wards are centrally heated and are connected up to the newly installed septic tank system.

Medical Officers' Residence—Estimated cost £1,800.—A building of brick construction with mottled tile roof containing five rooms, and kitchen, situated on the main approach drive of the Institution. Septic tank, electric light, cooking and hot water services are provided.

Nurses' Home—Estimated cost, £11,000.—The new building, nearing completion, is designed to house thirty-two nurses and domestic staff associated with the home. The building is of two storeys of brick construction and is roofed with tiles. Dining and sitting room provision are included, while a special section is set apart for the Matron. Verandah and balcony accommodation for lounge and sleeping purposes is arranged for on a suitable aspect. Septic tank installation is provided.

Recreation Hall—Estimated cost, £2,220.—The Recreation Hall is located on a new section of the area. Accommodation is provided for 500 persons and the building has been designed on modern amusement hall lines with stage, cinema, &c. The construction is of brick with galvanised iron roof.

Manager's Cottage—Estimated cost, £1,780.—The Manager's residence provides living room, breakfast room, three bedrooms and verandah. Brick building with tiled roof.

MENTAL HOSPITALS.

Broughton Hall Psychiatric Clinic.

New Ward Block—Estimated cost, £14,000.—The new ward block, planned as part of a complete scheme, is of brick construction, roofed with tiles of French pattern. The building is planned with centrally situated dining and recreation rooms, on each side of which extending north and south are two fourteen-bed wards. Associated with each ward are single rooms for special patients, giving accommodation for sixty-eight female patients. Wide verandahs are provided, while a special feature—a solarium—is planned in the north-east corner of the building. The bathrooms present special features for dealing with the particular class of patient to be accommodated in the building.

Orange Mental Hospital.

Epileptic Wards—Estimated cost, £38,000.—These two Ward Blocks (one male and one female), each comprise two twenty-six-bed dormitories and ten single rooms for refractory patients, giving accommodation for sixty-two male and sixty-two female patients. In addition, provision is made for a day room, attendant's room, dressing rooms, a servery, clothes store, boiler room, bathrooms and lavatories.

Morissey Mental Hospital.

Male and Female Admission Blocks—Estimated cost £24,000.—Two new brick buildings each containing three dormitories of ten beds, and six single rooms, giving additional accommodation for thirty-six male and thirty-six female patients. In addition, the planning includes day rooms, kitchens, stores, bathrooms, service room, shower room, changing room, dressing room, boiler room, two paved courts and verandahs and airing courts.

Chronic Male Ward—Estimated cost £11,000.—A two storey brick building to house forty-four additional patients and consisting of three dormitories, of eighteen beds, twelve beds, and ten beds, respectively, and four single-bedrooms. The scheme also comprises dining room, day room, pantry, dressing room, bathroom, lavatories, stores, verandah, &c.

SCHOOLS.

Manly Domestic Science School—Estimated cost, £15,000.—The new building of brick externally and concrete internally is covered with tiles. The cookery rooms and associated domestic rooms are arranged on the ground floor, as also are shelter shed, lavatories and several class-rooms. The first floor is devoted to class-rooms, assembly room and staff rooms, while the second floor makes further provision for class-rooms, totalling 17 altogether. Incinerator installation meets the requirements of each floor, access being available from corridors. The new building occupies the site of the old Teacher's residence at the corner of Darley-road and Collingwood-parade, and makes provision for 720 students.

Canterbury Domestic Science School—Estimated cost, £31,000.—This new school is being erected on a recently resumed site in Church-street, adjacent to the existing Girls' School. The building is a two-storey brick structure with tiled roofs. The main frontage and southern wing are devoted to classrooms, of which there are 18, affording accommodation for 860 pupils. On the ground floor of the northern wing is situated the domestic science section comprising two large kitchens, a laundry and a home unit. This unit comprises dining room, bedroom, kitchen and bathroom arranged to give a purely domestic atmosphere in the teaching of the management of the home. On the first floor class-rooms are also arranged for sewing, art, typewriting, &c. In addition a gymnasium and library together with administrative offices and the usual provision of staff, hat, and store rooms have been included.

Mortlake Public School—Estimated cost, £12,000.—This school building provides for primary classes of boys and girls. The building is of two storeys, constructed of face bricks, with concrete, wood-covered floors and mottled tile roof. The accommodation will meet the needs of 480 pupils.

Punchbowl Public School—Estimated cost, £9,106. This new building will accommodate about 450 infants. The building is of brick construction, with assembly hall, kindergarten room and seven class rooms.

Russell Lea Public School—Infants—Estimated cost, £7,449.—Erected on a recently acquired site this building forms the nucleus of a school in this district. The structure is of brick with concrete upper floors and stairways. Wood covering is applied to concrete floors. Provision is made for kindergarten room, assembly hall and five class-rooms, together filling the requirements of 336 pupils.

Darlinghurst Public School—Infants—Estimated cost, £5,226.—A building of two storeys on the site of the old Teacher's residence. Brick construction and fireproof upper floor and stairway are embodied in the scheme. Six class-rooms and accommodation for teachers are provided.

Coonamble Public School—Estimated cost, £7,500.—The building is a two-storey brick structure with tiled roof and comprises four class-rooms, up-to-date science room and offices; there are also weather-shed and lavatory block in wood, sanitary annexe in brick, and a drift well to take sanitary wastes.

Dubbo North Infants' School—Estimated cost, £3,300.—This school, comprising two class-rooms and offices is constructed of brick with tiled roof and is replete with sewerage and up-to-date weathershed and sanitary block. The construction was carried out by the Education Department's painting and repair staff under the supervision of this Department.

Parkes Intermediate High School—New building—Estimated cost, £11,950.—This two-storey building has been constructed of locally-made bricks on reinforced concrete foundations, and has a roof covering of terra-cotta Marseilles pattern tiles. Six full-sized class-rooms and two class-rooms of smaller dimensions will afford the necessary seating for 252 scholars. A large assembly hall on the ground floor, and a science room and preparation room on the first floor, are important features in the building. Suitable provision has been made for the teaching staff and for shelter sheds, lavatory and other accommodation for pupils, including bicycle sheds fitted with racks for 56 bicycles—evenly divided between boy and girl pupils.

Grenfell Public School—New building—Estimated cost, £6,000.—A two-storey building containing five class-rooms and a science room. The removal of an existing building, erection of new weathersheds and W.C's and ground improvements are included in the work, which will increase the accommodation by 270 pupils.

Armidale Teachers' Training College—Ground improvements—Estimated cost, £2,890.—This work includes general re-grading of the grounds, formation of roads, footpaths, kerbing and guttering within the grounds, also fencing and entrance gates to site.

Armidale High School—Additions—Estimated cost, £4,882.—Four new class-rooms in brick have been added to the existing two-storey building, thereby increasing the accommodation for pupils by 144 seats.

Cessnock West Public School—Estimated cost, £3,336.—Two new class-rooms and corridors have been added to the existing two-storey brick building. This work was carried out by the Education Department's painting and repair staff under the supervision of this Department.

New Lambton School—Estimated cost, £14,157.—A new brick building for girls and additions to the infants' school are nearing completion. The new buildings will make provision for more than 600 additional pupils, viz., 384 girls and 224 infants.

The girls' school will be of two floors, containing eight classrooms, an assembly, principal's room, staff room, a study, and minor rooms. The additions to the infants' school building will consist of two storeys also, together with a basement. The basement will serve as a shelter shed and lavatory, the two floors above containing three classrooms, a kindergarten, staff room, store, and additional enclosed verandah and balcony spaces.

Newcastle Central Domestic Science School—Estimated cost, £30,000.—The main building will be a three-storey brick structure, with a slate roof, designed to accommodate 700 pupils. The building consists of eighteen ordinary classrooms, planned with a main central entrance, leading to the administrative offices from which a main central corridor gives access to the classrooms on the ground floor. Fire-resisting construction is employed throughout.

So as to provide direct and quick entry and minimise crowding, the entrances for scholars are situated at both ends of the building, those to the first and second floors being kept entirely separate from the entrance to the ground floor.

In addition to the classrooms, the accommodation includes two science demonstration rooms, three sewing rooms, art room, typewriting room, and library. Large staff rooms and services are provided on each floor. The cookery section comprises two large kitchens, a laundry, staff and changing rooms.

A feature in the scheme is the home unit, a typical modern cottage as an adjunct to the cookery section, to enable the teaching of domestic duties and cookery in a proper environment.

Tuck shop, shelter and closet accommodation are provided for in detached buildings designed in brickwork, with slate roof covering to correspond with the main building.

Wagga Wagga High School—Additions—Estimated cost, £9,500.—The additions are of brick, with fibrolite tile roof to match existing portion, and comprise a three-storey block consisting of one classroom, tuckshop, boys' and girls' shelter sheds in the basement; four classrooms, store room and assembly hall on ground floor; and three classrooms, demonstration and staff rooms on the top floor. The building is installed with electric light, water services and septic tank. Full advantage has been taken of the site to obtain the necessary accommodation required.

POLICE BUILDINGS.

A multiplicity of urgent and necessary works to various Police buildings has been carried out from a total allocation of £51,102. The largest of these were: New Police buildings at Bondi, £4,000; garages at Alexandria, £2,550; Redfern Police Depot, additions, £2,650; additions, alterations and repairs at Mudgee, £1,856; Bourke, £1,196; Grafton, £1,218; Berrima, £1,289; Bowral, £1,144; Wollongong, £1,120; and Granville, £1,272.

GENERAL.

La Perouse Aborigines' Reserve—New Huts—Estimated cost, £4,000.—To replace the old accommodation at the Aborigines Station, new quarters have been erected, and comprise six two-room huts, five three-room huts, two four-room huts, a dormitory block, a laundry and sanitary block. Water supply, sewerage and septic tank facilities are provided. Erected on an elevated site with a fine outlook over Botany Bay, the buildings are of wood and fibro-cement construction, roofed with a russet corrugated fibro-cement sheeting.

Erection of Thirty-three Huts for Aborigines (Country)—Estimated cost, £3,036.—These huts were erected in the following localities: Wallaga Lake, Roseby Park, Ul Gundahi Island, Purfleet, Brewarrina, Darlington Point, Casino and Urunga.

DESIGN.

Department of Public Instruction.—A conspicuous feature of the year's work has been the number of large school buildings planned to meet the requirements of the Department of Public Instruction. Plans for the Western Suburbs Technical High School at Marrickville, and for a new infants' school building at Carlton South are nearing completion; those for Boys' Intermediate High Schools at Homebush and Neutral Bay, for a new infants' school at Mayfield West, and a new primary school building at Moree are well advanced. Entirely new schemes brought to completion during the year include a High School at Inverell, an Electrical Engineering School at the Sydney Technical College, a District School and manual training building at Griffith, and a new school building, together with remodelling of the existing buildings, at Grenfell. The estimated cost of the work contemplated in each locality ranges between £5,000 and £38,000.

Important schemes dealt with, but not yet advanced beyond the sketch stage include an Agricultural High School at Tamworth, a Men's Hostel at Armidale Teachers' College, and a Trades School at Wollongong; Domestic Science Schools at Bankstown, Gladesville Central, and Parramatta; Girls' Schools at Bankstown and Waratah; an Infants' School at Marrickville West; an Intermediate High School at Temora; and new buildings, additions, &c., at Carlingford, Gardener's-road, Orange, Randwick, and Westmead. The estimated cost of the least of these schemes is £7,100; that of the greatest is £61,500.

Hospitals Commission.—Ranking next in importance and volume was the work done for the Hospitals Commission. Contract drawings and specifications, on the lines of the sketch scheme reported last year, have been prepared for new and converted buildings for the Berrima District Hospital, Bowral. In like manner the sketch schemes for new hospitals at Manning River (Taree) and Erina Shire (Gosford), for the new Children's Block at St. George District Hospital (Kogarah), and a remodelling scheme at Yass District Hospital have been followed up, and the working drawings brought to an advanced stage. Working drawings and specifications are almost complete for new nurses' quarters at Wagga Wagga District Hospital, and for new nurses' quarters and a morgue at Bathurst; they are quite complete for a new isolation block at Wollongong Hospital. Estimates for these works vary from rather more than £5,000 to about £42,000.

Sketch schemes drawn and forwarded for consideration by the Hospitals Commission include the following :—

A new laundry block at Broken Hill and District Hospital; new nurses' quarters and medical officers' quarters at Balmain District Hospital; alterations to present buildings and erection of additional buildings at the hospitals at Balranald, Bourke, Brentwood (Muswellbrook), Corowa, Forbes, Glen Innes, Goulburn, Grenfell, Narrabri, Nepean (Penrith), Parkes, and the Prince Albert Memorial (Tenterfield); also for a scheme under which the existing nurses' quarters at Dubbo District Hospital would be converted into maternity wards. The range of estimated cost in these cases was between about £5,700 and £18,800.

State and Mental Hospitals.—Among works for which full plans and specifications have been prepared in connection with State and Mental Hospitals the most important were as follows :—

Two new ward blocks for epileptics at Orange Mental Hospital; a new dormitory block at Milson Island Mental Hospital; new nurses' quarters at Liverpool State Hospital (re-designed to reduce cost); a new kitchen block at Broughton Hall; new quarters for medical officers at the Coast Hospital; and new nurses' quarters at Newington State Hospital (re-designed). Working drawings are in progress for a new laundry block at Morisset Mental Hospital. Costs in these cases were estimated at from £6,000 to £38,000.

Sketch plans prepared in connection with the institutions last mentioned include a new scheme for nurses' quarters at the Coast Hospital (£57,250); additional buildings at Broughton Hall (about £38,000) and an additional storey to ward blocks at Gladesville Mental Hospital (£13,800).

Justice Department.—The work carried out for the Justice Department was inconsiderable, consisting wholly of small contracts for the upkeep of existing buildings.

Chief Secretary's Department.—The principal works undertaken for the Chief Secretary's Department were defrayed from an appropriation of £51,102 from funds at the disposal of the Unemployment Relief Council, and have already been referred to elsewhere.

GENERAL.

Consequent upon the building of the Sydney Harbour Bridge, and the resultant widening of Kent-street by resumptions along its western side, the fronts of certain buildings in this area have been re-designed with a view to demolition and re-erection upon the new alignment. Up to the present the buildings known as Grafton Bond and Nos. 213-215 are the only ones for which full plans and specifications have been completed. The sketch stage only has been reached in the cases of the Traffic Office and the Sydney and Melbourne Hotel.

In order to provide better accommodation for the aborigines living upon the reserve at La Perouse a group of residential huts and other necessary structures has been designed, and the greater part of the work carried out. As proper drainage has been included healthier conditions as well as greater comfort should result.

Other contract works deserving of mention include a new ambulance station at Orange, two new sports pavilions and honor rolls (to be executed in bronze) for the University of Sydney. This last contract includes new freestone slab flooring and a new panelled timber ceiling in the Memorial Porch under the Great Tower, also a new panelled timber ceiling in Porch No. 2.

Important sketch schemes considered and drawn include the addition of another storey to the Lands Department Building at an estimated cost exceeding £40,000, an additional storey to the Treasury Building to cost £30,400 and, alternatively, the completion of the Treasury Building at a cost of about £101,000.

Owing to the munificence of the American multi-millionaire, Mr. J. D. Rockefeller, a sum of £100,000 is being made available to the authorities of the University of Sydney. It is intended to expend this sum in the erection and equipment of a new Medical School building. Sketch plans for this work have been completed and approved, and working drawings and specifications have been carried to an advanced stage.

During the year 257 contracts were prepared, the building work represented being estimated to cost £695,610. Sketch proposals were valued at £1,324,260.

Summary.

Original drawings prepared	...	...	...	...	1,183
Copies of drawings prepared	...	...	...	...	5,980
Total	...	...	...	...	7,163
Draft specifications prepared	...	...	...	...	347
Copies of specifications prepared	...	...	...	...	2,500
Total	...	...	...	...	2,847

BUILDING OPERATIONS.

Apart from the works carried out from Unemployment Relief Council monies, which are referred to elsewhere, the principal buildings erected during the year were :—

Schools.

North Sydney (Crow's Nest) Infants' School.—Contract, £6,321.—The school is located on land resumed from the Lady Hay Estate and surrounded by gardens. The building is of brick construction, with tiled roof. The basement is taken up by shelter sheds and lavatories, and the main floor is planned with seven classrooms, kindergarten room and assembly hall, the whole to house about 450 infants.

Cowra Public School—New Building.—Completed cost, £9,247. A brick building with tiled roof, providing eight large class-rooms, assembly hall, science room and usual offices, fitted with electric light.

Ballina High School.—Contract, £8,556. A new two-storey brick building of six classrooms, assembly hall, science room, staff room, stores, two brick weathersheds, &c.; also additions to existing manual training building, forming new domestic, cooking and laundry block.

Ben Venue School.—Contract, £4,272. A new single-storey brick building comprising three class rooms, kindergarten room, staff room, stores, new weathersheds, &c.

Lismore Public School.—Contract, £19,128. A new three-storey building for boys, consisting of ten classrooms, two assembly halls, staff room, store room, &c. The shelter shed, bicycle room and lavatory, &c., are located in the basement. An existing wooden building has been remodelled to form a new science room.

Forbes Intermediate High School—Additions.—Completed cost, £2,630. The accommodation of the existing main school, which is a brick building of two floors, was extended by providing two large class-rooms with corridors and stairway.

Mental Hospitals.

Orange Mental Hospital—Staff Dining Room.—Completed cost, £7,112. A two-storey brick building with tiled roof, containing large dining and recreation rooms, fitted with electric light.

Two Wards for Unrecovered Male Patients.—Completed cost, £41,428. Two two-storey brick buildings, roofed with tiles, each containing a twenty-two-bed dormitory and twenty-three single rooms. Large dining and day rooms are included, and a 15-feet wide verandah extends the full length of the north-eastern side. Each building is fitted with hot water, heating system and electric light.

Recreation Block.—Estimated cost, £10,400.—A brick building with cement dressings treated in simple classical design, to harmonise with surrounding buildings. Erected on the central axis of the site, it will be used as a church, concert hall and ballroom. The building contains main hall, 90 ft. x 42 ft., stage and chancel, with suitable dressing and entertainment rooms, also offices. Fitted with hot water, heating system and electric light.

Administrative Block.—Estimated cost, £8,921. A single-storey brick building with mottled tile roof, and containing office accommodation for administrative staff, surgeries for doctor and dentist, matron's room and offices.

Two Blocks for Quiet and Industrious Patients—Male and Female.—Estimated cost, £21,574. Each building contains three dormitories of twenty beds each (making provision for sixty patients), radiating from a central service unit connected with large dining and day rooms which open upon large verandahs. Full lavatory accommodation is provided for each ward.

Conversion of Stables into Ward Block and Erection of New Stables.—Estimated cost, £3,113. The recently-erected brick stable building has been converted into a ward block of thirty beds, with dining-room and full lavatory accommodation, and fitted with hot water, heating system and electric light throughout. New stables of galvanised iron, providing accommodation for eight horses, and with a loose box, have been built to replace the converted building. Rooms are also provided for buggies, carts, storage of fodder and harness cleaning.

Hospitals Generally.

Manly Peace Memorial Hospital—Nurse's Home.—Contract Price, £15,590. The building is of brick construction with fireproof floors. Accommodation is provided on ground floor for boiler and laundry requirements of the institution, and on the two upper floors for nurses and domestic staff.

Balmain District Hospital—Outpatients' Department.—Contract price, £5,757. The building is of brick and concrete construction on fire-resisting lines. It consists of two storeys, and the extension will be modern in all its provisions. The work has been so planned as to enable the lower ground floor to be utilised as a female ward when required.

Coonabarabran District Hospital—Isolation Block.—Contract price, £2,113. A single-storey building of weatherboard construction, consisting of four two-bed wards, duty room, sink room, two bathrooms and surrounding verandahs, &c.

Griffith District Hospital—New Building.—Estimated cost, £24,000. This new hospital comprises a group of eight buildings connected by covered ways and four separate buildings, so planned and situated as to suit the contours of the site, and at the same time to give easy working facilities.

The administrative block, which is centrally situated, contains a private ward section in addition to the usual offices connected with the general administration of hospitals. Operating block, X-ray and casualty department, and wards for children and intermediate patients are situated on each side of the administrative block, and twelve-bed wards for male and female patients form the extreme wings. The kitchen block is immediately behind the administrative block, and the whole of the foregoing buildings are connected by covered ways. A new laundry is also included in the scheme, together with temporary buildings which have been removed from the old Red Cross farm at Beelbangera, altered and re-erected to be used as maternity block, and nurses' quarters and night nurses' quarters respectively.

The new buildings are of local bricks, with tiled roofs, and have been designed on the simplest lines. Electric light, heating service and septic tank installation have been included.

Wallsend Mining District Hospital—Operating Theatre.—Completed cost, £2,735. The existing theatre block has been completely remodelled to provide for two theatres with necessary anaesthetic and sterilizing rooms, common to the two theatres. A complete ventilation scheme is a special feature of the remodelling.

Police Stations and Court Houses.

Coff's Harbour Police Station and Court House—Completed cost, £3,040.—The new building comprises police office, C.P.S. office, court room, magistrate's room, fireproof strongroom, cells, exercise yard and charge room. The existing building has been renovated and repaired.

Quirindi Court House—Completed cost, £4,393.—The building is of brick construction, and comprises court room, C.P.S. office, private office, magistrate's room, police office, legal profession room, male and female witnesses' room, jury room, bathroom, and closets.

ENGINEERING.

Restriction of public expenditure has somewhat affected the work of the Engineering Section of the branch. Although there has been a falling off so far as new work is concerned, this has been more than counterbalanced by a growing increase in the demand on officers' time for supervision and operation of mechanical and electrical equipment in State Institutions. A large proportion of this plant is rapidly nearing the end of its economic life and cannot be kept in continuous service without increasing attention and supervision by specialised officers of the Branch.

The principal works undertaken during the year may be summarised as follows:—

1. *Electrical Engineering Works.*—

	£	s.	d.
Parramatta Mental Hospital—Electric light and power services	3,130	0	0
Newington State Hospital—Rewiring	1,845	0	0
Armistead Teachers' College—Electric light and power services	1,942	0	0
Gladesville Mental Hospital—Electric lighting and power services	3,441	0	0
Morisset Mental Hospital—Electric lighting and power services	2,800	0	0
Electrical maintenance	2,686	0	0

2. *Mechanical Engineering Works.*—

Total value of preliminary design	53,176	0	0
Total value of working drawings ready for tenders... ..	14,965	0	0
Total value of works under construction	8,151	0	0
Total value of works completed	13,030	0	0
Mechanical maintenance	1,330	0	0

The main feature of the works outlined above is a decided decrease in capital costs of recent designs, indicative of the progress made in standardising equipment.

August, 1931.

EVAN SMITH, F.R.I.B.A.,
Government Architect.

Engineering Design Branch.

Annual Report, 1930-31.

I submit herewith report on the operations on the Branch for the twelve months period ending 30th June, 1931, being the second annual report since its inception.

The past year has been a particularly active one in so far as the operations of the Branch are concerned, especially with regard to works for unemployed relief; for which the designs were required as a matter of great urgency, entailing considerable additional work in the preparation of plans.

The work performed during the year included the following (the order of the list as shown being made to accord with the work attended to for the different branches, although such divisions no longer exist with regard to design, these now falling into the natural divisions of civil, mechanical and electrical sections).

Bridges.

Contract plans and specifications were prepared for the following bridges in the Western Division:—Five-mile, Nine-mile and Winbar Creeks (Louth to Wilcannia), Brindingabba Creek (Bourke to Hungerford), Stoney Creek and Cumbedore Creek (Louth to Tilpa), Deadman's Creek (Bourke to Louth), Salt Hole Creek (Broken Hill to Wompah), Boneley Creek (Wilcannia to Menindie), and Murray River at Bringenbrong.

Preliminary designs and estimates were prepared for Parramatta River (Sutherland-street), Lake Illawarra at entrance, Throsby Creek at Cowper-street, Newcastle, and Beardy River at Shannonvale (Glen Innes).

Harbour Works.

Preliminary designs and estimates were prepared for extensive additional wharfage facilities at the northern breakwater, Port Kembla, for coal-loading purposes.

Detail drawings were checked and examined for the following dredge plant constructed or under construction by the Government Dockyard, Walsh Island, Newcastle:—Suction hopper bar dredge "Hermes" (192), bucket dredge "Pluto" (77), four marine boilers for dredge service (19); also numerous designs, sketches and reports on tenders in connection with coastal harbour construction and maintenance.

Swamp Drainage.

Preliminary designs and estimates were prepared for additional works at Shark Creek (Maclean) and at Tuckean Swamp (Coraki), and for new works at Upper Belmore (Macleay River); further investigations were made in connection with the proposed Tuckombil Flood Escape (Richmond River at Woodburn) and for improvement of flood conditions at Curl Curl Lagoon, Manly.

Water Supply.

Preliminary designs and estimates were prepared for new schemes for Bundanoon, Gulgong, Oaklands, and Woy Woy, and for alterations and additions (or extensions) at Ballina, Bathurst, Broken Hill, Casino, Goulburn, Gunnedah, Grenfell, *Kiama, Katoomba, Lismore, Moama, Mittagong, Morisset, *Nowra, Parkes, Orange, Quirindi, South-west Tablelands, Singleton, Wentworth, as well as many minor extensions.

Contract plans and specifications were prepared for alterations, additions and/or extensions at Broken Hill, Casino, Glen Innes, Grenfell, Katoomba, Kenmore, Orange, South-west Tablelands, Tenterfield, Tamworth, Wagga Wagga, Wellington, as well as numerous reticulation extensions, and are at present in progress for Bourke, Culcairn (new work), Mudgee, Nyngan, South-west Tablelands; the last-mentioned work having several special features requiring numerous details not covered by the ordinary standards.

Sewerage.

Contract plans and specifications were prepared for a new distribution system for the filter beds at Bathurst; for syphons and distributors for the filter beds at Forbes; for chlorination plant at Goulburn; for Nos. 1 and 2 pumping stations, rising mains and treatment works at Lismore; while plans are in progress for the sewers, ventilation and treatment works for a new scheme at Parkes.

Preliminary designs and estimates were prepared for the sewerage of the following hospitals:—A new system at Bingara, extensions at Corowa, pumping station at Rydalmere; while plans are at present in hand for extensions at Morisset.

Stormwater Drainage.

Contract plans were prepared for the following works of stormwater drainage:—In the Metropolitan area—Salt Pan Creek channel (Salvia-street branch), at Bankstown; that part of Powell's Creek channel between Pomeroy-street and Parramatta-road, Homebush; and Arthur-street channel, including Church-street branch, at Lidcombe. In country districts—For alterations to the existing stormwater drainage at Casino, and for new works at Canowindra, preliminary designs were prepared.

Electrical.

The principal work attended to was in connection with extensions to the Burrinjuck Hydro-electric and Port Kembla electricity supply systems, consisting of designs for transformer stations and transmission lines, including those for the Gundagai, Marilba, Darby's Falls, and Cootamundra rural districts.

Plans and specifications were prepared for the conduit and pressure pipes for No. 2 unit at the Burrinjuck power station, and for a rearrangement of the step-up transformer at Port Kembla.

Other work attended to included such matters as wiring diagrams of existing sub-stations, standard arrangements in connection with transmission and metering equipment, operating diagrams, data sheets and log sheets for use in the field generally; also the collection of statistics with regard to electricity supply in New South Wales.

River Murray Works.

Detail designs for the Hume Reservoir have been attended to as required. Drawings Nos. 61 to 82 were added during the year. These relate principally to details of valve houses, expansion joints of main structure and various details in connection with the earthen embankment on the Victorian side.

Standard Specifications.—The position with regard to the work of the Standards Association has not altered to any considerable extent from that as stated in the report of last year, the work of the Association having been considerably curtailed owing to lack of funds. Slight modification was made in the specification for Structural Steel (A. 1-1931), while a proposed standard for concrete pipes (precast) is under review.

Extraneous.—In addition to the foregoing, other work attended to from time to time by members of the Drawing Office staff include inspection of hull, boiler, and machinery of dredge plant, machinery trials, tests of electrical plant and apparatus, and relief of officers in other branches.

The work in connection with improved methods of railway loading especially in regard to pipes, referred to in last year's report, continued to receive attention and further substantial savings continue to result owing to the improved methods that have been introduced.

Staff.—The staff at the present time consists of the following officers:—38 professional, 3 clerical, 9 general, total 50. Officers in all sections have shown keen interest in the work of the Department, and made every effort to cope with the special calls made on them during the year.

G. B. CARLETON, M.E., M. Inst., C.E.
Principal Designing Engineer.

6th August, 1931.

Survey and Survey Drafting Branch.

General survey, drafting, heliographing, plan mounting and recording were carried out in connection with the following works :—

Country Towns Water Supply.

Armidale, Ballina, Bathurst, Casino, Culcairn, Forbes, Glen Innes, Goulburn, Greta-Branxton, and North Rothbury, Grenfell, Hunter District, Kiama, Manilla, Mittagong, Moree, Moruya, Muswellbrook, Mullumbimby, Narrandera, Nowra, Nyngan, Oaklands, Orange, Portland, South-west Tablelands, Tamworth, Tenterfield, Tullamore, Wagga Wagga and Werris Creek.

Country Towns Sewerage.

Albury, Casino, Cessnock, Bingara Hospital, Forbes, Glen Innes, Goulburn, Morriston Mental Hospital, Mudgee, Newcastle, Stockton and West Tamworth.

Stormwater Channels.

Bankstown, Homebush, Lidcombe, Moss Vale, Cardiff and Newcastle (Throsby Creek and Cottage Creek Channels).

Electrical Development.

Picton to Yerrinbool and Koorawatha to Grenfell Transmission Lines, also easements and resumptions in connection with the Burrinjuck Hydro-Electric Scheme and the Port Kembla Electricity Supply.

Roads.

Kuring-gai to Cowan Creek, Coulson's Creek to Miller's Creek.

Bridges.

Hinton Bridge, Eurolie Bridge.

Harbours and Rivers.

Botany Bay, Byron Bay, Camden Haven, Coff's Harbour, Cook's River, Hunter River and Fullerton Cove, Kangaroo Point, Hawkesbury River, Lake Macquarie, Manly Lagoon, Manning River, Moscheto Island, Newcastle Harbour Improvements, Nambucca River, Port Kembla, Port Hacking, Port Macquarie, Richmond River, Stockton Foreshores, Shoalhaven River, Wallis Lake Foreshores, and Clarence River Entrance.

Swamp Drainage.

Austral-Eden Drainage Union, Upper Belmore, Shark Creek, Waterfall Sanatorium Cemetery, and Woodford-Leigh Drainage Union.

Public Watering Places.

Plans and descriptions were prepared in connection with the establishment of nine watering places. Five were revoked and nine partly revoked.

Local Government.

Descriptions were prepared of alterations to the boundaries of 37 municipalities and shires, and in connection with residential districts in 13 municipalities and shires. Action was taken in connection with resumptions, &c., for 29 municipalities and shires, and 95 plans prepared.

Murray River Waters Act.

Hume Reservoir, road deviations, New South Wales, and Bethanga Bridge.—Road of access.

Land Matters.

Information on legal and land matters was obtained by search for practically all resumption and easement plans, also in connection with public watering places and other works generally.

General.

Five hundred and thirty-seven plans and descriptions for resumptions, easements, and appropriations, &c., were drawn; 13 detail sheets were traced, and 211 miscellaneous drawings, including plans, sections, diagrams, capacity curves and tables were prepared.

The number of files dealt with was 3,400.

Helios to the number of 29,431 were printed, and 1,840 plans mounted. This includes (in addition to work for this Department), heliographing and plan mounting for the Railway, Education, Valuer-General's and Fisheries Departments.

In the Plan room 2,696 new plans and 210 field and level books were registered and 14,700 plans, &c., were issued and returned.

Survey.

Field surveys were carried out in connection with the following :— Mudgee Sewerage, including detail survey, Shark Creek Drainage, South Grafton Stormwater Drainage, Bankstown Stormwater Drainage, Nowra Water Supply, Glen Innes Water Supply Augmentation, Moruya Water Supply, Bathurst Water Supply, Grenfell Water Supply, Kiama Water Supply, Picton to Yerrinbool and Koorawatha to Grenfell Transmission Lines, and easements on the Darby's Falls to Young, Binalong to Galong, and the Jugiong Transmission Lines. Strathfield Police Station, Bankstown Police Station, Erina Shire Memorial Hospital Site, Eastern Suburbs Hospital Site, Maitland Hospital, Camden District Hospital, Manning River District Hospital Site, Hunter River Flood Prevention, Hume Reservoir Road, Kuring-gai to Cowan Creek Road, Moscheto Island Land and Hydrographic Survey, Coff's Harbour, Nambucca River, Port Macquarie, Shoalhaven River, Port Kembla, Botany Bay, Bateman's Bay, Shea's Creek, Manly Lagoon, Waterfall Sanatorium, Darlinghurst Public School, Canterbury High School.

26th August, 1931.

*71865—D

T. G. WILSON,
Officer-in-Charge of Surveys.

Testing and Inspection Branch.

Annual Report, 1930-31.

Owing to the general depression in trade and finance during the past twelve months, the work carried out by the Testing and Inspection Branch during that period shows a considerable falling off compared with the work of the previous year.

The estimated value of the material sampled, tested and inspected before being sent forward from the various works amounted to approximately £598,916, a decrease of £500,422 on the previous year's operations. It may be noted that in addition to the causes above-mentioned, value of the material handled has also been reduced. Fees charged for the work carried out amounted to £7,892, a decrease of £3,482.

Cement Testing.

The curtailment of construction work, and the slump in building construction has caused several of the cement manufacturers to shut down for various periods during the past year.

Seven hundred and forty (740) certificates covering the sampling, testing, and issuing of 2,164,938 jute bags of cement of an estimated value of £448,022, were issued during the year. Fees amounting to £4,341 were charged for the work carried out. This shows a decrease of 855,482 in the number of bags sampled and a reduction of £1,729 in the amount of fees charged compared with the previous year.

Steelwork Inspection.

Nine thousand two hundred and ninety-two (9,292) tons of steel rails, structural steel, mild steel and cast-iron pipes, together with 1,266 valves and hydrants, and 47 miscellaneous jobs, of an estimated value of £150,894, were inspected and tested prior to despatch from the various steelwork manufacturers of Sydney, Newcastle and Lithgow. The fees charged for the work carried out amounted to £1,923. The consignments sent forward totalled 559. Owing to the completion of a large contract for the manufacture of steel rails, &c., in the early portion of the period under review, and the closing down of the manufacture of cast-iron pipes at the Government Dockyard, the output compared with the previous year's operations shows a decrease of 17,129 tons of an estimated value of £233,360, while the revenue dropped £1,692.

Miscellaneous Investigations.

Seven hundred and nine (709) reports, covering 2,271 tests of concrete cubes, iron and steel bars, paints, oils, asphaltum, &c., were carried out in the Testing Branch laboratories. Fees charged for the work performed amounted to £1,627. Compared with the previous year, the results show only a slight decrease.

Two hundred and eighty-four (284) instruments were overhauled and repaired by the instrument maker.

Summarised details of the work carried out are given in the following statement :—

Particulars of Service.	Unit.	Quantity.	Reports.	Tests.	Estimated Value.	Fees.		
					£	£	s.	d.
Cement Testing	Bags	2,164,938	.....	740	448,022	4,341	2	0
Steelwork Inspection—								
Rails and fishplates	Tons	2,536	.....	.....	30,963	221	17	2
Structural steel	"	2,931	.....	.....	38,106	366	10	1
Pig-iron	"	131	.....	.....	786	1	12	8
Cast-iron pipes and castings	"	1,240	.....	.....	16,516	263	3	7
Mild steel pipes	"	2,454	.....	.....	47,144	860	2	7
Valves and hydrants	No.	1,266	.....	.....	6,762	33	9	3
Miscellaneous jobs	"	47	.....	.....	10,617	176	8	4
Miscellaneous Investigations—								
Concrete cubes .....	" .....	.....	68	1,295	.....	509	19	0
Sand .....	" .....	.....	31	41	.....	62	12	7
Stone .....	" .....	.....	3	6	.....	4	3	6
Iron and steel .....	" .....	.....	161	531	.....	217	12	6
Paints, oils, &c. ....	" .....	.....	29	85	.....	204	3	6
Asphaltum .....	" .....	.....	28	158	.....	146	12	1
Coal .....	" .....	.....	3	3	.....	5	1	0
Miscellaneous .....	" .....	.....	86	152	.....	311	19	10
Standardised sand	Cwt.	95	.....	.....	.....	165	13	9
Instrument maker	No.	284	.....	.....	.....	.....	.....	.....
Totals .....	.....	.....	.....	.....	598,916	7,892	3	5

A. MORRISON,
Superintendent of Testing and Inspection.

The Director.

Walsh Island Dockyard and Engineering Works, Newcastle.

Annual Report, 1930-31.

The financial year which closed on the 30th June, 1931, has been a lean one for this establishment. Although a little more activity has prevailed than in most engineering shops in the Commonwealth, the work has not been available in the country to provide the necessary turnover for such a large establishment. Nevertheless, much important work has been successfully completed during the year.

The suction dredge "Hermes" was completed. Trials were carried out very successfully, and the vessel was handed over for service.

Considerable progress was made on the construction of the bucket dredge "Pluto," which will be completed within the next few months.

A contract was successfully completed for six (6) electrically-driven capstans for the Railway Commissioners.

A number of important mild steel electrically-welded pipe lines were constructed, including :—

11½ miles of steel pipes, 22 inches in diameter, for the South-west Tablelands.

11 miles of steel pipes, 18 inches in diameter, for the Broken Hill Water Supply were completed.

Miscellaneous pipe lines were supplied for the Metropolitan Water Board and town and country water supplies.

The contract for 67-inch and 71-inch diameter steel pipes for the Shannon River Hydro-Electric Scheme in Tasmania was completed satisfactorily.

A start has been made on further pipe lines, including an additional 15 miles for the South-west Tablelands.

The dredges "Latona," "Jupiter," "Tethys," "Neptune," and "Clarence" were overhauled, and various hopper barges and tugs received minor repairs. Four (4) Scotch marine boilers were constructed for the dredge service.

Miscellaneous engineering work completed throughout the year included steelwork for the North Sydney Railway Station, valves for the Brisbane City Council and Tasmania, tipping trucks for the Water Conservation and Irrigation Commission. Two (2) 24-passenger motor-buses for the South Maitland Railways, and various small contracts in general engineering.

The floating dock has been well occupied considering the unprecedented slackness in shipping. Besides small craft, some 20 large vessels, ranging from 320 feet to 420 feet long have been docked and repaired during the year.

With the brightening of the coal trade, which has been showing an improvement during the last couple of months, the business for the floating dock should greatly improve.

The general outlook, however, for the Walsh Island Engineering Works as a whole at the present time is by no means bright. This establishment depends largely on the requirements of Public Works, Railways, Water Boards, Power Commissions and Councils, all of whom are facing a drastic curtailment of expenditure. Therefore, until the financial position improves, no great increase in activity can be expected.

Further, there appears to be little prospect of obtaining orders for new vessels until some provision is made for vessels trading on the coast of Australia being built in Australia.

The unemployment in the ranks of the class of labour usually engaged at establishments of this kind, viz., fitters, patternmakers, moulders, shipwrights, blacksmiths, joiners and boilermakers, is almost unprecedented, and represents a very serious problem. Many of these organisations in the Newcastle district have half of their members unemployed.

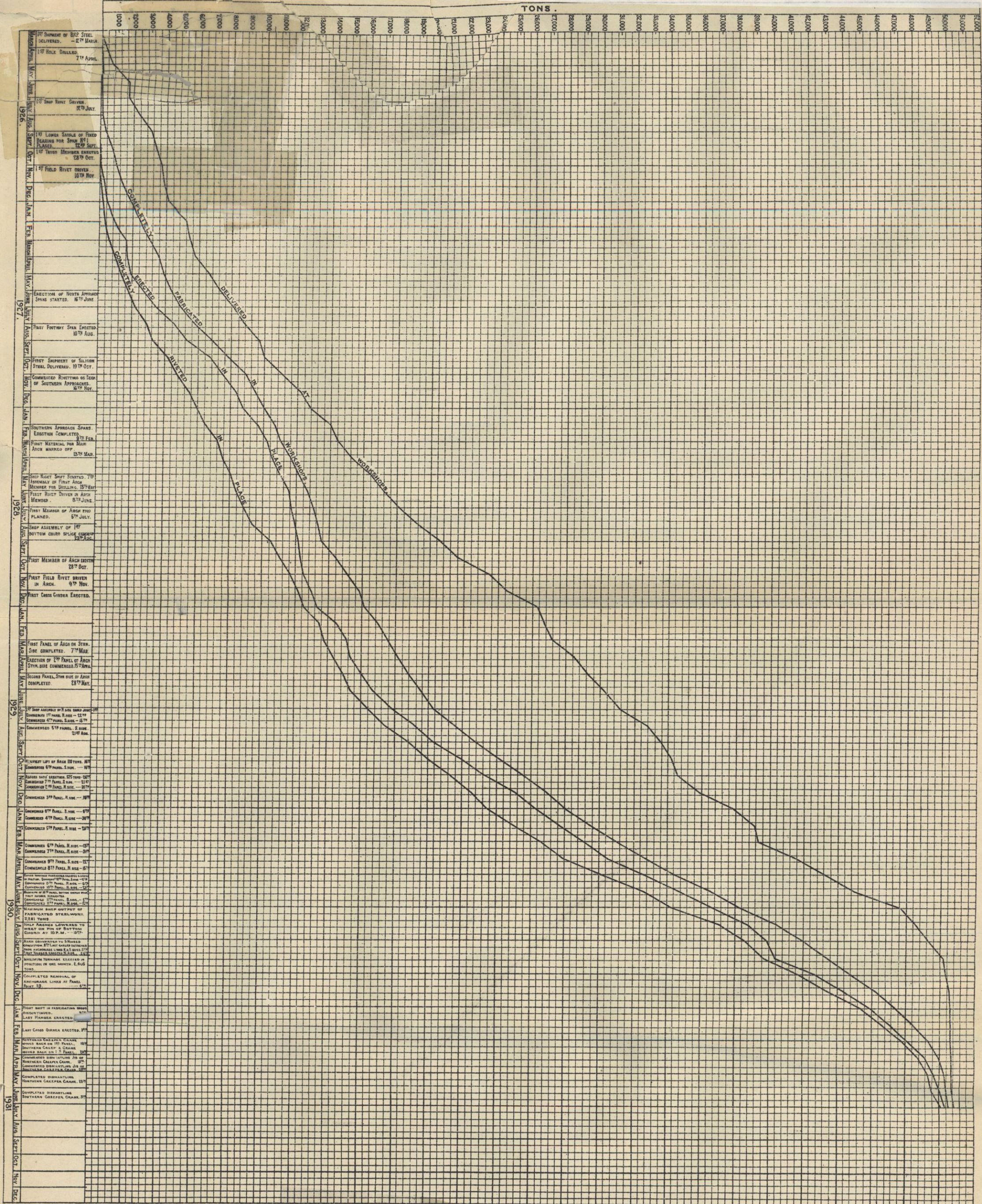
For three consecutive years the number of employees averaged nearly 2,000 throughout, and when it is stated that the numbers during the last nine months have averaged about 600 rationed employees, the effect of the present crisis is apparent, so far as this establishment is concerned. The staff and men who remain have been severely rationed for several months, and every endeavour is being made to share the work available as far as is reasonably possible.

Every co-operation is fostered in securing work from the various Government Departments, and observing the good service rendered by the Dockyard when large requirements have been necessary, definite preference to Walsh Island seems reasonable, particularly in view of its magnitude and national importance.

24th August, 1931.

A. C. WATERS,
General Manager.

[Two lithos.]



1926. 1st Shipment of RRP Steel delivered. - 12th March.
1st Hole Drilled. 7th April.
1st Shop Rivet Driven. 12th July.
1st Lower Saddle of Fixed Bearing for Span 85' Placed. 12th Sept.
1st Truss Member Erected. 28th Oct.
1st Field Rivet Driven. 16th Nov.
1927. Erection of North Approach Span started. 16th June.
First Footway Span Erected. 10th Aug.
First Shipment of Silicon Steel delivered. 19th Oct.
Commenced Rivetting on Deck of Southern Approaches. 15th Nov.
Southern Approach Spans Erection Completed. 9th Feb.
First Material for Main Arch Marked off. 13th Mar.
Shop Night Shift Started. 7th Assembly of First Arch Member for Jacking. 13th May.
First Rivet Driven in Arch Member. 6th June.
First Member of Arch End Placed. 5th July.
Shop Assembly of 1st Bottom Chord Splice Complete. 13th Aug.
First Member of Arch Erected. 28th Oct.
First Field Rivet Driven in Arch. 9th Nov.
First Cross Girder Erected.
1928. First Panel of Arch on Stem. Side Completed. 7th Mar.
Erection of 2nd Panel of Arch Stem Side Commenced. 15th Apr.
Second Panel, Stem Side of Arch Completed. 28th May.
1929. 1st Shop Assembly of 8th Side Chord Joint. Commenced 1st Panel S. Side - 12th Commenced 4th Panel S. Side - 15th Commenced 5th Panel S. Side - 21st Aug.
1st Rivet Lift of Arch 10th Nov. Commenced 6th Panel S. Side - 10th
2nd Rivet Lift of Arch 10th Nov. Commenced 7th Panel S. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 6th Panel S. Side - 10th Commenced 6th Panel N. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 9th Panel S. Side - 12th Commenced 9th Panel N. Side - 15th
1930. 1st Rivet Lift of Arch 10th Nov. Commenced 6th Panel S. Side - 10th
2nd Rivet Lift of Arch 10th Nov. Commenced 7th Panel S. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 6th Panel S. Side - 10th Commenced 6th Panel N. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 9th Panel S. Side - 12th Commenced 9th Panel N. Side - 15th
1931. 1st Rivet Lift of Arch 10th Nov. Commenced 6th Panel S. Side - 10th
2nd Rivet Lift of Arch 10th Nov. Commenced 7th Panel S. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 6th Panel S. Side - 10th Commenced 6th Panel N. Side - 11th Commenced 7th Panel N. Side - 15th Commenced 8th Panel N. Side - 18th
Commenced 9th Panel S. Side - 12th Commenced 9th Panel N. Side - 15th

30TH SEPTEMBER. 1926.

31ST DECEMBER. 1926.

31ST MARCH. 1927.

30TH JUNE. 1927.

30TH SEPTEMBER. 1927.

31ST DECEMBER. 1927.

31ST MARCH. 1928.

30TH JUNE. 1928.

30TH SEPTEMBER. 1928.

31ST DECEMBER. 1928.

31ST MARCH. 1929.

1929.

30TH SEPTEMBER. 1929.

31ST DECEMBER. 1929.

31ST MARCH. 1930.

30TH JUNE. 1930.

30TH SEPTEMBER 1930.

31ST DECEMBER 1930.

31ST MARCH 1931.

30TH JUNE 1931.

Ending 30th June, 1931

5 28 0
35 48 1

Ladder Dredge.	Where Working	Material Lifted.	Tons Lifted.	Hours Dredging	Hours Working	Expenditure £ . s . d	Pence per Ton	Cost per hour Dredging			Cost per hour Working			Percentage of Working hrs.							Remarks
								£	s	d	£	s	d	Dredging	Coaling	Removals	Bad Weather	Waiting for Tugs	Repairs	Other causes	
Clarence ✓	Newcastle	Mud Sand	206,590	699	1,934	4,080. 8. 11	4.7	5	16	9	2	2	2	36	2	8	1	5	19	29	Discharging into Dumb Barge and towed to Sea.
Hunter.	Newcastle	Mud Sand	775,500	967	1,935	4,220. 5. 5	1.3	4	7	3	2	3	6	50	3	3	2	1	15	26	Discharging into Steam Barge.
Juna	Newcastle	Sand Clay Shingle	379,375	939	1,942	4,417. 15. 5	2.7	4	14	0	2	5	5	48	2	8	2	10	9	21	Discharging into Steam Barges. Working on rock, part time.
		Totals	1,361,465	2,605	5,811	12,718. 9. 9															
		Averages					2.7	4	17	8	2	3	9	45	2	6	2	5	14	26	

Statement of Large Sand Pump Dredge Expenditure
—for 12 months Ended 30th June 1931—

Large Sand Pump Dredge	Where Working	Material Lifted	Tons Lifted	Hours Dredging	Hours Working	Expenditure			Pence per Ton	Cost per hour dredging			Cost per hour Working			% of Working hours.								Remarks.
						£.	s.	d.		£.	s.	d.	£.	s.	d.	Dredging	Coaling	Removals	Bad Weather	Disposal of Silt	Repairs	Other Causes		
ALESUS	Newcastle	Sand Mud	9,150	110	336	293	7	9	7.7	2	13	3	17	6	33	-	38	-	-	4	25	Fuel Oil and lubricating oils. Cost not included on trials only. Not taken over from Dockyard		
HEXHAM	Newcastle	Sand Mud	186,150	681	1454	3339	7	2	4.3	4	18	1	2	5	11	47	-	2	1	9	15	26	Working only part time through retrenchment.	
FIBRONIA	Newcastle	Sand Mud	40,550	170	401	825	2	11	4.8	4	17	1	2	1	2	42	2	15	-	2	6	33	Out of commission through want of funds.	
STOCKTON	Newcastle	Sand	134,733	658	1944	4640	19	8	8.3	7	1	1	2	7	9	34	3	21	1	-	14	27		
HARRINGTON	Richmond	Sand	75,302	808	1942	4324	18	2	13.8	4	16	7	2	4	5	42	4	14	5	-	20	15		
ANTLEON	1930-31 Batemans Bay Marooma River Manning River Shoal-haven	Sand	225,150	646	2000	6760	4	8	7.2	10	9	5	3	7	6	32	8	7	2	27	4	20	Now due for extensive overhaul.	
LATONA	Macleay Tweed R. Clarence	R. Sand	148,650	521	1426	11196	7	4	18.1	21	9	7	7	17	37	10	10	3	13	9	18	Bar Dredge working only shallow Bars.		
JUPITER	Richmond Coff's Harbour Clarence River Byron Bay	R. Sand	439,450	334	1852	7393	2	5	4.1	22	2	8	3	19	10	18	6	11	6	16	18	25	Recently overhauled, cost not included 1930-31.	
TETHYS	Newcastle Clarence River Richmond River	Sand	47,350	177	552	8818	19	1	44.7	49	16	5	15	19	5	32	7	12	3	20	9	17	Out of commission for 9 months and then a very extensive overhaul.	
NEPTUNE	Bellinger Newcastle Clarence	Sand	104,675	526	1683	11622	6	11	26.6	22	1	7	6	18	2	31	6	18	2	8	13	22	Pumping ashore from own hoppers.	
HERMES	Lake Macquarie Richmond R. Clarence R.	Sand R.	102,555	417	1050	2452	11	9	5.7	5	17	7	2	6	7	40	5	7	-	14	12	22	New Dredge commissioned April, 1930.	
Totals			1,513,715	5,048	14641	61667	7	10																
Averages									9.8	12	4	4	4	4	3	35	5	14	2	10	11	23		

Statement of Small Sand Pump Dredge Expenditure

for 12 Months Ended 30th June 1931

Small Sand Pump Dredge	Where Working	Material Lifted.	Tons Lifted.	Hours Dredging	Hours Working	Expenditure			Pence per Ton.	Cost per hour dredging.			Cost per hour Working.			Percentage of Working Hours.								Remarks.
						£.	s.	d.		£.	s.	d.	£.	s.	d.	Dredging	Coaling	Removals	Bad Weather	Waiting for Purts	Repairs	Other Causes		
Bellingren.	NOT IN COMMISSION																			Out of commission Laid up in Newcastle.				
Botany.	Newcastle	Mud Sand	54,740	430	1,123	2,145	12	9	9.4	4	19	5	1	18	2	38	2	10	1	-	32	17		
Forster.	Cape Hawke	-	-	-	375	854	19	4	-	-	-	-	2	5	6	-	-	-	-	-	100	-	Dredge "Forster" removed to Newcastle in August, 1930, and laid up.	
Gosford.	Cook's R.	Mud Clay	26,555	293	419	1,054	10	2	9.5	3	12	0	2	10	3	70	2	9	-	-	2	17	"Gosford" laid up August, 1930.	
Zeno	Cook's R.	Mud Sand Shell	62,863	369	929	1,504	18	3	5.8	4	1	6	1	12	4	40	-	9	-	-	20	31	"Zeno" laid up January, 1931.	
Macksville.	Nambucca River	Sand	114,233	998	1943	3,215	-	8	6.7	3	4	5	1	13	1	51	4	15	-	-	18	12		
Maclean.	Clarence River	Mud Sand Shell	12,571	777	1957	2,296	4	5	43.8	2	19	1	1	3	5	40	1	14	-	-	39	6	Motor launch attached to this plant. Working with Grab Buck only.	
Swansea	Lake Macquarie	Sand	58,632	594	1430	2,226	8	9	9.1	3	15	0	1	11	1	42	2	30	1	-	8	17	Swansea laid up March, 1931	
Tempe.	Cook's R.	--	---	--	375	454	.	7	-	-	-	-	1	4	2	-	-	-	-	-	100	-	Tempe laid up August, 1931	
Totals.			329,594	3,461	8,551	13,751	14	11																
Average									10.0	3	19	5	1	12	2	35	1	11	-	-	40	13		

Statement of Grab Dredge Expenditure.
for 12 months ended 30th June 1931

Grab Dredge.	Where Working	Material Lifted.	Tons Lifted.	Hours Dredging	Hours Working	Expenditure.			Pen- ce per Ton	Cost per hour Dredging.			Cost per hour Working.			% of Working Hours								Remarks.	
																Dredging.	Coaling.	Removals	Bad weather	Waiting for Punks.	Repairs.	Other causes.			
						£.	s.	d.	d.	£.	s.	d.	£.	s.	d.										
Como.	Cook's River	Clay Stone	16,130	1,238	1,938	3471	5	10	51.7	2	16	1	1	15	10	64	4	4	4	4	7	13	Working on rock and waiting for blasting.		
Coraki.	Richmond River	Sand Timber Stone Ballast	7,042	448	1,969	1911	7	9	65.1	4	5	4		19	5	23	3	35	3	-	6	30	Considerable time lost in removals working with transporter gear.		
Harwood.	Tweed R	Mud	17,076	899	1,937	1427	16	1	20	1	11	9		14	8	47	5	7	1	-	29	11			
Minmi.	Newcastle	Clay Rock Mud Debris	41,985	700	1,968	2040	2	5	116	2	18	4	1	-	9	36	2	13	4	9	17	19			
Urunga.	Nambucca	Mud Gravel	21,732	1,038	1,946	1883	15	8	20.8	1	16	3		19	5	53	2	17	-	-	10	18	Working with transporter part time.		
Wallsend.	Newcastle	Rock Clay Mud	63,410	936	1,936	2073	19	8	7.8	2	4	3	1	1	5	48	1	4	3	16	12	16			
Wickham.	Manning R	Gravel	39,900	1,079	1,980	2792	0	6	16.7	2	11	9	1	8	2	54	4	9	2	-	15	16			
	Totals.		209,275	6,338	13,674	15600	7	11																	
	Averages.								18.1	2	9	3	1	2	0	46	3	13	2	4	1	4	18		

Comparative Statement of Quantity and Cost of Work
— done by Large Sand Pump Dredges (with Towing) for Periods as stated. —

Large Sand Pump Dredge	Where Working	1 st July 1924 to 30 th June 1930					1 st July 1930 to 30 th June 1931					Remarks.
		Dredging Towing and Repairing					Dredging Towing and Repairing.					
		Tons	Expenditure £. s. d.			Pence per Ton d.	Tons	Expenditure £. s. d.			Pence per Ton d.	
"ALEXUS"	Not in Commission.					-	9,150	293	7	9	7.7	
"BALLINA"	Not in Commission		3,100	11	6	-	--	-	-	-	--	
"MORPETH"	do.	do.	425	6	2	-	--	-	-	-	--	
HEXHAM	Newcastle	427,848	8,102	18	8	4	186,150	5,053	2	2	6.5	
FIBRONIA	do.	157,715	7,931	19	10	12	40,550	1,605	15	11	9.5	
STOCKTON	do.	327,160	9,864	18	11	7	134,733	4,996	2	10	8.8	
HARRINGTON	Richmond	52,125	5,527	13	2	25	75,302	4,338	8	11	13.8	
ANTLEON	1930-31 Batemans Bay											
	Narooma Moruya Manning R. Shoalhaven	158,830	12,918	10	8	20	225,150	6,760	4	8	7.2	
LATONA	Macleay R.											
	Tweed R. Clarence River.	18,500	12,297	19	3	16	148,650	11,196	7	4	18.1	
JUPITER	Richmond Coff's Harb. Clarence R. Byron B.	411,500	11,588	11	6	7	439,450	7,393	2	5	4.1	
TETHYS	Newcastle Clarence R. Richmond R.	275,450	9,170	1	7	8	47,350	8,818	19	1	44.7	
NEPTUNE	Bellinger R. Newcastle. Clarence R.	198,825	7,716	12	11	9	104,675	11,622	6	11	26.6	
HERMES	Lake Macquarie Richmond R. Clarence R.	Not in Commission 1929/30					102,555	2,452	11	9	5.6	
TOTALS.		2,194,453	88,635	4	2	10	1,513,715	64,530	9	9	10.2	

Statement of Tug and Hopper Barge Expenditure and Work for
12 months ended 30th June 1931

[illegible]

Comparative Statement of Quantity and Cost of Work
done by Small Sand Pump Dredges (with towing) for periods as stated.

Small Sand Pump Dredger.	Where Working.	1 st July 1929 to 30 th June 1930				1 st July 1930 to 30 th June 1931				Remarks.	
		Dredging		Towing and Repairing		Dredging		Towing and Repairing			
		Tons.	Expenditure. £. s. d.	Pence per Ton.	Tons.	Expenditure. £. s. d.	Pence per Ton.				
Bellingen.	Not in Commission										
Botany.	Newcastle	103,051	4,447	0	9	10.3	54,740	2,500	15	10	10.9
Forster.	Cape Hawke	80,565	3,295	2	7	9.8	--	948	19	6	--
Gosford.	Shea's Creek	106,808	4,566	14	8	10.2	26,555	1,054	10	2	9.5
Macksville.	Nambucca R.	91,580	3,770	0	11	10.0	114,233	3,215	0	8	6.8
Maclean.	Clarence R.	23,322	2,939	3	2	30.2	12,571	2,296	4	5	43.1
Swansea.	Port Stephens	61,955	4,528	14	1	17	58,632	2,388	11	2	9.7
Tempe.	Cook's R.	6,382	2,125	0	6	80.	--	454	-	7	--
Zeno	Cook's R.	12,819	2,314	4	11	43.	62,863	1,504	18	3	5.7
TOTALS.		486,482	27,986	1	7	14	329,594	14,363	-	7	10.5

Comparative Statement of Quantity and Cost of Work
done by Grab Dredges (with towing) for periods as stated.

Grab Dredge	Where Working	1 st July 1929 to 30 th June 1930					1 st July 1930 to 30 th June 1931					Remarks.
		Dredging Towing and Repairing					Dredging Towing and Repairing.					
		Tons.	Expenditure. £. s. d.			Pence per Ton.	Tons.	Expenditure. £. s. d.			Pence per Ton.	
Como	Cook's R.	17,925	4,107	2	1	55	16,130	3,924	4	9	58.4	Including Tug "Croki" and Coxswain on Punts.
Coraki	Richmond R.	9,129	2,514	13	5	66	7,042	1,911	7	9	63.7	Working with Transporter gear and extra hands.
Harwood	Tweed R.	21,062	1,937	7	10	22	17,076	1,427	16	1	20	
Minmi	Newcastle	14,008	7,054	6	4	120	41,985	3,204	5	6	18.3	
Urunga	Nambucca R.	20,063	2,633	12	8	31	21,732	1,883	15	8	20.8	
Wallsend	Newcastle	94,655	8,376	14	4	21	63,410	3,563	17	0	13.5	
Wickham	Manning R.	34,865	5,565	2	11	38	39,900	2,792	0	6	16.8	
TOTAL.		211,707	32,188	19	7	38	207,275	18,707	7	3	21.6	

Comparative Statement of Quantity and Cost of Work
done by Ladder Dredges (with Towing) for periods as stated.

Ladder Dredge.	Where Working.	1 st July 1929 to 30 th June 1930					1 st July 1930 to 30 th June 1931					Remarks.
		Dredging Towing and Repairing					Dredging Towing and Repairing					
		Tons.	Expenditure.			Pence per Ton. d.	Tons.	Expenditure.			Pence per Ton.	
			£.	s.	d.		£.	s.	d.			
Clarence.	Newcastle	293,450	15,751	6	8	13	206,590	6,898	3	10	8.0	Discharging into Dumb Hopper Barges towed to sea from Steel Works channel.
Hunter.	Newcastle	742,500	25,803	18	3	8	775,500	10,328	15	7	3.2	
Juno	Newcastle	280,550	12,854	4	9	11	379,375	10,267	14	2	6.5	Removing rock from Newcastle Bar.
TOTAL		1316,500	54,409	9	8	10	1,361,465	27,494	13	7	4.8	