River Murray to Broken Hill Pipeline
Review of Environmental Factors
Final

Report Number DC16095
October 2017

Prepared for WaterNSW
## Document Control

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Foreword

This review of environmental factors (REF) has been prepared to assess the environmental impacts associated with the construction and operation of the River Murray to Broken Hill Pipeline project (the project). It is acknowledged that the project will be procured on a Design Build Operate Maintain basis and that the successful tenderer will site and design all infrastructure associated with the development. This REF is based on the scope of works and design and construction assumptions as described in Section 5.0 of this report and the infrastructure footprints shown in Table 6-1 and Appendix C.

Should the contractor propose a design and/or construction methodology that differs from that described in this REF, further assessment to determine the significance of any potential impacts in accordance with Part 5 of the NSW Environmental Planning and Assessment Act 1979 will be required.

The assessment of impacts associated with the River Murray to Broken Hill Pipeline project presented in this REF is based on the information provided at the time of drafting including specialist investigations and assessments. The analysis and assessment of Aboriginal cultural heritage impacts is being undertaken in four stages in line with the approach to obtaining Aboriginal Heritage Impact Permits (AHIP) in stages. The draft report for Stage 1 (Stephens Creek to Pine Creek) has been prepared and the draft reports for the remaining stages are currently being prepared. No works would be undertaken that would impact on Aboriginal objects unless an AHIP has been obtained for that section.
Author’s declaration

This Review of Environmental Factors (REF) has been prepared by Public Works Advisory, NSW Water Solutions on behalf of WaterNSW. The report presents the assessment of potential environmental impacts associated with the proposal to construct and operate the River Murray to Broken Hill Pipeline project.

WaterNSW is a State Owned Corporation and is the determining authority as defined in the Environmental Planning and Assessment Act 1979 (EP&A Act). The proposal satisfies the definition of an activity under the Act, and as such WaterNSW must assess and consider the environmental impacts of the proposal before determining whether to proceed.

This REF has been prepared in accordance with Sections 111 and 112 of the EP&A Act and Clause 228 of the Environmental Planning and Assessment Regulation 2000 (EP&A Reg).

This REF provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

The main impacts of the proposed, as identified in this REF, are matters relating to construction activities and include impacts to Aboriginal cultural heritage, terrestrial and aquatic ecology, soils, noise and vibration, air quality, and traffic and transport. The main operational issues relate to the impact of extracting water from the River Murray and noise from the pumping stations.

On the basis of the information presented in this REF it is concluded that by adopting the measures to avoid, minimise or manage environmental impacts:

1. the proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
2. the proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore a Species Impact Statement (SIS) is not required.
3. the proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or result in a significantly impact to any Matters of National Environmental Significance.

This REF has been prepared by the undersigned.

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Executive Summary

This Review of Environmental Factors (REF) has been prepared by the Public Works Advisory on behalf of WaterNSW. The report assesses the potential environmental impacts associated with the construction and operation of the proposed River Murray to Broken Hill Pipeline Project.

Introduction

Broken Hill, Menindee, Silverton and Sunset Strip are located in the Far West Region of New South Wales (NSW). Essential Water supplies water to people in Broken Hill, as well as to the communities of Menindee, Sunset Strip and Silverton. Town water supply is almost entirely dependent on water sourced from the Darling River/Menindee Lakes system which is about 100 kilometres south east of Broken Hill. Raw/untreated water is extracted from Weir 32 on the Darling River and pumped to Broken Hill via the existing aboveground pipeline and the Stephens Creek Reservoir. It is treated at the Broken Hill Mica Street water treatment plant (WTP) before it is delivered to customers.

Local climatic conditions, combined with upstream water demands, limited available storage capacity at Broken Hill and very high surface water evaporation rates have contributed to ongoing water shortages in the area. The current raw water supply does not meet the NSW Guidelines on Assuring Future Urban Water Security.

Given the limitations of the existing water supply system both in terms of availability and quality, the NSW government has committed to providing a secure long-term water supply solution. This involves constructing a pipeline and associated infrastructure to pump water from the River Murray at Wentworth to Broken Hill. The water would be pumped to and treated at the Mica Street WTP before it is delivered to customers using Essential Water’s existing water distribution system.

WaterNSW is delivering the River Murray to Broken Hill Pipeline project (the project) on behalf of the NSW Government.

Description of the project

The project is described in section 5. It will provide a secure water supply to Broken Hill by constructing and operating:

- A pipeline to transfer water from the River Murray to Broken Hill
- An inlet pumping station pumping station on the River Murray, a dosing plant, up to three transfer pumping stations (TPS) and a bulk water storage adjacent to the pipeline
- Ancillary components that include but are not limited to balance tanks, scour valves, air valves, power supply, telemetry, and associated electrical, mechanical and civil works.

Objective

The objective of the project is to provide a secure, reliable and long-term source of water to Broken Hill and the surrounding communities that complies with the NSW Guidelines on Assuring Future Urban Water Security.
Environmental planning and approvals

The project is permissible without development consent under Part 4 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) due to the application of Clause 125(1) of State Infrastructure Planning Policy (Infrastructure) 2007. The project is an activity that requires assessment under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and WaterNSW is the proponent and a determining authority as defined under section 110(1) of the EP&A Act.

The following approvals, licence or permits are also required for the project:

- Department of Primary Industries – Water for relevant approvals and licences under the Water Management Act 2000
- Roads and Maritime Services, Department of Industry – Lands and Forestry, Broken Hill City Council, Wentworth Shire Council – for works within classified roads that require approval under the Roads Act 1993.
- Office of Environment and Heritage – for activities that impact on Aboriginal cultural heritage and require a permit under the National Parks and Wildlife Act 1974.
- Australian Rail Track Corporation – A Construction Licence for works within the rail corridor and an Asset Licence for the pipeline within the rail corridor.

Summary of environmental impacts

Section 111 of the EP&A Act requires that the determining authority take into account the fullest extent possible all matters likely to impact on the environment due to the proposal. This REF has been prepared to meet the requirements of Section 111 and 112 of the Act. It details measures to minimise impacts and identifies whether the project is likely to have a significant environmental impact.

The main adverse impacts identified during construction would be associated with:

- Aboriginal cultural heritage. Aboriginal Heritage Impact Permits would be obtained because the project would impact on Aboriginal cultural heritage.
- soil and water due to erosion and sedimentation
- vegetation removal, primarily within road reserves and in areas that have been disturbed by previous land uses. A small area of Purple-wood Wattle which is a threatened species listed under the Threatened Species Conservation Act 1995 (TSC Act) would be impacted during construction. The project would also impact on the Acacia loderi shrubland and Sandhill pine woodland Endangered Ecological Communities (EEC) as listed under the TSC Act 1995 and the Lowland Darling River EEC and Lower Murray River EECs listed under the Fisheries Management Act 1994. Assessments of Significance were undertaken and conclude that the project is unlikely to have a significant impact on threatened biota.
- air quality due to dust from exposed surfaces
- noise due to the operation of machinery and equipment
impacts on traffic and access to the movement of construction vehicles.

These impacts would be limited to the construction phase and would be minimised by implementing mitigation measures.

Impacts associated with pipeline construction would affect individual locations for a short period of time as the construction works move along the pipeline alignment.

Operational impacts identified are limited to:

- extraction of water from the Murray River and the potential for aquatic organisms to be entrained or impinged at the intake
- discharge of water from the system during maintenance
- noise from the pumping stations
- visual impact of above ground assets.

Operational impacts would be minor and further minimised by implanting mitigation measures.

**Environmental management**

The Contractor will prepare a construction environmental management plan (CEMP) before construction commences.

An Operational Management Plan (OMP) is to be prepared to include measures to manage, operate and maintain the pipeline, pumping stations and associated system post construction.

The CEMP and OMP are to include the mitigation measures and requirements outlined in this REF, as well as any additional conditions of licences, permits or approvals that are required.

**Stakeholder and community consultation**

WaterNSW prepared a Community and Stakeholder Engagement Plan which set the framework for engaging with relevant government agencies, the community and key stakeholders during preparation of the REF. Issues raised during the consultation process have been addressed in the REF. Stakeholder consultation will continue during the detailed design and construction phases.

**Next steps**

The project is required to provide a secure, reliable and long term source of water to Broken Hill and the surrounding communities that complies with the NSW Guidelines on Assuring Future Urban Water Security. As such, the proposal is considered to be in the public benefit.

Overall, potential impacts associated with the proposal are unlikely to be significant, of short duration and can be adequately managed by implementing the mitigation measures outlined in this REF.
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<tr>
<td>BT</td>
<td>Balance Tank</td>
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<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan</td>
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<td>Nominal Diameter</td>
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1 Introduction

1.1 Background

Broken Hill, Menindee, Silverton and Sunset Strip are located in the Far West Region of New South Wales (NSW) (see Figure 1-1). Broken Hill, the most populous of the aforementioned towns, is located approximately 1,100 km west of Sydney and 500 km east of Adelaide. Given the remote location and semi-arid climatic conditions, water supply security has been an ongoing challenge throughout Broken Hill’s 132 year history.

Essential Water supplies water to approximately 18,777 people, industries and mines in Broken Hill, South Broken Hill and Railway Town as well as to the communities of Menindee, Sunset Strip and Silverton. Town water supply is almost entirely dependent on water sourced from the Darling River/Menindee Lakes system. Water is currently being drawn from Weir 32 on the Darling River which is located approximately 100km to the southeast of Broken Hill and transported via the existing above ground 98km Menindee pipeline, which is in poor condition. The pipeline delivers water to the Stephens Creek Reservoir before being pumped an additional 16km to the Broken Hill Mica Street water treatment plant (WTP).

The semi-arid climatic conditions, combined with upstream water demands, limited available storage capacity at Broken Hill and very high surface water evaporation rates have contributed to the ongoing water shortages in the area. Water shortages during drought conditions have resulted in elevated salinity and other water quality problems within the Menindee Lakes system. A temporary desalination (reserve osmosis) treatment plant at the Broken Hill Mica Street WTP was commissioned in 2016 to enable raw water with elevated salinity levels to be treated to comply with the Australia Drinking Water Guidelines (AWDG) before being delivered to customers. The desalination plant has high energy demands and is costly to operate.

1.1.1 Project Development

To find a long-term solution for Broken Hill, the NSW Government looked at a range of options, including sourcing water from deep aquifers, different pipeline routes, changing existing surface water arrangements.

Analysis has been undertaken to evaluate a range of water options to deliver water security to the region by complying with the NSW Guidelines on Assuring Future Urban Water Security (DPI Water, 2013). This involved a cost-benefit analysis and targeted consultation with a range of stakeholder groups over a 12 month period. The option evaluation is summarised in Section 4 of this REF. The construction of a water supply pipeline from the River Murray at Wentworth to Broken Hill was determined to be the preferred long-term option to secure Broken Hill’s water supply.

The analysis demonstrated the case for change, and the ‘Preferred Option’ to meet the Government’s objectives. It is within those objectives, and the broad parameters of the preferred investment identified by the business case, that the NSW Government approved the investment decision and directed WaterNSW to deliver “the project” in accordance with its directions, as noted in the Project Need and Justification (section 3.4).
1.1.2 Current Situation

Broken Hill and surrounding communities have a semi-arid climate and are dependent on water stored in Menindee Lakes for their water supply. The region has experienced severe water shortages and water quality issues throughout its history, and a range of short-term strategies have been implemented during these events.

Short-term water solutions, including an upgrade and recommissioning of Essential Water’s reverse osmosis plant in Broken Hill and construction of the Menindee Common Bore Field, were put in place to meet the community’s short-term needs. However, these solutions do not provide long-term water security for the community, business or Government.

The lack of long-term water security has the potential to jeopardise investment by industry in the region, including mining and tourism. This in turn may affect employment prospects for local residents and place economic pressure on the local community and the wider region.

The River Murray to Broken Hill Pipeline project (the project) seeks to benefit the local community and economy by providing a long-term sustainable water supply that complies with the NSW Guidelines on Assuring Future Urban Water Security. The project is needed to minimise the risk of the frequency and severity of impacts of droughts. Securing the region’s water supply will likely assist the Broken Hill region better manage the difficulties of its climate, remoteness, and unique socioeconomic issues.

1.2 Description of the Project

An overview of the project is provided in Figure 1-2. The main components include:

- A lift pump station at the River Murray with associated inlet works (referred to as the River Murray intake) located adjacent to the existing Wentworth Town Water Supply pumping station (PS) in Wentworth, and demolition of the disused wet well (associated with the Wentworth Town Water Supply PS);
- A below ground pipeline comprising 750 mm diameter mild steel concrete lined (MSCL) pipes to transport water from the River Murray intake to the Mica Street WTP. The pipeline would be located predominantly within the Silver City Highway road reserve on the western side of the highway. The total pipeline length is approximately 270 km;
- A dosing plant and associated transfer pump station (TPS1),
- Two transfer pumping stations (TPS2 and TPS3), and associated balance tanks and photovoltaic power generation system, located along the main pipeline alignment adjacent to the Silver City Highway (it is noted that a number of site options are being considered);
- A bulk water storage pond located adjacent to the Silver City Highway;
- Terminal balance tank and associated pipework at Mica Street WTP;
- Associated electrical (engineering), mechanical and civil works, including ancillary infrastructure such as scour valves and air valves.

Power supply to the River Murray intake, TPSs and bulk water storage will be provided by connecting to Essential Energy’s existing network. The power supply infrastructure is
being assessed separately. The details of the telemetry system required for the project, would also be subject to separate environmental assessment.

**Operation**

The project would transfer raw water from the River Murray in Wentworth to Broken Hill via a 270 km pipeline and a series of pumping stations, balance tanks and a bulk storage. A dosing plant would be located at TPS 1 to adjust the pH of the raw water. The raw water would be treated using the existing processes at the Mica Street WTP. Once operational, the scheme will be capable of providing a peak demand of 37.4 ML/d.
1.3 **Project Objectives**

The objectives of the project are to:

- provide a secure, reliable and long-term source of water to Broken Hill and the surrounding communities that complies with the NSW Guidelines on Assuring Future Urban Water Security,
- undertake the project consistent with all relevant environmental and planning legislation, regulations and guidelines.

1.4 **Land Ownership**

The proposed works would be located in Western NSW extending from Wentworth to Broken Hill. The infrastructure associated with the project would be installed on a number of different land allotments and tenure types as summarised in Table 1-1. More detailed information on the land ownership and tenure along the project site is provided in Appendix K.

**Table 1-1 Infrastructure and Land Ownership**

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Lot / DP</th>
<th>Land Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Murray Intake</td>
<td>Lot 1 and Lot 2 (part) DP817572</td>
<td>Crown Land managed by Wentworth Shire Council</td>
</tr>
<tr>
<td>Pipeline</td>
<td>Various (see Appendix K)</td>
<td>Various including Crown Land, private and Council owned (see Section 5.3)</td>
</tr>
<tr>
<td>Dosing Plant and TPS1</td>
<td>Lot 5102 DP720104</td>
<td>‘Thegoa’ Western Lands Lease 3828</td>
</tr>
<tr>
<td>TPS2 – Option 1</td>
<td>Lot 5302 DP768217</td>
<td>Crown Land WLL659 (Perpetual Lease)</td>
</tr>
<tr>
<td>TPS2 – Option 3</td>
<td>Lot 4077 DP766582</td>
<td>Radford-Western Lands Lease 7972</td>
</tr>
<tr>
<td>TPS3</td>
<td>Lot 29 DP 760275</td>
<td>Crown Land WLL659 (Perpetual Lease)</td>
</tr>
<tr>
<td>Bulk water storage</td>
<td>Lot 6475 DP769304</td>
<td>Bright- Western Lands Lease 430</td>
</tr>
<tr>
<td>Mica Street WTP</td>
<td>Lot 2129 DP 757298 Lot 7467 DP 1182254</td>
<td>Essential Energy</td>
</tr>
<tr>
<td>Pipeline</td>
<td>Lo1 1 DP 533250</td>
<td>ARTC</td>
</tr>
</tbody>
</table>
Figure 1-1 Locality Plan
Figure 1-2 Overview of the River Murray to Broken Hill Pipeline Project infrastructure
1.5 Purpose of this report

For the purposes of these works, WaterNSW is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This review of environmental factors (REF) has been prepared to assess the potential environmental impacts of the project. In doing so, the REF helps to fulfil the requirements of section 111 of the EP&A Act, that WaterNSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The description of the project and associated environmental impacts have been undertaken in context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The REF identifies the measures that need to be implemented to avoid or minimise potential environmental impacts that may be associated with the project.

The findings of the REF would be considered when assessing:

- whether the project is likely to have a significant environmental impact and therefore the need for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Environment under Part 5.1 of the EP&A Act
- the significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement
- The potential for the project to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether approval is required under the EPBC Act.

The footprint assessed in this REF is limited to the area described in section 6.2.
2 Statutory Considerations

The following section details the key legislation, environmental planning instruments, NSW government policies and guidelines applicable to the construction and operation of the project (excluding the power supply).

2.1 Permissibility under the NSW Environmental Planning and Assessment Act

The EP&A Act and its associate regulations provide a framework for environmental planning and assessment in NSW. The need or otherwise for development consent is set out in environmental planning instruments – State Environmental Planning Policies (SEPPs), Regional Environmental Plans (REPs) or Local Environmental Plans (LEPs).

The project would be located within Wentworth Shire local government area (LGA) in the Wentworth urban area and southern pipeline section which is subject to the Wentworth LEP. The section of the project within the Broken Hill urban area is within the Broken Hill City LGA and is subject to the Broken Hill LEP. The remaining section of the pipeline (including TPS3) between the Wentworth Shire and Broken Hill City LGAs is within unincorporated areas (i.e. no local government) and is administered by the DoI – Lands and Forestry.

Section 2.1.5 indicates that the project does not require development consent under Part 4 of the EP&A Act due to the application of Clause 125(1) of State Infrastructure Planning Policy (Infrastructure) 2007. The project is an activity that requires assessment under Part 5 of the EP&A Act and WaterNSW is the proponent and a determining authority as defined under section 110(1) of the EP&A Act.

Section 111 of the EP&A Act outlines the duty of determining authorities to consider the environmental impacts of an ‘activity’. When considering an activity, the determining authority is required to ‘examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment’.

Section 112 of the EP&A Act requires a determining authority to consider whether an activity is ‘likely to significantly affect the environment’ (including critical habitat) or threatened species, populations or ecological communities, or their habitats. If a determining authority is of the opinion that an activity would be likely to significantly affect the environment, by virtue of a Ministerial order, the activity would then require the approval of the Minister for Planning and Environment. Factors that need to be taken into account when considering the likely impact of an activity on the environment are outlined in Clause 228 of the EP&A Regulation. A review of the project against Clause 228 is contained in Appendix A.

Section 6 of this REF assesses the likely effect of the project on the environment. As the project is unlikely to result in significant impacts, an environmental impact statement is not required, and a REF has been prepared to assess the environmental impacts to satisfy the requirements of Part 5 of the EP&A Act.

Under Section 110(1) of the EP&A Act, a determining authority means ‘a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out’. 
The following organisations are determining authorities for the project:

- WaterNSW – as the proponent
- Department of Primary Industries – Water for relevant approvals and licences under the Water Management Act 2000
- Roads and Maritime Services – for works within classified roads that require approval under the Roads Act 1993.
- Office of Environment and Heritage – for activities that impact on Aboriginal cultural heritage and require a permit under the National Parks and Wildlife Act 1974.

### 2.1.1 Wentworth Local Environmental Plan 2011

The River Murray intake, dosing plant, TPS1, TPS2 and the southern section of the pipeline would be located within the Wentworth Local Government Area and which is subject to the Wentworth Local Environmental Plan 2011 (Wentworth LEP).

The land zonings and zone objectives for the each of the infrastructure components are provided in Table 2-1 below;

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Land Zoning</th>
<th>Zone Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Murray intake Initial section of the main pipeline from intake</td>
<td>RU5 Village</td>
<td>To provide for a range of land uses, services and facilities that are associated with a rural village. To promote development in existing towns and villages in a manner that is compatible with their urban function. To encourage well-serviced sustainable development. To ensure there are opportunities for economic development. To deliver new residential and employment growth in Buronga and Gol Gol. To ensure business and retail land uses are grouped within and around existing activity centres.</td>
</tr>
<tr>
<td>River Murray Intake (instream) Tuckers Creek Crossing</td>
<td>W2</td>
<td>To protect the ecological, scenic and recreation values of recreational waterways. To allow for water-based recreation and related uses. To provide for sustainable fishing industries and recreational fishing.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Land Zoning</td>
<td>Zone Objectives</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pipeline through Wentworth</td>
<td>IN1 General Industrial</td>
<td>• To provide a wide range of industrial and warehouse land uses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To encourage employment opportunities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To minimise any adverse effect of industry on other land uses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To support and protect industrial land for industrial uses.</td>
</tr>
<tr>
<td>Darling River Crossing</td>
<td>W1</td>
<td>• To protect the ecological and scenic values of natural waterways.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To prevent development that would have an adverse effect on the natural values of waterways in this zone.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To provide for sustainable fishing industries and recreational fishing.</td>
</tr>
<tr>
<td>Dosing Plant, TPS1, TPS2, Main pipeline</td>
<td>RU1 Primary Production</td>
<td>• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To encourage diversity in primary industry enterprises and systems appropriate for the area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To minimise the fragmentation and alienation of resource lands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To minimise conflict between land uses within this zone and land uses within adjoining zones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To ensure the protection of both mixed dryland and irrigation agricultural land uses that together form the distinctive rural character of Wentworth.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To ensure land is available for intensive plant agricultural activities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To encourage diversity and promote employment opportunities related to primary industry enterprises, including those that require smaller holdings or are more intensive in nature</td>
</tr>
</tbody>
</table>

As discussed in Section 2.1.5, State Environmental Planning Policy (Infrastructure) 2007 is the relevant environmental planning instrument for the project and allows water reticulation systems to proceed on any land without the need to obtain development consent.

### 2.1.2 Broken Hill Local Environmental Plan 2013

The northern section of the project would be located within the Broken Hill LGA which is subject to the Broken Hill Local Environmental Plan 2013 (BH LEP 2013). The pipeline would be located within a number of land zonings, including RU2 Rural Landscape, SP1
Special Activities, SP2 Infrastructure, IN1 General Industrial, B2 Local Centre and R1 General Residential, E2 Environmental Conservation (see Table 2-2).

As discussed in Section 2.1.5, State Environmental Planning Policy (Infrastructure) 2007 is the relevant environmental planning instrument for the project and allows water reticulation systems to proceed on any land without the need to obtain development consent.

**Table 2-2 Land zonings and objectives under the Broken Hill LEP 2013**

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Land Zoning</th>
<th>Zone Objectives</th>
</tr>
</thead>
</table>
| Mica Street WTP | SP2 Infrastructure | • To provide for infrastructure and related uses.  
• To prevent development that is not compatible with or that may detract from the provision of infrastructure. |
| Pipeline | B2 Local Centre | • To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area.  
• To encourage employment opportunities in accessible locations.  
• To maximise public transport patronage and encourage walking and cycling. |
| Pipeline | R1 General Residential | • To provide for the housing needs of the community.  
• To provide for a variety of housing types and densities.  
• To enable other land uses that provide facilities or services to meet the day to day needs of residents. |
| Pipeline | IN1 General Industrial | • To provide a wide range of industrial and warehouse land uses.  
• To encourage employment opportunities.  
• To minimise any adverse effect of industry on other land uses.  
• To support and protect industrial land for industrial uses. |
| Pipeline | RU2 Rural Landscape | • To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.  
• To maintain the rural landscape character of the land.  
• To provide for a range of compatible land uses, including extensive agriculture. |
| Pipeline | SP1 Special | • To provide for special land uses that are not |
Infrastructure | Land Zoning | Zone Objectives
--- | --- | ---
Activities | | provided for in other zones.
- To provide for sites with special natural characteristics that are not provided for in other zones.
- To facilitate development that is in keeping with the special characteristics of the site or its existing or intended special use, and that minimises any adverse impacts on surrounding land.

Pipeline | E2 Environmental Conservation | • To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To promote the preservation, conservation and enhancement of major landscape features and native fauna and flora in Broken Hill.

2.1.3 Unincorporated Areas of NSW

TPS3 and approximately 140 km of the pipeline are located within the Unincorporated Area of NSW, of which there is no local Council. As such, these areas have no land zoning or classification. While the Western Lands Commissioner undertakes some functions in the Unincorporated Area, this does not extend to planning consent or determination of land zoning/classification.

The pipeline and TPS3 meet the definition of a water reticulation system for the purposes of State Environmental Planning Policy (Infrastructure) 2007 cl 125(1) and as such are permissible without consent on any land.

2.1.4 Murray Regional Environmental Plan No 2 – Riverine Land

Murray Regional Environmental Plan No 2 – Riverine Land (MREP No.2) applies to riverine land of the River Murray within Wentworth LGA and aims to ensure that appropriate consideration is given to development with the potential to adversely affect the riverine environment and to establish a co-ordinated approach to environmental planning and assessment along the River Murray. The proposed River Murray intake is located on land subject to the MREP No. 20. The MREP No. 20 is deemed to be a SEPP.

Under the MREP No. 20, the River Murray means the waters of the main channel of the River Murray and its bed and banks, while the River Murray means the River Murray, the waters and the bed and banks of its tributaries and associated water bodies (including related anabranches, creeks, lagoons, lakes, billabongs and wetlands), as shown on the REP maps.

The objectives of the plan are:

(a) to ensure that appropriate consideration is given to development with the potential to adversely affect the riverine environment of the River Murray, and
(b) to establish a consistent and co-ordinated approach to environmental planning and assessment along the River Murray, and

(c) to conserve and promote the better management of the natural and cultural heritage values of the riverine environment of the River Murray.

Clause 13 of the MREP No. 20 provides planning controls for certain works undertaken on land subject to the SEPP. The MREP No. 20 states that development consent is only required for public utility undertaking (which includes the supply of water) that is likely to significantly affect the environment. As the works will not significantly affect the environment, development consent from Council is not required.

Clause 8(c) requires consideration of the following planning principles when a public authority proposes to carry out development which does not require development consent but which has the potential to adversely affect the riverine environment of the River Murray:

(a) the aims, objectives and planning principles of MREP No.2,

(b) any relevant River Management Plan,

(c) any likely effect of the proposed plan or development on adjacent and downstream local government areas,

(d) the cumulative impact of the proposed development on the River Murray.

MREP No.2 includes a number of specific principles for:

- foreshore access (see Section 6.2),
- bank disturbance (Section 6.7),
- landscaping (Section 6.9) and
- water quality (Section 6.8).

Clause 13 requires consultation with the following agencies for works that relate to public utility undertakings or the excavation, dredging or alteration to the alignment or shape of the bank or bed of the River Murray:

- Office of Environment and Heritage (previously Conservation and Land Management (CaLM)),
- Department of Primary Industries (DPI) Water (previously Department of Water Resources (DWR)),
- Environment Protection Authority (EPA),
- Murray Darling Basin Authority (MDBA),
- Roads and Maritime Service (RMS),
- DPI Fisheries, and
- if adjacent to River Murray, Victorian Department of Environment, Land, Water and Planning (previously Conservation and Natural Resources (C&NR)).

These agencies have been consulted and the responses are summarised in Section 2.5.5.
2.1.5 **State Environmental Planning Policy (Infrastructure) 2007**

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to assist in the effective delivery of public infrastructure by improving certainty and regulatory efficiency. The ISEPP provides clear definition of environmental assessment and approval process for public infrastructure and services facilities.

Clause 125 (1) of the ISEPP states that development for the purpose of water reticulation system may be carried out by or on behalf of a public authority without consent on any land. A water reticulation system is defined by ISEPP as a **facility for the transport of water, including pipes, tunnels, canals, bores, pumping stations, related electricity infrastructure, dosing facilities and water supply reservoirs**. The project comprises elements such as a raw water intake, dosing plant, pipeline, balance tanks and pumping stations. These elements are for the purpose of water transport and therefore meet the definition of a water reticulation system and can therefore proceed without the need to obtain development consent.

Accordingly, the project is described by clause 125(1) and can proceed without the need to gain development consent.

2.1.6 **State Environmental Planning Policy (State and Regional Development) 2011**

The *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) declares certain types of development and infrastructure to be of State and regional significance. Schedule 3 of the SRD SEPP lists infrastructure projects that are declared to be State significant infrastructure and includes:

- Development for the purpose of a water storage or water treatment that has a capital investment value of more than $30 million (Clause 4(1)).
- Development for the purpose of a pipeline where a licence under the *Pipelines Act 1967* is required.
- Infrastructure that would have a significant impact on the environment and consequently require an environmental impact statement (EIS) under Part 5 of EP&A Act (Clause 1(1)).

Development determined to be State significant infrastructure requires the preparation of an Environmental Impact Statement (EIS) in accordance with Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and consent of the Minister for Planning and Environment.

The project meets the definition of a water reticulation system as discussed in section 2.1.5 and is not considered to be for the purpose of water treatment. The project therefore is not subject to Clause 4(1) of Schedule 3 of the SRD SEPP.

The pipeline does not require a licence under the *Pipelines Act 1967* (Section 5(1)(b)) and therefore is not State significant infrastructure under clause 5 of the SRD SEPP.

As the project is unlikely to significantly affect the environment an EIS is not required, therefore it would not be State significant infrastructure under clause 1(1) of Schedule 3(1) of the SRD SEPP.
2.1.7 State Environmental Planning Policy No 44 Koala Habitat Protection

The State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

The Wentworth LGA is listed under SEPP 44 as having potential koala habitat. Although SEPP 44 does not apply to activities assessed under Part 5 of the EP&A Act (refer to Section 2.1), the potential impacts to koalas have been considered in the preparation of this REF.

A Flora and Fauna Assessment has been prepared by NGH Environmental (2017) to assess the potential impacts of the project (provided in Appendix D - Flora and Fauna Assessment). The assessment concludes that the project would not significantly impact core koala habitat.
2.2 NSW Legislation

2.2.1 Water Management Act 2000

The object of the *Water Management Act 2000* (WM Act) is the sustainable and integrated management of the State’s water for the benefit of both present and future generations. The WM Act is the main piece of water legislation for NSW ensuring secure access of water for users and that water is provided for the environment.

**Approvals**

The following provides an overview of approvals required for the River Murray to Broken Hill Pipeline Project:

- a water access licence (s.56) is required to extract water from the River Murray Water Source
- a water supply work approval (s.90(2)) to construct a water supply work and undertake works within waterfront land.

DPI Water has advised that a water use approval is not required under s.89 of the WM Act because the project would be for a town water supply, or stock and domestic water supply.

Clause 34 (1) of the *Water Management (General) Regulation 2011* (WM Reg) states that a person is exempt from section 91B (1) of the Act in relation to the construction of water pipe where the sole use is for conveying water from one place to another. This exemption does not apply on waterfront land (other than waterfront land relating to a minor stream) (cl 34(2)(j)). Waterfront land is defined under the WM Act to mean:

(a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or

(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or

(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,

Waterfront land includes the area within 40 m of the above. Minor streams are first or second order streams which do not maintain a permanent flow (cl 3 WM Reg). The majority of waterways in the project area are considered to be minor streams and are therefore exempt under Clause 34 (1) of the WM Reg. The water supply work approval would therefore need to ensure it covers the directional drilling establishment sites and any works within 40 m of Darling River, River Murray and Tuckers Creek.
Clause 38 of the *Water Management (General) Regulation 2011* exempts public authorities from the requirement to obtain a controlled activity approval under Section 91E of the WM Act, which would normally be required for works involving the removal of material from waterfront land. Although WaterNSW is not required to obtain this controlled activity approval, DPI Water has advised that the proposal should be constructed in accordance with DPI Water guidelines for instream works on waterfront land.

An aquifer interference approval under Section 91 is required if more than 3 ML of groundwater is extracted per annum. Based on the consideration of soils, geology and climate it is considered unlikely that a groundwater would be intercepted during the construction works and therefore an aquifer interference approval is unlikely to be required.

**Water Access Licence**

The WM Act provides for a local water utility to gain water access for town supply through a special purpose access licence. The Act also provides the legislative framework for water transactions in NSW. Details of Essential Water’s existing WAL for water supply are provided in Section 3.1.3. There are three options currently being considered with regards to the water access licence (WAL) for the River Murray to Broken Hill Pipeline Project.

The WAL would be obtained by Essential Water. Essential Water will consult with DPI Water to confirm the preferred option to obtain the WAL.

The WAL would be issued and operated in accordance with the rules set out in the *NSW Murray and Lower Darling Regulated Rivers Water Sharing Plan*.

**2.2.2 Crown Lands Act 1989**

The *Crown Lands Act* 1989 sets out how Crown land is to be managed in NSW. The Act is administered by Crown Lands Division within the Department of Industry – Lands & Forestry (DoI – Lands & Forestry). A large section of the pipeline is located on unincorporated Crown land.

Under s155 of the Act it is an offence to erect a structure, clear or dig up public land without a lawful authority. Elements of the project within Crown land would require authorisation by a lease, licence or other permit to allow the use of Public Land (section 45 of the Act). DoI – Lands have been consulted with regards to the project and the requirement to access Crown Land.

**2.2.3 Crowns Land Management Act 2016**

The Crown Lands Management Act 2016 was passed in November 2016 but has not yet commenced. It is anticipated that the majority of this new legislation will commence in early 2018. Upon coming into force, this Act will consolidate eight pieces of legislation into one, including the *Crown Lands Act 1989* and *Western Lands Act 1901*. The aim of the new legislation is to reduce complexity and duplication with regard to management of Crown lands. The proposed works are consistent with the *Crown Lands Management Act 2016* and this Act will not impose any requirements for additional approvals when it commences.

**2.2.4 Western Lands Act 1901**

A large section of the pipeline is held under lease from the Government under ‘Western lands leases’. The *Western Lands Act 1901* Act regulates how land in the Western
Division can be used, how roads and rights of way are created, and how leases are issued. One of the objectives of the Act is to ensure that Western Division land is used in accordance with the principles of ecologically sustainable development. Schedule 2 of the Act specifies provisions of the *Crown Lands Act 1989* that apply to land in the Western Division.

Where the project impacts areas within the Western Division, any lease, licence, easement or acquisition relating to the project will require the written consent of the Lessee, any owner of an affected interest, and DoI – Lands & Forestry.

### 2.2.5 Roads Act 1993

Under Section 138 of the *Roads Act 1993* a person must not *erect a structure or carry out a work in, on or over a public road*, other than with the consent of the appropriate roads authority. However, Schedule 2, Clause 5(1) states that a public authority is not required to obtain a roads authority’s consent under Section 138 to exercise the public authority’s functions in, on or over an unclassified road other than a Crown road.

Silver City Highway is a Classified Road, and therefore Section 138 of the *Roads Act 1993* applies. DoI – Lands & Forestry, Wentworth and Broken Hill Councils are the relevant roads authorities. All works within the Silver City Highway road corridor will require approval from the relevant roads authority and concurrence of RMS under Section 138(2) of the *Roads Act 1993*.

### 2.2.6 Protection of the Environment Operations Act 1997

The NSW Environment Protection Authority (EPA) is responsible for the administration of the *Protection of the Environment Operations Act 1997* (POEO Act). The POEO Act regulates air, noise, land and water pollution.

Activities listed under Schedule 1 of the POEO Act are scheduled activities that require an environment protection licence (EPL). Land-based extractive activities that involve the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials are considered to be a scheduled activity requiring an EPL under the POEO Act. Clause 19 of Schedule 1 defines land-based extractive activity as meaning *the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods*.

It is predicted the project would require the excavation of more than 30,000 tonnes of material. The EPA is the Appropriate Regulatory Authority as the work is being undertaken by a public authority. EPA has advised that they consider a licence is not required given the extracted material would be reused on the site it is generated for construction purposes (refer to Table 2-4).

Schedule 1 clause 17 lists general electricity works with capacity to generate more than 30 megawatts of electrical power as a scheduled activity. This excludes solar power, and therefore does not apply to the proposed PV generation plants.

Based on the likely construction methodology, the works would not trigger any Scheduled 1 activities for which an EPL would be required such as concrete batching plant, crushing, grinding or separating materials or waste storage. Should the contractor decide to establish a batching plant for concrete production, or to undertake on-site crushing, grinding or separating materials with the capacity to process more than 150 tonnes of
materials per day or 30,000 tonnes of materials per year, EPA would be consulted to confirm whether an EPL is required.

Section 120 of the POEO Act makes it an offence to pollute waters. It is considered that the construction and operation of the project can be carried out without causing water pollution and therefore a licence would not be required. Consultation with the EPA has confirmed that an EPL is unlikely to be required, if spoil is managed in accordance with the methodology set out in this REF.

WaterNSW and its contractors will comply with POEO Act, including the requirement to notify EPA under section 148 if a pollution event occurs that causes or threatens material harm.

### 2.2.7 Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation 2014* sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The disposal of construction waste including spoil and operational water by-products would be required to comply with this regulation.

### 2.2.8 Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

Notification is required for any proposed dredging and reclamation works in 'waterland' undertaken by a public authority (other than a Council), in accordance with Section 199 of the FM Act.

The project would require a new river intake (including pumping station and inlet) to extract water from the River Murray, as well as several waterway crossings along the pipeline alignment. These works are considered to be dredging for the purposes of the FM Act and would require DPI Fisheries to be notified under Section 199 of the FM Act. WaterNSW is required to consider any matters raised by DPI Fisheries within 21 days of the notification being given. The removal of snags is also considered to constitute dredging under the FM Act and as such notification to DPI Fisheries is required if this were undertaken as part of construction.

### 2.2.9 Threatened Species Conservation Act 1995

The assessment of flora and fauna impacts has been undertaken under the (former) *Threatened Species Conservation Act 1995* (TSC Act). The Act protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW.

Biodiversity assessments are now subject to the provisions of the recently enacted *Biodiversity Conservation Act 2016* (See Section 2.2.11 below). General savings provisions under Schedule 9 4(1) of the *Biodiversity Conservation Act 2016* state that anything done under a former Act before the repeal of the former Act and still having effect immediately before that repeal could have been done under this Act if this Act had been in force when the thing was done, the thing done continues to have effect as if it had been done under this Act.
2.2.10 Biodiversity Conservation Act 2016


As stated in Section 2.2.9 above, assessment of the project has been undertaken under the TSC Act in reference to the Savings, transitional and other provisions under Schedule 9 of the *Biodiversity Conservation Act* 2016.

2.2.11 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act* 1974 (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. The Office of Environment and Heritage (OEH) administers the NPW Act. Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86).

An Aboriginal Cultural Heritage Assessment (ACHA) is currently being prepared for the project by Niche Environment and Heritage (2017), a draft of which is provided in Appendix E. Aboriginal objects were found during the field survey undertaken as part of the ACHA (see Section 6.11) and harm to these objects cannot be avoided. Therefore an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act to take or destroy Aboriginal objects will be required prior to construction works commencing. Due to the extent of the project area, applications are being prepared to obtain four (staged) AHIPs. This approach is proposed to enable construction to commence in each section once the AHIP has been obtained for that section.

2.2.12 Heritage Act 1977

The *Heritage Act* 1977 is a statutory tool designed to conserve environmental heritage in NSW. It is used to regulate development impacts on the state’s historical heritage assets. The Act defines a heritage item as “a place, building, work, relic, moveable object or precinct”. To assist with the management of the State’s heritage assets, the Act distinguishes between items of local and State heritage significance. Items that are assessed as having State heritage significance are be listed on the NSW State Heritage Register. Proposals to alter, damage, move or destroy heritage items listed on the State Heritage Register or protected by an Interim Heritage Order, require an approval under s.60 of the *Heritage Act* 1977 unless they involve works that are exempt from the need to obtain approval from the Heritage Council.

There are no items listed on the State Heritage Register located within, or in close proximity to, the project areas and no approval under the *Heritage Act* 1977 will be required.

2.2.13 Local Land Services Act 2013

The *Local Land Services Act* 2013 regulates the clearing of native vegetation on rural land in NSW. However, the Act does not apply to any clearing that is authorised under other legislation, including an activity carried out by a determining authority within the meaning of Part 5 of that Act after compliance with that Part (s60O(b)).
As this project would be an activity within the meaning of Part 5 of the EP&A Act, the *Local Land Services Act* 2013 does not apply.

The Broken Hill and Wentworth township areas are categorised as ‘excluded land’ on OEH native vegetation regulatory mapping under the LLS Act.

### 2.2.14 Wilderness Act 1987

The *Wilderness Act* 1987 provides the legislative framework for the nomination, assessment, identification and declaration of wilderness and its subsequent management in NSW. The *Wilderness Act* 1987 is administered by the OEH and the National Parks and Wildlife Service is responsible for the investigation, protection and management of wilderness areas in NSW.

There are no declared wilderness areas located within, or in close proximity to, the project areas.

### 2.2.15 Biosecurity Act 2015

The *Biosecurity Act* 2015 repeals the *Noxious Weeds Act* 1993, which previously provided regulatory controls and powers to manage noxious weeds in NSW. The *Biosecurity Act* 2015 guides the management of weeds at the regional level throughout NSW. Under the Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant who knows or ought to know of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Individual land holders and managers are required under the Act to control priority weeds for their area according to the relevant biosecurity toolset. Priority weeds were identified at the site and are discussed further in section 6.9. These weeds would be managed in accordance with the *Biosecurity Act 2015*.

### 2.2.16 Contaminated Lands Management Act 1997

The *Contaminated Lands Management Act* (CLM Act) 1997 provides the management framework for contaminated sites in NSW and is administered by the EPA. A number of registered contaminated sites were identified in the Broken Hill area (see Section 6.14), however these sites would not be impacted by the project.

### 2.3 Commonwealth Legislation

#### 2.3.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist ‘matters of national environmental significance’. Matters of national environmental significance include:

- World Heritage properties;
- National Heritage places;
- Ramsar Wetlands;
- Nationally threatened species and ecological communities;
• Migratory species;
• Commonwealth marine areas;
• Great Barrier Reef Marine Park;
• Nuclear actions (including uranium mining); and
• A water resource, in relation to coal seam gas development and large coal mining development.

A number of matters of national environmental significance were identified in the project area, including several threatened and migratory species, and the City of Broken Hill which is listed as a National Heritage Place. Three wetlands of international importance (Banrock Station, Riverland, The Coorong) are located downstream of the River Murray in South Australia.

An assessment of the project against matters of national environmental significance has determined that it would not result in a significant impact and referral to the Commonwealth Department of Environment and Energy is not required (see Section 6.9 and 6.12 for further details).

Facilitated impacts are defined under the EPBC Act as those impacts which result from further actions (including actions by third parties) which are made possible or facilitated by the action (sub-section 527E(2) of the EPBC Act). No facilitated impacts arising from the proposal are considered to result in a significant impact on matters of national environmental significance.

2.3.2 Native Title Act 1993

The Native Title Act 1993 sets up processes to determine where native title exists, how future activity impacting upon native title may be undertaken, and to provide compensation where native title is impaired or extinguished. The Act gives Indigenous Australians who hold native title rights and interests or who have made a native title claim, the right to be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land.

The majority of the project area is subject to a determined Native Title claim which recognises the Barkandji Traditional Owners as the traditional owners of land. Native Title has been extinguished over most of the land, however the following rights apply:

• exclusive rights apply to certain land at Broken Hill, and east of Wentworth;
• non-exclusive rights apply to most of the River Murray and its shore, land around the outskirts of Broken Hill and between Menindee and Wentworth

Non-exclusive rights allow the traditional owners to access, use and travel over these areas. No areas of exclusive rights have been identified as being impacted by the works. The implications of the Native Title claim and requirements for the project are detailed in Section 5.3. The land parcels subject to the Native Title Claim is detailed in Appendix K.

2.3.3 Water Act 2007

The Water Act 2007 establishes the Murray—Darling Basin Authority (MDBA) and requires the MDBA to prepare the Basin Plan for the sustainable management of water resources
in the Murray-Darling Basin. The Basin Plan and its implications for the project are discussed in Section 2.5.2 below.

Where a State Contracting Government proposes to carry out work not provided for under the Murray Darling Basin Agreement (Schedule 1 to the Water Act 2007) they must submit particulars of the proposal, including plans of the proposed work, to the Murray Darling Basin Authority. The Water Act 2007 does not expressly provide that approval of the Authority is required for any such works, but states that the Authority may approve such works subject to conditions. WaterNSW will consult with the MDBA on whether it considers it has an approval function, or intends to exercise such a function, with respect to the project.

2.4 Summary of Approvals

The following table (Table 2-3) provides a summary of the statutory approvals, permits and notifications required for the project.

2.4.1 Statutory Consultation

The ISEPP (see Section 2.1.5) requires consultation with a local council where a development will result on impacts that are not minor or inconsequential on council-related infrastructure or services. Consultation has been undertaken with Broken Hill City and Wentworth Shire Councils during the project design and preparation of this REF (see Table 2-4), however further consultation would be required prior to and during construction in each local government area.

The MREP No. 2 requires consultation with certain agencies for works undertaken for water supply or within the bank or bed of the River Murray. Whilst the project does not require consent under MREP No. 2, consultation has been undertaken with all agencies as required in clause 13 (See Section 2.1.4 and Table 2-4).

Table 2-3 Summary of approvals, notification and consultation requirements

<table>
<thead>
<tr>
<th>Act or environmental planning instrument</th>
<th>Requirements</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 5 of the EP&amp;A Act</td>
<td>WaterNSW to determine the REF</td>
<td>WaterNSW</td>
</tr>
<tr>
<td><strong>Water Management Act 2000</strong></td>
<td>A water access licence is required under sections 56 and 61 of the Act to extract water from the River Murray. A water supply works approval is required under section 90(2) of the Act for work on waterfront land.</td>
<td>Essential Water will obtain the water access licence. WaterNSW will obtain the water supply works approval.</td>
</tr>
<tr>
<td><strong>Crown Lands Act 1989</strong></td>
<td>A lease, licence or other permit is required from DoI – Lands and Forestry under Section 45 of the Act</td>
<td>WaterNSW</td>
</tr>
<tr>
<td>Act or environmental planning instrument</td>
<td>Requirements</td>
<td>Responsibility</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>--------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>to use and occupy Crown land.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Roads Act 1993</strong></td>
<td>A permit from the relevant road authority under Section 138 of the Act would be required for works within a classified road. The relevant road authority may be RMS, DoI – Lands and Forestry, Broken Hill City Council, or Wentworth Shire Council.</td>
<td>WaterNSW (via the Contractor)</td>
</tr>
<tr>
<td><strong>Fisheries Management Act 1994</strong></td>
<td>DPI - Fisheries is required to be notified in accordance with section 199 of the Act.</td>
<td>WaterNSW</td>
</tr>
<tr>
<td><strong>National Parks and Wildlife Act 1974</strong></td>
<td>An AHIP is required from OEH under section 90 of the Act.</td>
<td>WaterNSW</td>
</tr>
<tr>
<td><strong>ISEPP</strong></td>
<td>Broken Hill City Council and Wentworth Shire Council are required to be consulted under clause 13 of ISEPP. RMS is required to be consulted under clause 16 of ISEPP.</td>
<td>WaterNSW</td>
</tr>
</tbody>
</table>
| **MREP 2**                               | The following organisations are required to be consulted under clause 13:  
  - DPI Water  
  - DPI Fisheries  
  - RMS  
  - OEH  
  - MDBA  
  - EPA  
  - Wentworth Shire Council  
  - DELWP (Vic) | This consultation was completed during preparation of the REF. |
| **Water Act 2007 (Cth)**                 | Approval from MDBA may be required under Schedule 1, clause 63 of the Act to carry out work not provided for under the Murray Darling Basin Agreement. | WaterNSW |
### 2.5 Policies, Guidelines and Management Plans

#### 2.5.1 The Water Sharing Plan for the Murray and Lower Darling Regulated Rivers Water Sources 2016

The Water Sharing Plan for the Murray and Lower Darling Regulated Rivers Water Sources (WSP) regulates both the Lower Darling Water Source and Murray Water Source. The WSP sets the rules for the management of water access licences, water allocation accounts, the extraction of water, the operation of dams and the management of environmental water flows. Conditions in relation to water supply work approvals are also provided in the WSP. The WSP sets annual limits on diversions per water source, which are known as Long-Term Annual Average Extraction Limits, commonly referred to as ‘Plan Limits’. The Plan Limits are set below Murray Darling Basin ‘Cap’ levels (see Section 2.5.2) that would authorise accessing water from the River Murray.

Essential Water holds a Local Water Utility (LWU) NSW WAL, no. 8584 for 9,975ML that is enables water to be extracted at Menindee to supply Broken Hill and related communities. The Murray and Lower Darling Water Sharing Plan indicates that 10,135ML of Local Water Utility is held in the Lower Darling system and it is assumed that the 160ML balance relates to the Pooncarie WAL held by the Wentworth Council.

The existing WAL no. 8584 is a Specific Purpose Access Licence (SPAL). This limits the capacity of the WAL-holder to vary the location of the works, to sell entitlement and transfer water allocations.

The project would require a new WAL to extract water from the River Murray intake in Wentworth. The new WAL may be obtained through:

1. Fully relinquishing WAL 8584 (all allocations) and purchasing a new WAL to meet all the Essential Water’s water needs.
2. Partially relinquishing WAL 8584, maintaining sufficient water to meet local needs at and near Menindee only and purchasing a new water entitlement for the River Murray Intake.

3. Retaining WAL 8584 in full (based on existing the water supply works at Menindee) and seek to transfer the allocation (annually or permanently) to the new water supply works for the River Murray Intake.

Section 4 discusses the options being considered for the WAL required to operate the scheme. Regardless of the option selected, the WAL would need to be consistent with requirements WSP and within the Murray-Darling Basin cap / sustainable diversion limit (SDL).

The Minister for Land and Water would need to consider any proposed changes to a Water Sharing Plan, which is outside the scope of this REF.

Figure 2-1 Murray and Lower Darling WSP area

2.5.2 Murray–Darling Basin Plan 2012

The Murray–Darling Basin Plan (Basin Plan) provides a coordinated approach to water use across the Murray–Darling Basin's four states and the ACT. The Basin Plan reduces the amount of water that can be taken from the rivers by setting sustainable diversion limits (SDLs) for both surface water and groundwater for each catchment in the Basin. The Basin Plan has set a limit of 10,876 GL of surface water which can be taken from the basin each year. The new WAL would need to be consistent with the Basin Plan.
Sustainable Diversion Limits

There are 29 surface water SDL resource units as defined by the Basin Plan. The surface-water SDL is the maximum long-term annual average quantity of water that can be taken on a sustainable basis from water resources in a surface-water SDL resource unit. The proposed new intake point at Wentworth is located within the Lower Darling SDL unit.

Under the Basin Plan, the long-term average SDL for the Lower Darling SDL resource unit is the baseline diversion limit (baseline limit of take from an SDL resource unit) minus 8 GL per year (local reduction amount) minus the SDL resource unit shared reduction amount. The Basin Plan makes the following notes;

- Note 1: The Authority estimates the basin diversion limit to be 60.5 GL per year and therefore this limit is estimated to be 52.5 GL per year minus the SDL resource unit shared reduction amount.
- Note 2: As of 30 June 2012, the reduction achieved is estimated to be 2.8 GL per year and thus the gap remaining is estimated to be 5.2 GL per year in relation to the local reduction amount for this SDL resource unit.

Water Resource Plans

Water Resource Plans (WRP) are being developed as part of the Basin Plan implementation and will consist of a comprehensive suite of plans/documents covering various aspects of water resource management. The WRP areas in NSW largely correspond with NSW's water sharing plans. It is understood that the WSP will form a part of the WRP, and will be updated in order to be in line with the SDL requirements.

Critical Human Water Needs

The Basin Plan and the Murray-Darling Basin Agreement seek to ensure that critical human water needs are met. Critical human water needs refers to the 'minimum amount of water needed to meet basic human needs'.

2.5.3 Policy and guidelines for fish habitat conservation and management 2013 update (DPI, 2013)

The Policy and Guidelines for Aquatic Habitat Management and Fish Conservation Update 2013 (DPI, 2013) (Policy & Guidelines Update) has been prepared to improve the conservation and management of aquatic habitats in NSW and provide guidance on the developments which may impact on aquatic ecosystems. It is targeted at local and state government authorities, proponents of developments and their advisors, and individuals or organisations concerned with the planning and management of our aquatic resources, including conservation organisations.

DPI Fisheries take these policies and guidelines into account when they assess proposals for developments or other activities affecting fish habitats. These policies and guidelines will assist DPI Fisheries to apply the legislative requirements consistently and fairly to individual proposals. DPI Fisheries recommends proponents of developments or other activities to submit proposals that address these policies and guidelines.

Sections of the Policy & Guidelines Update as relevant to the works include;

- Section 3.3.2 Standard precautions and mitigation measures; relevant to all instream works
• Section 4.1.2 Policy and guidelines for fish passage; relevant to pipe laying within waterways
• Section 4.5.2 - Guidelines for temporary structures, relevant to the instream cofferdamming as required for the new River Murray intake,
• Section 4.6.2 - Policy and guidelines for in-stream rehabilitation works, relevant for all instream works post construction
• Section 6.2.2 Policy for water extraction and use

The policy and guidelines detailed in the Policy & Guidelines Update have been considered in this REF as relevant to the project.

DPI Fisheries has been consulted and have provided their requirements to be addressed in the REF (see Section 2.5.5 below). DPI Fisheries has also stipulated the design criteria for the River Murray Intake.

2.5.4 NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)

DPI Water (formerly the NSW Office of Water) has developed a number of guidelines for controlled activities listed under the WM Act. Although the project is exempt from the need to obtain a controlled activity approval under the WM Act (see Section 2.2.1), consideration has been given to these guidelines as relevant to the works.

The Controlled Activities on Waterfront Land – Guidelines for instream works on waterfront land (NOW, 2012) guideline states that the design and construction of works or activities within a watercourse or adjoining waterfront land should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised.

The guideline specifies the information required to accompany an application for a controlled activities approval and has been considered in the concept design and detailed in this REF.

2.5.5 Two Rivers Ski and Recreation Reserve Draft Management Plan

The proposed River Murray intake site is located on land subject to the Two Rivers Ski and Recreation Reserve Draft Management Plan (GHD, 2017), prepared for Wentworth Shire Council and the Great Murray Darling Interpretive Project Committee. The intake site lies within the Zone 1 visitor amenity, which is identified as a high use highly developed area, as distinct from the low key less developed areas. The plan aims to restrict higher impacts to this zone.

Zone 1 currently has a high use for active and passive recreation, including boat launching, car parking for boat trailers and people access the island river banks, picnicking and amenities, visiting the canoe tree. It specifies the following management objectives for the site in order to achieve the following desired management outcomes:

Management Objectives:
• Maintain as high use visitor amenity node with a range of appropriate facilities including toilet facilities
• Emphasis the low key natural features of Junction Island over the channel
• Restrict installation of high level visitor facilities to this site
- Provide for interpretation of canoe tree (Aboriginal scar tree) and visitor orientation
- Provide for boat launching and trailer parking
- Provide for small and large vehicle parking
- Restrict high impact use to the site

**Desired Management Outcomes**

- Improved visit facilities
- Soften site and improve separation between carpark and picnic areas
- Improved traffic flow and vehicle capacity
- Improved signage
- Improve sense of place at canoe tree
- Provide introduction gateway interpretation
- Improve access to island
- Reduce threat from exotic pest species

The presence of an existing intake structure and water tower within this area is not acknowledged in this draft plan, nevertheless it is considered that the construction of a replacement intake structure on the existing pump station site adjacent to existing water supply infrastructure would not impede the continued use of this area for recreational activities. The works are not inconsistent with the objectives of the *Two Rivers Ski and Recreation Reserve Draft Management Plan* (GHD, 2017).

### 2.6 Stakeholder Consultation

#### 2.6.1 Agency Consultation

Consultation with relevant agencies has been ongoing during the preparation of the REF. A summary of the key consultation activities are provided below.

**Agency Workshop**

An agency round table workshop was held in Broken Hill on 24 August 2016, to provide a project briefing. The aim was to invite discussion from the various project stakeholders and highlight key issues to be addressed as part of the project design and environmental assessment. Representatives of the following organisations were in attendance:

- Public Works Advisory (PWA)
- RMS
- DoI - Lands
- OEH
- EPA
- Essential Water
- Essential Energy
- Wentworth Shire Council
• Broken Hill City Council

REF Consultation

Consultation with key stakeholders has been undertaken during the preparation of this REF. This involved an initial consultation letter, with follow up phone and email correspondence at various stages of the REF development. The following agencies have been consulted and their responses are provided in Appendix B:

• DPI Water
• DPI Fisheries
• DoI - Lands
• OEH
• EPA
• RMS
• ARTC
• Central West Local Land Service (formerly Catchment Management Authority)
• Broken Hill City Council
• Wentworth Shire Council
• Murray Darling Basin Authority
• Barkandji Traditional Owners
• Essential Energy
• National Broadband Network (NBN)
• Department of Environment, Land, Water and Planning (Vic)

Concept Design Consultation

Ongoing consultation has been undertaken by the PWA design engineers with the following organisations:

• RMS – requirements for temporary and permanent access points, construction in the road reserve, driveway designs, lighting
• Essential Energy – power supply
• ARTC – pipeline in the rail corridor and associated requirements

2.6.2 Community Stakeholder Consultation

A detailed Stakeholder Engagement Strategy has been developed for the project. The strategy has identified key stakeholders and provides for targeted, proactive stakeholder engagement, concentrated in the early stages prior to start of construction. The strategy includes consultation with affected landowners (see Section 5.3).

During the investigation and preliminary design phase, project information has been available via the project website, via a 1800 community information line and email
address. Individual landowners and both Wentworth and Broken Hill Councils, impacted by the investigation were contacted directly and permission gained to access land.

Community interviews were undertaken as part of the Social Impact Assessment (see Section 6.15.1) from 31 October through to 3 November 2016. A total of 15 interviews were undertaken with a range of community, business and government organisations to understand the social impacts of the project.

In the lead up to the start of construction WaterNSW will be meeting with stakeholders to provide briefings and detail the plan for the delivery of the project.

A Local Representative Committee has been established to provide a forum for ongoing information sharing on pre-construction, construction and commissioning of the River Murray to Broken Hill Pipeline.

The committee will work to:

- gain feedback to inform decisions on aspects of the project that affect the community
- assist in identifying key stakeholders and communicating project information to the broader community
- receive information on the project to support open discussion and provide information back to the project team about potential community benefits and impacts.

Detailed information will be distributed to the community in the form of regular construction updates and project fact sheets. WaterNSW will have project information booths at local community events.

2.6.3 Aboriginal Community Consultation

Statutory Consultation

Consultation with the Aboriginal community has been undertaken as part of the ACHA process and in accordance with Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW, 2010a). The guidelines outline a four stage consultation process and stipulate the statutory notification periods. Stages 1, 2 and 3 are now complete. Consultation undertaken as part of Stages 1 to 3 is provided in the ACHA (Appendix E) and summarised below. Stage 4 is being undertaken progressively as the ACHA reports are completed for each AHIP application.

**Stage 1 – Project Notification and Identification of Aboriginal Parties**

The following registered Aboriginal parties (RAPs) were identified through Stage 1 notification;

- Barkindji Native Title Group Aboriginal Corporation (BNTGAC)
- Barkindji Maraura Elders Environment Team (BMEET)
- Broken Hill Local Aboriginal Land Council (BHLALC)
- Dareton Local Aboriginal Land Council (DLALC)
- Mr. Derek Hardman
Stage 2 – Presentation of Project Information and Project Methodology

The RAPs have been provided information about the project and a copy of the proposed ACHA methodology and invited to provide feedback within the 28 day notification period. Submissions are provided in the ACHA (Appendix E).

Stage 3 – Gathering information about the cultural significance

A key means of gathering information about the cultural significance of the project area has been via the RAP participation in the field survey. Stage 3 consultation has also been undertaken through the receipt of formal submissions and ongoing consultation with the RAPs. Aboriginal Focus Group meetings were held in Wentworth and Broken Hill in March 2017 and provided further mechanism for gathering cultural significance information from the RAPs.

Stage 4 – Review of draft cultural heritage assessment report

Stage 4 consultation will be undertaken in four stages to reflect the staged AHIP application process for the project. The ACHA for the first AHIP application (Broken Hill to Pine Creek) has been submitted to the RAPs for review. The remaining three ACHA will be provided successively to the RAPs for review. A summary of submissions received from the RAPs will be included in the ACHA reports.

Project Stakeholder Consultation

Consultation with Aboriginal leaders has been identified as an important aspect of the Stakeholder Engagement Strategy. The approach will focus on supporting the process commenced as part of the ACHA. Initial meetings will be held with representatives and groups prior to the start of construction to identify communication channels and opportunities for indigenous participation. Regular updates will continue to be provided to representatives and groups when construction starts.

2.6.4 Native Title Claimants

The Barkandji Traditional Owners have been consulted as part of the ACHA process (see Section 2.6.3). Further consultation with the Barkandji Traditional Owners will be undertaken as part of the land use agreement (see Appendix K and Section 5.4).
### Table 2-4 Summary of Agency Consultation

<table>
<thead>
<tr>
<th>Agency</th>
<th>Comment / Issue Raised</th>
<th>Where Addressed in REF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Rail Track Corporation</td>
<td>ARTC compliance documents <em>ETG1701 and AS 4799 - Installation of underground utility services and pipelines within railway boundaries</em> need to be complied with.</td>
<td>Section 6.3.3</td>
</tr>
<tr>
<td></td>
<td>Geotechnical investigation will need to investigate the ground conditions adjacent to the rail crossing. Drilling rig must be kept a minimum distance from the track.</td>
<td>Section 6.3.3</td>
</tr>
<tr>
<td></td>
<td>The pipe may have to be encased.</td>
<td>The pipeline will be encased at least 3m below the track level but confirmation shall be obtained from ARTC</td>
</tr>
<tr>
<td></td>
<td>What will happen to the land around or adjacent to the track?</td>
<td>The land will be rehabilitated following construction works.</td>
</tr>
<tr>
<td></td>
<td>A spotter will be required to monitor any problems, interference and ensure damage to structure does not take place. This needs to be a contract obligation.</td>
<td>Section 6.3.3</td>
</tr>
<tr>
<td></td>
<td>A safe worker may be required to monitor train movements. This may need to be a contract obligation.</td>
<td>Section 6.3.3</td>
</tr>
<tr>
<td>DPI Fisheries</td>
<td>Conform to the <em>NSW Department of Primary Industries Requirements for the Preparation of Environmental Planning and Assessment Documents</em>.</td>
<td>Section 2.5.3</td>
</tr>
<tr>
<td></td>
<td>If the pipeline works involve any dredging and reclamation works then written notice of the work must be provided and 28 days of consideration given.</td>
<td>Section 2.2.8</td>
</tr>
<tr>
<td></td>
<td>If the proposed works permanently or temporarily inhibit, obstruct or block the movement of fish then a permit must be obtained.</td>
<td>Section 2.2.8</td>
</tr>
<tr>
<td></td>
<td>DPI Fisheries preferred option for pipeline crossing of streams would be to either utilise</td>
<td>Section 5.5.5</td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td></td>
<td>existing infrastructure or horizontal directional drilling, over open trenching</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A seven-part test as per Section 5A of the EP&amp;A Act should be undertaken for aquatic threatened species potentially impacted on by the project.</td>
<td>Appendix D</td>
</tr>
<tr>
<td></td>
<td>Any Key Threatening Processes (KTPs – found in the FM Act) should be identified, as well as any mitigating measures.</td>
<td>Appendix D</td>
</tr>
<tr>
<td></td>
<td>The pump station poses a risk of having an impact upon the native fish including threatened species via entrainment, so the REF should include measures to prevent the entry and entrainment of fish (including the larval stages) by the raw water intakes. The intake design is to have a 0.1 m/s approach velocity and a screen aperture of up to 3 mm.</td>
<td>Considered in the design, see Section 5.2.1</td>
</tr>
<tr>
<td></td>
<td>Include any impact mitigation measures that will be undertaken before, during and after the proposed works, including the provision for fish passage, sediment and erosion control and site rehabilitation measures.</td>
<td>Section 7.2.5 and 7.2.7</td>
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<tr>
<td></td>
<td>Any blockages or obstructions to fish passage, whether temporary or permanent will require approval from DPI Fisheries.</td>
<td>Section 2.2.8</td>
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<td></td>
<td>Works that involve the removal or movement of large woody debris or snags require approval from DPI Fisheries.</td>
<td>Section 2.2.8</td>
</tr>
<tr>
<td></td>
<td>Use of explosives in waterways requires a permit from DPI Fisheries.</td>
<td>Use of explosives is not proposed</td>
</tr>
<tr>
<td>DoI – Lands &amp; Forestry</td>
<td>Native Title – Should an Indigenous Land Use Agreement (ILUA) or other agreement be successfully negotiated, payment of any compensation to the Barkandji Native Title Group Aboriginal Corporation (BNTGAC) may be required to proceed with a lease, licence, easement or acquisition.</td>
<td>Noted</td>
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<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>Aboriginal Land Claim – If the proposed water supply uses Crown land, consent for sale, lease, licence or development cannot be given until any Aboriginal Land Claims (ALCs) are formally withdrawn in writing or determined (granted or refused) or written consent has been provided by the NSW Aboriginal Land Council.</td>
<td>Section 5.3</td>
</tr>
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<td></td>
<td>Travelling Stock Reserves – if the project impacts upon Travelling Stock Reserves approval from the relevant Local Land Services (LLS) is required. If no approval is required from LLS then written evidence from the LLS is required to this effect.</td>
<td>Section 5.3</td>
</tr>
<tr>
<td></td>
<td>Crown Land – Where the project impacts upon Crown land (likely a mix of Crown reserve (with or without a Reserve Trust), Crown road, Common and Western Lands Lease (WLL)), the written consent of the Reserve Trust Manager WLL lessee and/or DoI - Lands will be required for any lease, licence, easement or acquisition.</td>
<td>Section 5.3</td>
</tr>
<tr>
<td></td>
<td>Options to authorise water supply infrastructures over Crown land:</td>
<td>Section 5.3</td>
</tr>
<tr>
<td></td>
<td>• Licence – a Crown Land Licence will be required from DoI - Lands to authorise occupation over affected Crown land for the construction, operation and maintenance of the water supply infrastructure. Occupation, use, development or construction must not commence on Crown land until a licence has been granted for that specific purpose.</td>
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<td>• Easement – a request in writing for the creation of an easement over Crown land should be made. Details for the information required for the request can be on the Land and Property Information NSW website. Compensation will be required.</td>
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<td></td>
<td>• Acquisition – an application to acquire Crown land will require full compliance with the <em>Land Acquisition (Just Terms Compensation) Act 1991</em>.*</td>
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<tr>
<td></td>
<td>Silver City Highway – consult with relevant Councils and RMS to identify any impacts on road use and maintenance including potential impact on gravel/borrow pits and water supply.</td>
<td>Section 2.6.1</td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>Environmental Assessment, Consents and Approvals – if the project impacts upon native vegetation then approval will be required from the relevant LLS for any clearing that may be required. If no approval is required from the LLS, then written evidence from the LLS is required to this effect.</td>
<td>No approval is required. See Section 2.2.10</td>
</tr>
<tr>
<td></td>
<td>Provide detailed routes and maps to allow tenure to be properly addressed, in particular: (a) the northern section of the pipeline and Transfer Pump Station No. 3 in the Unincorporated Area; and (b) the proposed route into Broken Hill.</td>
<td>Provided during consultation</td>
</tr>
<tr>
<td></td>
<td>Provide the footprint size of pump site/intakes. Pipeline, pump stations and transfer pump stations.</td>
<td>Table 6-1</td>
</tr>
<tr>
<td></td>
<td>Provide details on any water storage reservoir(s) – will these be new or are they existing, their proposed location, etc.</td>
<td>Section 5</td>
</tr>
<tr>
<td></td>
<td>Given that construction is to commence in late 2017, what is the expected timeframe to have all required approvals in place by?</td>
<td>To be confirmed</td>
</tr>
<tr>
<td>DPI Water</td>
<td>DPI Water advised that the REF should include the following considerations and components:</td>
<td>Sections 3, 4 and 5.2</td>
</tr>
<tr>
<td></td>
<td>An over view of the proposed pipeline and all other alternatives considered to improve water supply security for Broken Hill.</td>
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<td>Justification and design basis for the proposed water treatment and wastewater management facility for the River Murray water source, and the necessary submission for s60 approval under the Local Government Act 1993 or s292 under the Water Management Act 2000 (refer to cl116 of the Water Management (General) Regulation 2011) depending on the project proponent.</td>
<td>Not applicable – the proponent is not a local council.</td>
</tr>
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<td></td>
<td>Justification for the volumetric water entitlement needed from both the Menindee Lake and from River Murray including water balance hydrologic modelling to demonstrate the level of</td>
<td>Section 4.4.</td>
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<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>impact to third parties from the volumetric water entitlement requested from the regulated River Murray source.</td>
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<td>Summary of the existing and future annual water demand for each water use category including the need for any legislative amendments. Once demand for each use category is defined, discussion the DPI Water has been requested.</td>
<td>The category of use is town water supply for residential, commercial and industrial. Stock and domestic offtakes will be provided. No legislative amendments are required. Section 2.5.1, 3.1.4</td>
</tr>
<tr>
<td></td>
<td>Identification of critical human water needs in NSW River Murray Water Source as required by the MDBP, and subsequent discussion with DPI Water.</td>
<td>Section 2.5.2</td>
</tr>
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<td></td>
<td>Details of the proposed change in location of the water offtake in terms of the requirements of the relevant WSPs, including necessary changes or additions to the existing WAL and whether this is consistent with the requirements of any relevant unregulated and/or regulated WSPs.</td>
<td>Section 2.5.1</td>
</tr>
<tr>
<td></td>
<td>Detail the proposed change in location of water offtake in terms of the SDL established by the Basin Plan. If the project is inconsistent with the Basin Plan an amendment to the SDL may need to be proposed.</td>
<td>Section 2.5.2</td>
</tr>
<tr>
<td></td>
<td>Include existing and proposed water licensing requirements in accordance with the WM Act. This is to demonstrate that existing licences (include licence numbers) are appropriate, and to identify where additional licences (WSWA and WAL) are proposed.</td>
<td>Section 2.2.1</td>
</tr>
<tr>
<td></td>
<td>Inclusion of an Operational EMP that defines adequate and secure water supply for construction, testing and on ongoing maintenance of the project.</td>
<td>Section 5.8. An operational EMP needs to be developed by Essential</td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>Identification of water demands, water sources (surface and groundwater), water treatment and waste water disposal methods and water storage in the form of a water balance.</td>
<td>Section 3.1.4, 6.8</td>
</tr>
<tr>
<td></td>
<td>Details of the location, operation and capacity of the proposed infrastructure including the pump stations, pipeline, balance tanks, treatment facility, sludge lagoons, scour valves and offtake points.</td>
<td>Section 5</td>
</tr>
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<td></td>
<td>Impact assessment due to the installation and operation of the pump infrastructure proposed to be located on the River Murray, addressing the following:</td>
<td>Section 6.8, 6.9</td>
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<td></td>
<td>• Construction impacts on the ecology and geomorphic stability of the River Murray.</td>
<td>Section 5.9, 6.9</td>
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<td>• Details of the proposed pump size/s and daily/yearly extraction requirements, and the proposed method to obtain the necessary licensed water entitlement.</td>
<td>The project will be consistent with the WSP</td>
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<td></td>
<td>• Third party impacts (including environment) arising from extraction rates on the other water users within the weir pool including any mitigation measures to manage impacts.</td>
<td>The project will be consistent with the WSP</td>
</tr>
<tr>
<td></td>
<td>• An understanding of the operation of the Murray/Darling River in terms of unregulated and regulated contributions, losses and water user demands will aid in the surface water modelling for this assessment.</td>
<td>The Scheme will be consistent with the WSP</td>
</tr>
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<td>• Availability of water to meet the water demands of the project whilst protecting the water supply for the environment and existing extractive users.</td>
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<td>Assessment of watercourses to be crossed and selection of appropriate techniques and mitigating measures to minimise impact.</td>
<td>Section 6.7</td>
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<td></td>
<td>Design and construction of works within 40m of watercourses are to be in accordance with “DPI Water’s Guidelines for Controlled Activities on Waterfront Land (CAA Guidelines)”. Temporary and permanent vehicle crossings should also be assessed in the REF.</td>
<td>Section 2.5.4,</td>
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<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>Assessment of any impact on flooding, flood distribution and flood flow direction, including an assessment of flood risk of infrastructure including appropriate mitigating measures.</td>
<td>Section 6.7</td>
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<td></td>
<td>Assessment of potential impact of sludge lagoons on groundwater and surface water and measures to monitor and mitigate any impacts.</td>
<td>Section 6.7.2</td>
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<td></td>
<td>Annual volumes of surface water and groundwater proposed to be taken by the construction activity (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.</td>
<td>Section 6.7</td>
</tr>
<tr>
<td></td>
<td>Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.</td>
<td>Section 2.5.1, 6.8</td>
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<tr>
<td></td>
<td>Technical details and data of all surface and groundwater modelling.</td>
<td>Modelling not considered necessary as water would be taken under the existing WSP cap.</td>
</tr>
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<td></td>
<td>Proposed surface and groundwater monitoring activities and methodologies</td>
<td>Section 2.5.1, 6.8</td>
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<td></td>
<td>Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.</td>
<td>Section 4.4</td>
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<td></td>
<td>Adequate monitoring and mitigating measures to manage construction and operational impacts of the project.</td>
<td>Section 7</td>
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<td></td>
<td>Consideration of relevant policies and guidelines.</td>
<td>Section 2.5</td>
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<tr>
<td>EPA</td>
<td><strong>Air Quality</strong></td>
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<td></td>
<td>The REF must include an assessment of all sources of dust emissions, the potential impact</td>
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<td>Where Addressed in REF</td>
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<td>and the mitigation measures to prevent/control dust from construction works and associated vehicle movements. Emissions from any plant must meet the design criteria detailed in the <em>Protection of the Environment Operations (Clean Air) Regulation 2010</em>. Details need to be provided on the proposed air pollution control techniques from any air emission points, including proposed measures to manage and monitor efficiency and performance.</td>
<td>Section 6.6</td>
</tr>
<tr>
<td>Noise</td>
<td>Potential noise sources are to be assessed in accordance with the <em>NSW Industrial Noise Policy (EPA, 2000)</em>, and where required mitigation measures proposed (for example, appropriate equipment chosen to minimise noise levels). The times of operation for all phases of the project that generate noise must be specified in the assessment, including ongoing noise from pump stations. All residential or noise sensitive premises likely to be impacted by the project must be identified and included in the assessment. The project will result in increased traffic movements. The potential noise impacts associated with any traffic increases need to be assessed in accordance with the <em>NSW Road Noise Policy (EPA, 2011)</em>.</td>
<td>Section 6.5</td>
</tr>
<tr>
<td>Water</td>
<td>The REF should document the measures used to achieve the goals of the project, which should include the following: - No pollution of waters (including surface and groundwater), except to the extent authorised by the EPA (in accordance with an Environment Protection Licence) - Contaminated water (including process waters, wash down waters, polluted stormwater or sewage) captured on the site and collected, treated and beneficially reused, where this is safe and practicable to do so - Anticipate wet weather impacts and develop contingencies into the design of all contaminated water infrastructure and clean water diversions</td>
<td>Section 6.7, 6.8</td>
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<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td>• Ensure any proposed discharges are acceptable to the NSW Water Quality and River Flow Objectives and where appropriate propose monitoring and management measures. Details of any natural or artificial waters within or adjacent to the pipeline pathway must be identified and where applicable measures proposed to mitigate potential impacts of the development on these waters. The REF should provide details of the proposed design and construction of water management systems for the project to ensure surface and ground waters are protected from contaminants.</td>
<td>Section 6.7, 6.14</td>
</tr>
</tbody>
</table>

**Land**

The REF must describe the project area in terms of soil types and properties and soil contamination. Any likely impacts resulting from the construction or operation of the project must be identified including the likelihood of the following:

- Disturbing any existing contaminated soil.
- Contamination of soil by operation of the activity.
- Subsidence or instability.
- Soil erosion.
- Disturbing acid sulfate or potential generation of acid sulfate.

The goals of the project should include the following:

- No pollution of land, except to the extent authorised by the EPA, in accordance with an EPL.
- Any potentially contaminated sites that are encountered or disturbed are appropriately managed and rehabilitated.
- The potential impact of land erosion from the development is mitigated.
- The land impacted by waste disposal is appropriately monitored and managed in accordance with relevant EPA guidelines.
<table>
<thead>
<tr>
<th>Agency</th>
<th>Comment / Issue Raised</th>
<th>Where Addressed in REF</th>
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<tbody>
<tr>
<td></td>
<td>The REF should document the measures that will achieve the above goals.</td>
<td>Section 6.14</td>
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<td></td>
<td><strong>Waste and Chemical</strong></td>
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<td>The REF must provide details of solid and liquid waste management from the project, including the following:</td>
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<td>• The assessment, handling and transport of waste generated by the project.</td>
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<td>• Any stockpiling of wastes and recovered materials.</td>
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<td>• Any waste processing related to the project, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site.</td>
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<td>• The method for disposing of all wastes or recovered material.</td>
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<td>• The leachate arising from the handling, storage, processing and reprocessing of waste.</td>
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<td>• The proposed controls for managing the environmental impacts of these activities.</td>
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<td>The goals of the project should include the following:</td>
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<td>• It is in accordance with the principles of the waste hierarchy and cleaner production.</td>
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<td>• Where potential impacts associated with the handling, processing and storage of waste at the premises are identified, these be mitigated by the works.</td>
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<td>• The beneficial reuse of all wastes generated at the premises are maximised where it is safe and practical to do so.</td>
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<td>• No waste disposal occurs on site except in accordance with an Environment Protection Licence.</td>
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<td>The REF also needs to identify the proposed type, quantity and location of chemicals to be stored on site. Spill management measures, including items such as bunding, and emergency procedures should be clearly outlined.</td>
<td>Section 6.14</td>
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<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
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<td></td>
<td>While carrying out the REF refer to the relevant guidelines that are applicable to NSW for air quality, noise and vibration, water quality, groundwater, stormwater, wastewater and waste.</td>
<td>Relevant parts of Section 6</td>
</tr>
<tr>
<td></td>
<td>Although the construction of the project is not a scheduled activity under the POEO Act, extractive activity during construction works may trigger the licensing threshold. However, based on the information provided from the calculations in the concept design, the material that will be extracted during construction is going to be re-used on the site it is generated (under planning approval) and on this basis, EPA considers a licence is not required.</td>
<td>Noted Section 2.2.6</td>
</tr>
<tr>
<td>EPA</td>
<td><strong>Air Quality</strong></td>
<td>Section 6.6</td>
</tr>
<tr>
<td>Follow up consultation July 2017</td>
<td>The EPA acknowledges the environment and remote nature much of the project is being developed in. Based on the pipeline corridor and project area we support a risk based approach being taken to dust management and mitigation with a focus on sensitive receptors and townships.</td>
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<td>The goal of the project in relation to air quality should be to ensure sensitive receptors are protected from any adverse impacts from dust during construction. In assessing the potential impacts from the project the REF should identify sensitive receptors and identify measures to be implemented to minimise potential adverse impacts.</td>
<td>Section 6.6</td>
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<td></td>
<td><strong>Water Quality</strong></td>
<td>Section 6.7, 6.8</td>
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<td></td>
<td>Based on the pipeline corridor and project area we accept the adoption of a risk based approach in the evaluation and minimisation of potential water quality impacts and would expect mitigation measures to focus on sensitive receiving environments.</td>
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<td>In assessing the potential impacts from the project the REF should identify all receiving environments, evaluate the risk of adverse impacts as a result of the project, and implement measures appropriate for the level of risk to control or mitigate potential adverse impacts on water quality in receiving environments.</td>
<td>Section 6.7, 6.8</td>
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<td>Agency</td>
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<td><strong>Revegetation</strong></td>
<td>In assessing the impacts of this project the proponent should take into consideration the principles of ecologically sustainable development. Where mitigation strategies are impracticable or not cost effective for low risk or short term activities the EPA considers it would be appropriate for the proponent to adopt a reasonable and feasible approach to mitigation.</td>
<td>Section 6.9</td>
</tr>
<tr>
<td>Essential Energy</td>
<td>No formal response received</td>
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<tr>
<td>Essential Water</td>
<td>No formal response received</td>
<td></td>
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<tr>
<td>Local Land Services Western Region</td>
<td>Desktop analysis of the proposed route reveals it does not appear to pass through sensitive or unmodified vegetation and therefore not through high conservation value lands. This advice should be confirmed with the OEH as part of the REF process.</td>
<td>Section 6.9</td>
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<td>An Aboriginal Heritage Information Management System (AHIMS) and Historic Heritage Information Management System (HHIMS) review should be carried out in the REF process in conjunction with OEH to determine the presence or suspected presence of culturally significant sites or artefacts. The REF should also address suitable cultural heritage training or reporting protocols for construction staff.</td>
<td>Section 6.11, 6.12</td>
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<td>Outside the terms of the REF is the need to ensure regular and adequate water flow regimes in both the Darling River and the Menindee Lakes. This is to both achieve the Government’s stated aims in the Menindee and Lower Darling Endangered Ecological Community (EEC) Declaration by the NSW Fisheries Scientific Committee and to ensure adequate supplies of quality water to the Darling River, its downstream communities, pastoralists and irrigators. The provision of a water pipeline to Broken Hill should not be seen to reduce this necessity.</td>
<td>Noted. This is outside the scope of this REF</td>
</tr>
<tr>
<td>MDBA</td>
<td>No response received</td>
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<td>Declined attendance at the interagency meeting</td>
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<td>Agency</td>
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<tr>
<td>NBN</td>
<td>NBN does not have any assets from the start of the Silver City Highway, Broken Hill until the city of Wentworth, where there is a Transmission Fibre that runs down Wentworth Street.</td>
<td>Noted</td>
</tr>
<tr>
<td></td>
<td>Within Broken Hill the NBN relies on the Telstra ducts to house their fibres. Telstra will need to be approached if duct levels are required.</td>
<td>Noted</td>
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<td>If the streets that may be impacted are connected to the NBN, a more detailed impact assessment can be made as there will be a clearer indication of the network impact.</td>
<td>Noted. The construction contractor will be responsible for ensuring adequate protection of services.</td>
</tr>
<tr>
<td>OEH</td>
<td>The assessment should include details about the location, extent and activities undertaken for associated infrastructure such as whether the pipeline will be buried or on the surface, the final path of the pipeline and the resulting area of each vegetation community that would be disturbed. This is particularly the case at the Broken Hill end of the pipeline where no indication of the path of the pipeline has been provided. Any need to relocate water, telecommunications, gas and electricity infrastructure, and any necessary access tracks should also be described to address the overall impacts of the complete project.</td>
<td>Section 5.2, 6.9.1</td>
</tr>
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<td></td>
<td>The assessment should consider direct and indirect impacts as a result of both construction and operation of the project. The REF should also assess the cumulative impacts of this and other developments in the area.</td>
<td>Section 6</td>
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<td></td>
<td>The initial environmental assessment shows that a considerable extent of natural vegetation would be disturbed by the project. If it is determined that a flora and fauna assessment is required, then either the BioBanking Assessment Methodology or a detailed biodiversity assessment, including an Assessment of Significance can be used.</td>
<td>Section 6.9</td>
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<td>The NSW Biodiversity Offsets Policy for Major Projects does not apply, however given the potential impact of the project, it is recommended that if impacts to threatened species</td>
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<td>No offsets are proposed</td>
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<td>Agency</td>
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<td>cannot be avoided then consideration should be given to using offsets.</td>
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<td></td>
<td>It is almost a certainty that Aboriginal cultural heritage will be compromised as part of the proposed activity. As the environmental impacts for the project are being assessed in accordance with the ISEPP, if Aboriginal objects or places are to be harmed and AHIP will be required. OEH recommends that a cultural heritage assessment of the potential impacts of the project be made. Further detail on the assessment requirements for biodiversity and Aboriginal cultural heritage are provided in <em>Detailed SEARs for Proposed Broken Hill Long Term Water Supply REF</em> (attachment A of the OEH response).</td>
<td>Section 6.11</td>
</tr>
<tr>
<td></td>
<td>The project is within the Barkandji #8 Native Title Determination area. This area contains a mixture of Native Title that will influence how consultation needs to be implemented. Further discussion is recommended with OEH, the Native Title Tribunal and NTSCorp (as representatives of the determinant) to clarify the correct procedure of identifying Registered Aboriginal Parties to undertake consultation for the project.</td>
<td>Noted. Consultation has occurred with the Barkandji Traditional Owners</td>
</tr>
<tr>
<td></td>
<td>Check with Department of Planning and Environment whether the assessment pathway should be Infrastructure SEPP Part 5 of the EP&amp;A Act or State Significant Infrastructure.</td>
<td>Sections 2.1.5 and Section 2.1</td>
</tr>
<tr>
<td></td>
<td>Extracting red sand from relic dunes would increase the likelihood of Aboriginal Cultural Heritage disturbance. The extraction of white creek sands would be a controlled activity matter for DPI to provide advice on.</td>
<td>Noted</td>
</tr>
<tr>
<td>OEH</td>
<td>It was identified during the original consultation that the pipeline for the project was subject to an impact corridor of approximately 20 metres and that additional areas would be outside this for ancillary infrastructure. OEH believe this is sufficient to identify the likely footprint. If a greater area has been assessed then this needs to be documented and the AHIP application includes sufficient detail to demonstrate that the entire final footprint has been assessed, and that RAPs have had the opportunity to comment on this basis, then we believe this should be sufficient to satisfy the consultation guidelines.</td>
<td>Section 6.11. The AHIP will cover an area greater than the construction footprint.</td>
</tr>
<tr>
<td></td>
<td>The REF will need to identify the final footprint and the mitigation measures in place to address the potential impacts on biodiversity, including threatened species. The REF should</td>
<td>Section 6.9</td>
</tr>
<tr>
<td>Follow up Consultation July 2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td></td>
<td>include an Assessment of Significance, and if as stated below this has not lead to a significant impact, then no further assessment will be required (a Species Impact Statement (SIS) would be required if it was significant).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>So long as the entire footprint is addressed then it should meet the requirements of the <em>Threatened Species Conservation Act</em> 1995. Ideally the footprint in the <em>Acacia carneorum</em> patch should be minimised, and will need to be clearly identified in the REF.</td>
<td>Section 6.9</td>
</tr>
<tr>
<td>RMS</td>
<td>A Construction Management Plan (CMP) is to be developed for the project in consultation with Roads and Maritime Services, Wentworth Shire Council and Broken Hill City Council. The CMP is to detail how traffic generation, traffic movements and construction activities on or close to the classified road network will be managed to ensure the safety and traffic efficiency of the classified road network is not compromised by construction activities.</td>
<td>Section 5.8</td>
</tr>
<tr>
<td></td>
<td>To avoid conflict with future road maintenance, table drain maintenance, road widening, realignment and upgrade projects, the pipeline and pump stations are to be located as close as possible to the road reserve boundary. Further consultation with Roads and Maritime is required regarding the alignment of the pipeline.</td>
<td>Section 5 and 6.3</td>
</tr>
<tr>
<td></td>
<td>Vehicular accesses to pump stations are to achieve Safe Intersection Sight Distance (SISD). For a 100km/h speed zone SISD is 262 metres and for a 110 km/h speed zone, SISD is 300 metres.</td>
<td>Section 6.4</td>
</tr>
<tr>
<td></td>
<td>Works within classified road reserves require prior concurrence from Roads and Maritime under section 138(2) of the <em>Road Act 1993</em>.</td>
<td>Section 2.2.4</td>
</tr>
<tr>
<td></td>
<td>Where the pipeline needs to cross any classified road, and any public road in the Unincorporated Area, the following minimum clearances are to be achieved:</td>
<td>Section 5.5.5</td>
</tr>
<tr>
<td></td>
<td>• 1 metre below the bottom of the table drain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1.2 metres below the road surface.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pipeline crossings of classified roads are to be minimised. Where crossings are required,</td>
<td></td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>the pipeline is to be at, or as near as possible, to perpendicular to the roadway.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The pipeline is not to be attached to or below any Roads and Maritime road bridge or culvert structure.</td>
<td>Section 5.5.5. The pipeline will not be attached to any road bridge or culvert.</td>
</tr>
<tr>
<td></td>
<td>Any damage or disturbance within public road reserves is to be restored to match surrounding landform in accordance with the requirements of the relevant road authority.</td>
<td>Section 6.4.3</td>
</tr>
<tr>
<td></td>
<td>Roads and Maritime requires that hydrant and release points along the pipeline are located in rest areas, and if possible, that access to water be made available to RMS at these locations for road maintenance works</td>
<td>Section 6.4.3</td>
</tr>
<tr>
<td></td>
<td>Road Occupancy Licence may be required for works within 3 metres of travel lanes.</td>
<td>Section 6.4.3</td>
</tr>
<tr>
<td></td>
<td>Should a construction workers’ camp be proposed, plans and supporting documentation of the camp are to be provided to Roads and Maritime for comment.</td>
<td>Section 6.4.3</td>
</tr>
<tr>
<td></td>
<td>At the completion of the project, Works-As-Executed plans are to be provided to Roads and Maritime indicating final levels, distances and location of the pipeline and associated infrastructure.</td>
<td>Section 6.4.3</td>
</tr>
<tr>
<td></td>
<td><strong>Wentworth Shire Council</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>State Environmental Planning Policy (Infrastructure)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Division 24 Water Supply Systems should be addressed</td>
<td>Section 2.1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Threatened Species Conservation Act 1995</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consideration of potential impacts on listed threatened species and/or ecological communities should be addressed in the first instance through the seven matters listed under section 5A of the EP&amp;A Act.</td>
<td>Section 6.9 and Appendix D</td>
</tr>
<tr>
<td></td>
<td><strong>Fisheries Management Act 1994</strong></td>
<td>Section 6.9 and Appendix D</td>
</tr>
<tr>
<td>Agency</td>
<td>Comment / Issue Raised</td>
<td>Where Addressed in REF</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>It is assumed that the water offtake locations will be within the Lower River Murray Endangered Ecological Community. Impact on the endangered and/or threatened species listed under the Fish Management Act should be undertaken.</td>
<td></td>
</tr>
</tbody>
</table>
|                                                                      | *National Parks and Wildlife Act 1974*  
An AHIP is required to be obtained under section 90 of the Act prior to the works commencing if there is any potential to disturb and known Aboriginal artefacts. | Section 6.11 and Appendix E                  |
|                                                                      | *Heritage Act 1977*  
Consideration should be given to the impact of the development on known local and state heritage items.                                                                 | Section 2.2.12 and 6.12                     |
|                                                                      | *Crown Land Act 1989 and Western Lands Act 1901*  
All development on Crown Land needs to be consistent with the principles of crown land management.                                                                 | Section 2.2.2 and 2.2.4.                    |
|                                                                      | *Water Management Act 2000*  
Typically a controlled activity approval would be required under section 91E(1) of the WM Act to allow for construction within 40 metres of a watercourse.            | Section 2.2.1                              |
|                                                                      | *Native Vegetation Act 2003*  
Needs to be addressed as part of the REF to support the Part 5 assessment.                                                                                                                                         | Section 2.2.14                              |
|                                                                      | *Protection of the Environment and Operations Act 1997*  
The management of environmental impacts in relation to air, noise and water quality fall under the provisions of the POEO Act. These aspects should be addressed as part of the REF. | Section 2.2.6                               |
<p>|                                                                      | Management of Water and Waterside Lands Regulation – NSW                                                                                                                                                    | This was repealed in                         |</p>
<table>
<thead>
<tr>
<th>Agency</th>
<th>Comment / Issue Raised</th>
<th>Where Addressed in REF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Management of Waters and Waterside Land Regulations – NSW contains provisions for the general management of waters and waterside land. This should be considered.</td>
<td>October 2016</td>
</tr>
<tr>
<td></td>
<td>State Environmental Planning Policy No. 44 Koala Habitat Protection Schedule 1 of NSW State Environmental Planning Policy 44 – Koala Habitat Protection identifies Wentworth Shire Council as a Local Government Area to which this SEPP applies. This should be considered.</td>
<td>Section 2.1.7</td>
</tr>
<tr>
<td>Broken Hill City Council</td>
<td>No response received</td>
<td></td>
</tr>
</tbody>
</table>
| DELWP (Vic)             | The department acknowledges that the proposed works are to occur within NSW The department has requested information from Lower Murray Water, who have provided the following comments for consideration:  
  - Where is the supporting entitlement coming from? The Murray or elsewhere.  
  - If it is intended to create a Murray Entitlement by exchange rate or some other means. does the Cap apply?  
  - Can an entitlement in the Darling above Weir 32 at Menindee be utilised out of the Murray if the lakes are dry?                                                                                                                          | Noted Sections 2.2.1, 2.5.1, 2.5.2 |

State Environmental Planning Policy No. 44 Koala Habitat Protection Schedule 1 of NSW State Environmental Planning Policy 44 – Koala Habitat Protection identifies Wentworth Shire Council as a Local Government Area to which this SEPP applies. This should be considered.

Native Title Act 1993 Under the Native Title legislation ‘future act’ is a proposed act on land or waters that affects native title rights and interests and can include building public infrastructure. Under Section 24JB of the Native Title Act, Native Title Claim groups have ‘procedural rights’ to be notified of public works proposed within the native title claim and given the opportunity to comment. Noted. Consultation has occurred with the Barkandji Traditional Owners.

Environmental Protection and Biodiversity Act 1999 This Act is administered by the Commonwealth Department of Environment and provides assessment and approval system. This should be considered. Section 2.3.1 and 6.9
<table>
<thead>
<tr>
<th>Agency</th>
<th>Comment / Issue Raised</th>
<th>Where Addressed in REF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- If an entitlement in another zone is utilised will it be tagged and subject to Basin Plan rules?</td>
<td></td>
</tr>
</tbody>
</table>
3   Need for the Project

This section reviews the existing infrastructure and the need for the project.

3.1   Existing Water Supply

3.1.1   The Menindee Lakes system

The Menindee Lakes is the primary water source for the townships of Broken Hill, Menindee, Silverton and Sunset Strip. The Menindee Lakes originally consisted of a series of natural depressions that filled only during flood events. After a flood event, water would drain from the lakes back into the main river channel while some would be retained in the lowest parts of the depressions and would eventually evaporate or infiltrate. Between 1949 and 1968, major infrastructure works were completed by the (then) NSW Water Conservation and Irrigation Commission to regulate water flows and improve the conservation of water assets in and around the Menindee Lakes.

The Menindee Lakes are within the Lower Darling River System which forms part of the Murray Darling Basin System. The Lakes are about 200km north of the Darling River junction with the River Murray at Wentworth. The river system directly upstream from the Menindee Lakes is the Barwon-Darling River, which receives flows from catchments further upstream thus connecting the northern and southern regions of the Murray Darling Basin.

When flowing, the Barwon–Darling River feeds the Menindee Lakes System and, depending on the amount of water in the Menindee Lakes, the Darling River continues to flow into the Lower Darling region towards the River Murray.

The Menindee Lakes System is owned by the NSW Government and managed by WaterNSW. It stores 2,049GL of water when full. Management of the Menindee Lakes is extremely complex due to the arid environment that is subject to high evaporation and the requirements of multiple stakeholders. Storage of water within the Menindee Lakes System serves several purposes, including:

- assisting in the water supply to New South Wales, Victoria and South Australia;
- meeting the urban and mining needs at Broken Hill and other local communities;
- stock, domestic and irrigation needs;
- flood management along the Lower Darling River; and
- recreational amenity.

3.1.2   Water supply system

The regulated lakes system consists of four main interconnected lakes. A series of weirs and regulators control the flow of water between the Darling River, the Menindee Lakes system and the Great Darling Anabranch. This infrastructure allows the bulk water supplier, Water NSW, and the water retailer, Essential Water, to adjust the water levels, which assists gravitational flows from Lake Wetherell into Lake Pamamaroo and then sequentially to Lake Menindee (via Copi Hollow) and Lake Cawndilla.
Since the creation of the Menindee Lakes system, Broken Hill and the surrounding satellite communities have their water needs served primarily by storage in Lake Menindee. At a sufficient level, water in Menindee Lake is released into the Darling River via the Menindee Outlet Regulator. Water then accumulates behind Weir 32, which is positioned slightly downstream from this outlet regulator, to permit extraction at Menindee and then pumping towards consumers in the region. The water level at this point in the Darling River is driven by the mandated releases downstream and the water demands of Broken Hill and the local communities.

The Menindee Pumping Station pumps water from Weir 32 to Broken Hill via the 116 km long Broken Hill-Menindee pipeline. Water is discharged to the Stephens Creek Reservoir and then pumped to the Mica Street WTP for treatment and before delivery to local customers. A combination of potable and raw water oftake structures are also in place along the Broken Hill - Menindee pipeline for agricultural and extractive industry consumers as well as some small residential communities.

Broken Hill is also supplied by other catchments – Stephens Creek Reservoir (Stephens Creek), Umberumberka Reservoir (Umberumberka) and Imperial Lake Dam (Imperial Lake) - and supporting infrastructure in and around the town. Stephens Creek and Imperial Lake also act as balancing storages for Broken Hill.

3.1.3 Existing Water Access Licence

Essential Water currently holds a Specific Purpose Access Licence (SPAL) for 10GL of bulk water access. Despite having access to 9,975 ML of bulk water per annum, on average, Essential Water extract 6 GL per annum, or 14 ML per day, of water to supply its customers. Of this, approximately 80% is treated and of potable water standard, while the remaining 20% is raw water that is supplied to a number of industrial, commercial and agricultural customers.

3.1.4 Water Demands

Historic water demand analysis for Essential Water, including peak day demand requirements, is provided in below. The peak day demand is the highest volume of water consumed in a given day across the year. Peak day demand usually occurs during the summer months. Highly variable water consumption volumes across seasons, highlighted by the difference between average daily demand and peak day demand, are to be expected of a town located in a semi-arid environment.

The water volumes shown in Table 3-1 are supplied to around 10,000 residential customers and 600 non-residential water customers. Further breakdown of consumption by customer segment is outlined in Table 3-2.

The largest water customer in the region is mining company Perilya Ltd (Perilya), which uses approximately 29% of the total water supplied by Essential Water. CBH Resources Ltd (Broken Hill Operations), a second miner, which also operates close to Broken Hill, accounts for a further 7% of total water consumption. The 1% of water supplied to Menindee, Sunset Strip and irrigators includes non-potable water supply to 47 rural users along the Menindee to Broken Hill pipeline for stock and domestic purposes.
### Table 3-1 Essential Water - Water Demands

<table>
<thead>
<tr>
<th>Year</th>
<th>Raw water production average (ML/d)</th>
<th>Treated water production average (ML/d)</th>
<th>Average total water production average (ML/d)</th>
<th>Peak day total water demand (ML/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1.6</td>
<td>12.6</td>
<td>14.2</td>
<td>29.7</td>
</tr>
<tr>
<td>2010</td>
<td>1.5</td>
<td>10.9</td>
<td>12.4</td>
<td>26.3</td>
</tr>
<tr>
<td>2011</td>
<td>1.9</td>
<td>10.8</td>
<td>12.7</td>
<td>25.1</td>
</tr>
<tr>
<td>2012</td>
<td>3.3</td>
<td>11.2</td>
<td>14.5</td>
<td>25.5</td>
</tr>
<tr>
<td>2013</td>
<td>4.1</td>
<td>12.4</td>
<td>16.5</td>
<td>28.7</td>
</tr>
<tr>
<td>2014</td>
<td>3.7</td>
<td>11.5</td>
<td>15.2</td>
<td>31.6</td>
</tr>
</tbody>
</table>

*Source: NSW Department of Primary Industries, March 2016*

### Table 3-2 Water Demand Breakdown by Customer

<table>
<thead>
<tr>
<th>Customer</th>
<th>% of total supply (FY15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>49%</td>
</tr>
<tr>
<td>Mines</td>
<td>36%</td>
</tr>
<tr>
<td>Commercial</td>
<td>11%</td>
</tr>
<tr>
<td>Local councils</td>
<td>3%</td>
</tr>
<tr>
<td>Menindee, Sunset Strip and irrigators</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Source: NSW Department of Primary Industries, March 2016*

### 3.2 Water Supply Reliability and Security

#### 3.2.1 Water reliability

Drought conditions and limited access to a secure bulk water supply has been a consistent challenge since Broken Hill's establishment. Intermittent responses by the local community and government to water security threats have been significant since the town’s inception to the present day.

Demand for a secure bulk water supply increased with the climbing population in the late 1800s and early 1900s as speculators and mining interests continued to be drawn to the region in search of economic gain and employment. A drought event in 1891 saw 230KL of water carted into Broken Hill daily via rail from South Australia for a period of seven months. Rail carting from South Australia or the Darling River at Menindee was also
temporarily adopted to support the town during drought periods during the years 1902-3, 1919, 1941, 1944 and 1951.

Local residents and commercial operators continually lobbied government in response to concerns that long-term water supply was not secured especially given that mining operations were to require increasing volumes of water in order to extract ore deposits. These efforts eventually led to the augmentation of Imperial Lake, Stephens Creek and Umberumberka Reservoirs. The Broken Hill-Menindee pipeline was completed in 1952 and the Darling River, via the Menindee Lakes, was to be Broken Hill's primary source of water by 1960 with the completion of the Menindee Lakes scheme.

DPI Water has modelled inflow sequences from the Darling River into the Menindee Lakes from the period between 1895 and 2009 to provide insight as to the probable storages in the Lakes, under the following assumptions:

- The surface water extractions occurring upstream from Menindee Lakes are in line with current state development and licencing arrangements on regulated rivers; and
- Actual upstream flows in unregulated streams are used in conjunction with simulated flow routing and extraction downstream based on current development.

These modelled inflow sequences indicate the implied accessible storage volumes for the 114-year period. The analysis defined a contingency threshold that equates to storing sufficient water to provide a supply for 18 months, which if breached, indicate a drought ‘event’. These breaches usually result in a response from government and/or Essential Water to restrict demand and plan to access alternate water supply sources.

Contingency thresholds have been breached on 24 occasions in the last 114 years, an average of 6.3 events in 30 years. More recently, the frequency and severity of droughts has increased to a comparable level to the early 1900s.

### 3.2.2 Storage inefficiency of the Menindee Lakes

The primary consumer of water in the Menindee Lakes is evaporation with an average of 420GL lost every year due to the dry, hot and windy conditions. By comparison, customers in the Broken Hill region require access to about 10GL per annum, or 2% of the amount lost to evaporation every year.

Under the Murray Darling Basin Agreement, to which NSW Government is a signatory, when water stored in the lakes rises above 640GL, operation of the Lakes is transferred to the MDBA on behalf of all signatory States. When storage volumes fall below 480GL, as is the current state, then control is transferred to the NSW Government until the levels return to 640GL.

At present, depressed sections of the lake floor do not allow all water to drain towards an outlet point. This creates an element of ‘dead storage’ that cannot be consumed or used productively. In addition, the size of some regulation points around the Lakes limit the rate at which water can pass from the Menindee Lakes back into the Darling River.

During low-inflow periods, the stored volumes across the Menindee Lakes fall rapidly and thus threaten the security of water supply for the local communities.
3.2.3 NSW Guidelines for Water Security

In December 2013, the former NSW Office of Water updated the guidelines for Assuring Future Urban Water Security for Local Water Utilities in NSW. The Guidelines enable each utility to assess the future secure yield of its urban water supplies and form the basis for planning water supply headworks upgrade and/or augmentation, where warranted, for the impact of variable climatic patterns and population growth. This planning is usually performed over a 30 year water supply horizon.

A study of the performance of water supply systems during the severe droughts of 2007/08 identified that systems designed and operated in accordance with the original 5/10/20 design rule, specified by the Guidelines, performed well during the drought. The measurable target for water supply system design has since been updated to the ‘5/10/10’ rule, due to significant improvements in residential water efficiencies in the last two decades, which reduce the ability of residential customers to limit consumption further.

The ‘5/10/10’ water supply system design rule requires water security planning on the basis of:

- The time spent in drought restrictions should be no more that 5% of total time
- Restrictions should not need to be applied in more than 10% of years
- During periods of water restrictions, the water supply system should be able to provide 90% of the unrestricted dry year water demand (i.e. 10% reduction in demand) through a repetition of the worst recorded drought commencing at the time restrictions are introduced.

As this methodology approximates the severity of a ‘1 in 1,000 year’ drought, urban water supply systems that meet this criteria are deemed to be capable of withstanding a ‘1 in 1,000 year’ drought.

Analysis has been undertaken to determine the current level of reliability of Broken Hill’s water supply using the 5/10/10 rule. The analysis considered the previous 114 years of data as this time period reflects the effects of climate variability and makes it possible to observe the extent of drought conditions the region experiences. Using the available data and assuming water restrictions are implemented upon breach of current demand management contingency thresholds, Table 3-3 indicates that the current water supply does not comply with the NSW guidelines for Assuring Future Urban Water Security for Local Water Utilities in NSW.

Table 3-3 Frequency and duration of water restrictions under the Base Case

<table>
<thead>
<tr>
<th></th>
<th>Base Case</th>
<th>NSW Guidelines target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of contingencies required</td>
<td>21%</td>
<td>5%</td>
</tr>
<tr>
<td>% of years contingencies are required</td>
<td>46%</td>
<td>10%</td>
</tr>
</tbody>
</table>
3.2.4 Short-term responses to the lack of water security

The frequency of the contingency threshold being breached appears to be increasing, prompting repeated attempts by the NSW Government to secure Broken Hill’s immediate water supply requirements.

In a number of cases, plans were developed to secure Broken Hill’s water supply but were deferred upon the next major Menindee Lakes inflow event. Where short-term strategies have been implemented, they are often costly and provide no long-term water security for the community, business or Government. Examples of short-term actions that have been implemented include:

- 1981: Separating Copi Hollow from the Menindee Lakes to stop water flow into Menindee Lake and Lake Cawndilla, allowing water storage build up in Copi Hollow
- 2003/2007: Various alterations were made to the management of the Stephens Creek Reservoir to capture small intakes and utilising the internal levee, splitting the reservoir floor into a western and eastern section
- 2007: Essential Water (formerly Country Energy) contributed to the transfer of water from Lake Tandure into Lake Wetherell to secure Broken Hill’s water supply. This was done with WaterNSW (formerly State Water) and Tandou (major irrigator located on the southern edge of the Menindee Lakes system)
- May 2015: Short-term water supply strategy agreed and commencement of shallow bore field testing at Menindee (Work Package 1) and RO Plant and brine pond design and distribution (Work Package 2).

Examples of short-term plans that were formed but not implemented due to drought breaking water inflow events include:

- 2003/04: Reverse Osmosis (RO) plant, bore fields and brine ponds were designed, while environmental approvals were sought (project was never commissioned due to timely floods)
- 2007: Essential Water engaged Arup to undertake investigation into the feasibility of delivering water by rail to Broken Hill from the River Murray in times of severe drought.
- 2016: Designs were developed to construct a borefield to extract groundwater from below Lake Menindee and deliver this to Broken Hill via the existing water supply infrastructure.

3.2.5 Water demand management

Water demand management is regularly enforced in the region of Broken Hill. Overall, water restrictions placed on the town’s population have a minor impact on the rate of water storage depletion, as water consumption by residents and industry in the Broken Hill region is negligible relative to water lost through evaporation in the Menindee Lakes. Therefore, additional reliable supply is required to meet future demand and avoid water depletion as traditional demand management measures have limited impact because the water conserved through water restrictions is still exposed to evaporative processes when in storage.
3.3 Impacts of a lack of water security

Section 3.2.1 indicates that contingency thresholds have been breached and typically triggered management intervention on 24 occasions in the last 114 years, an average of 6.3 events in 30 years. More recently, the frequency and severity of droughts has increased to a comparable level to the early 1900s. Compounding the historical evidence is uncertainty regarding climate change and its impact on future rainfall and system inflows from the Darling River. This adds further risk to the current status of the Menindee Lakes as the primary bulk water source for Broken Hill and the surrounding townships.

3.3.1 The community

A lack of water security has forced the local water retailer, Essential Water, to enforce strict water restrictions in the region. Water restrictions limit the ability of residents to use water for health and wellbeing purposes, such as watering sporting facilities and gardens and operating evaporative coolers. In an isolated semi-arid location that is exposed to intense heat, water is critical for the comfort and happiness of residents, particularly for infant and older aged residents.

Due to the geology, there are naturally occurring high levels of lead in soil at Broken Hill. Town water restrictions limit the use of water for suppressing lead dust. This poses a particular threat within backyards and public play areas, where water is used to avoid children and babies consuming lead dust.

Young children are most at risk from lead dust exposure because their brains and nervous systems are still developing and vulnerable. Very high blood lead levels can cause convulsions, coma and sometimes death. Moderate lead blood levels are associated with a range of long-term health effects, including anaemia, reduced kidney and nerve function, and increased blood pressure.

Critically, Broken Hill children’s blood lead levels are already at least twice that of Sydney children a decade ago. The most recent study (2014) found that 53% of Broken Hill children between 1 and 4 years blood lead level exceeded the target of 5 µg/dL set by the National Health and Medical Research Council (NHMRC Statement: Evidence on the Effects of Lead on Human Health, released 19 May 2015).

3.3.2 Impacts on tourism and hospitality

Essential Water has advised that in 2005/06, storage levels falling below a reserve of 12 months’ supply led to widespread tourist complaints and a drop off in tourist numbers due to quality of water concerns. During the 2006/07 drought, clubs, hotels and take away food outlet businesses reported a decline in business that took a number of years to return to pre-drought levels even after water quality improved in 2007.

3.3.3 Mining

Mines in the region use a combination of potable and raw water. Potable water consumed by the mines is entirely sourced from Essential Water, while raw water is sourced from both Essential Water and de-watering of old mine shafts. For the mining companies, scarce water availability may eventually require the mines to become wholly self-sufficient,
which will require additional investment and approvals, placing additional pressure on the viability of the region’s primary industry.

3.3.4 The local economy

According to Broken Hill’s local Regional Development Office (RDO), water security is the primary concern of potential new investors to the township. The RDO notes recent public investment in regional road infrastructure, the Broken Hill airport and healthcare facilities, has had limited effect on the economy in the absence of a reliable water source.

3.4 Project Need and Justification

3.4.1 Project need

The Broken Hill and surrounding communities are within a semi-arid climate and are dependent on water that is stored in the Menindee Lakes for their water supply. The region has experienced severe water shortages and water quality issues throughout its history, and a range of short-term strategies have been implemented during these events.

Short-term water solutions, including an upgrade and recommissioning of Essential Water’s reverse osmosis plant in Broken Hill and construction of the Menindee Common Bore Field, were put in place to meet the community’s short-term needs. However, these solutions do not provide long-term water security for the community, business or Government.

The project seeks to manage these issues for the benefit of the local community by providing a long-term sustainable water supply that complies with the NSW Guidelines on Assuring Future Urban Water Security. The project is needed to minimise the risk of the frequency and severity of impacts of droughts that are described in section 3.3. Securing the region’s water supply will likely assist the Broken Hill region better manage the difficulties of its climate and remoteness and unique socioeconomic issues.

3.4.2 Project Objectives

The objectives of the project involve the following:

- Water security - introduce a sustainable water solution that provides a level of water security that meets the NSW Guidelines on Assuring Future Urban Water Security, including:
  - The total time spent in drought restrictions should be no more that 5% of the time
  - Restrictions should not need to be applied in more than 10% of years
  - During periods of water restrictions, the water supply system should be able to provide 90% of the unrestricted dry year water demand (i.e. 10% reduction in demand) through a repetition of the worst recorded drought commencing at the time restrictions are introduced. This also ensures residents have access to adequate water supply for the suppression of heavy metal dust.

- Water supply service level requirements - provide sufficient water supply capacity to meet Essential Water’s projected demands:
  - Peak daily total water consumption of 37.4 ML
  - Peak weekly total water consumption of 226.4 ML
- Peak monthly total water consumption of 927.4 ML
- Maximum annual total water consumption of 7,582.7 ML
- Average annual total water consumption of 6,802.2 ML, or 18.6 ML per day.

- Value for money - deliver value for money to the State and NSW Government
- Quality - Provide quality of water supply that achieves:
  - Is able to be treated to provide a potable water supply to customers in accordance with the Australian Drinking Water Guidelines.
  - Raw water in accordance with public health standards.
- Affordability - Minimise system lifecycle costs to reduce the cost of water to customers, including:
  - Affordable potable water for communities
  - Affordable water for industry.

### 3.4.3 Project Justification

The project is justified as it would provide a sustainable long-term water supply to the Broken Hill, and surrounding communities that complies with the NSW Guidelines on Assuring Future Urban Water Security. This will benefit:

- Residents
- Local businesses
- Health infrastructure and providers
- Agriculture
- Industry.

An extensive analysis has been undertaken that explored a range of options that could deliver water security to the region to comply with the NSW Guidelines on Assuring Future Urban Water Security. This is summarised in section 4. The project described in Section 5 is justified as it:

- Addresses the project objectives detailed in section 3.4.2
- Is the result of a robust options identification and evaluation process
- Is consistent with the principles of ecologically sustainable development (refer to section 3.5)
- Is socially sustainable. The social benefits of this project are of particular significance, such as community confidence in the final solution, given the frequency and severity of recent droughts. The impact of water supply limitations is felt through the employment market, health sector and recreation. The project will deliver sufficient water to support the sustainability of the community of Broken Hill, the town’s infrastructure and the region’s employment market
- Is environmentally sustainable as it would source water from a highly reliable river system. The extraction of 34.7 ML/day represents approximately 0.3% of existing River Murray cap to meet human water use needs. The abstraction of this volume of water from the River Murray is unlikely to have any notable effect on the volume of water available to aquatic species and communities. The proposed pipeline routes primarily follow existing road easements, limiting the impact on less disturbed environments.
3.5 **Ecologically Sustainable Development Principles**

One of the objects of the EP&A Act is to encourage ecologically sustainable development (ESD). The definition of "ecologically sustainable development" has the same meaning in section 6 (2) of the Protection of the Environment Administration Act 1991. That is that:

The principles of ESD are:

*The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:*

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The Infrastructure Sustainability Council of Australia also provides guidance to the sustainable assessment of infrastructure in its scorecard ‘IS Scorecard v1.2 Design & As Built’.

A review of the proposal against the ESD principles is detailed below.
3.5.1 Precautionary Principle

This REF addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the project. Potential impacts have been identified and appropriate environmental safeguards would be implemented during all phases of the project (design, construction and operation) to minimise the risk of long term and irreversible environmental degradation in accordance with the precautionary principle.

3.5.2 Intergenerational Equity

The implementation of appropriate environmental safeguards, as described in Section 3.5.1, would assist in achieving the principle of intergenerational equity in relation to environmental degradation as a result of the project.

The project seeks to provide a long term water supply to the community of Broken Hill. Securing the region’s water supply will assist the community of the Broken Hill region better manage the difficulties of its climate and remoteness and unique socioeconomic issues and is viewed as having many positive social and economic impacts. The implications of not providing a secure long term bulk water supply are far broader, as detailed in Section 0. As a long term water supply project, benefits would be provided for both existing and future generations.

The project would require a new WAL to extract water from the River Murray, which would be obtained through purchasing a high security water access licence from the water market. The WAL would need to be consistent with requirements of the WSP and within the Murray-Darling Basin Cap / SDL, thereby ensuring no detrimental long term impact on the water source.

3.5.3 Conservation of Biological Diversity and Ecological Integrity

A Flora and Fauna Assessment has been undertaken by NGH Environmental (2017) (provided in Appendix D) for the project. This identified potential impacts and recommended measures to avoid or minimise potential impacts, and recommended safeguards to mitigate the residual impacts. Overall, the assessment concluded that the project would not have a significant effect on a threatened species, population or ecological communities or their habitat, or any Commonwealth Matter of National Environmental Significance.

3.5.4 Improved Valuation, Pricing and Incentive Mechanisms

Pricing of water provided by this project will be subject to a regulated pricing regime. The determination of pricing would be undertaken by the Independent Pricing and Regulatory Tribunal (IPART) and is likely reflect a large number of factors, including project costs and the impact of pricing on customers and the State Owned Corporation responsible for service delivery.

The proposed design includes photovoltaic cells to provide some of the power supply via solar energy, thereby providing a potential saving in energy costs and emissions during the operation of the scheme.
4 Option Evaluation

4.1 Introduction

As indicated in section 3, the existing water supply system does not comply with the design rules in *Assuring Future Urban Water Security for Local Water Utilities in NSW*. The NSW government decided to investigate options to provide a water supply system that complies with the design rules to minimise the negative impacts of a lack of water security, including loss of business confidence and detrimental social, economic and employment outcomes.

This section summarises the shortlisted options that were identified and evaluated by the NSW Government to select the Preferred Option. It also outlines activities undertaken to refine the preferred option.

It is within those objectives, and the broad parameters of the Preferred Option investment that the NSW Government approved the investment decision and directed WaterNSW to deliver “the project” in accordance with its directions.

4.2 Options Identification and Evaluation

DPI Water investigated a broad range of options to ensure that appropriate consideration was given to all possible solutions, ranging from groundwater options, to pipelines and reconfiguration of existing surface water arrangements. A pipeline from a secure water source or a shallow borefield was identified as the only feasible solutions able to potentially deliver water security and yield a sufficient water supply. Based in this outcome, a short list of possible long-term water supply options for Broken Hill was developed following consideration of the fundamental objectives of sustainability, potable capacity, flexibility, water quality, efficiency and affordability.

Targeted consultation was undertaken with a range of stakeholder groups over a 12 month period to evaluate the options and select the Preferred Option. During this period, nine stakeholders, including the community, business and government, were engaged through formal consultation forums, workshops, site visits, teleconferences and meetings.

The four short-listed options considered for the Broken Hill long-term water supply and the base case are discussed below. The indicative pipeline routes are shown in Figure 4-1.

4.2.1 Pipeline Installation – Above or Below Ground

As all options involved a long pipeline, consideration was given to whether the pipeline should be above or below ground.

Pipeline construction below ground minimises the risk of pipeline damage from bushfires, UV exposure, collision from vehicles and vandalism. Below ground pipelines are not exposed to high ambient air temperatures and direct solar radiation which reduces water temperatures compared to above ground pipelines. Lower temperatures minimise the public health risk of the occurrence of *Naegleria fowleri* transforming and growing rapidly in high water temperatures, particularly at temperatures of approximately 42°C and above.

The overall geology of the proposed pipeline route is that rock is unlikely to be encountered at typical excavation depths for most of the pipeline length, especially toward the southern end of the pipeline. It is anticipated that some degree of rock will occur in and around Broken Hill, however, this is likely to be a relatively small proportion of the pipeline.
Pipeline construction above ground is suitable when large distances along the route alignment require excavation in rock, or exhibit very aggressive soil conditions that are likely to reduce the lifespan of the pipe. Above ground construction provides easy access to the pipe for inspection for leaks, corrosion and other pipeline damage. Above ground construction requires pipe supports (chairs) at every joint for a rubber ring jointed (RRJ) pipe. In very long pipelines the cost of supports, usually of pre-cast concrete construction, could far exceed the cost of excavation, provided there are no significant distances which require rock excavation. Steel pipes are not recommended for above ground installation due to reduction in design life from UV exposure.

Given the available geological information, and the advantages and feasibility costings outlined above, all options were based on the pipeline being below ground.

4.2.2 Option 1a - NSW River Murray Western Route Option

This option involves construction of an approximately 270km long raw water supply pipeline from the town of Wentworth, at the River Murray in NSW to the existing Mica Street WTP, following the Silver City Highway for the majority of the alignment.

This option also requires:

- A river lift (pumping) station at the River Murray, transfer pumping stations and a bulk water storage along the pipeline,
- The transfer of raw water from Mica Street WTP to Stephens Creek Reservoir for storage.

This option would decouple Broken Hill’s water supply from the Menindee Lakes system, however Menindee and Sunset Strip would retain Menindee Lakes as its primary source. Menindee and Sunset Strip would also retain use of the Menindee Common borefield as a supplementary source.

4.2.3 Option 1b - The NSW River Murray Eastern Route Option

This option involves construction of an approximately 300km long raw water supply pipeline from the NSW River Murray weir pool to the existing Mica Street WTP, via the townships of Pooncarie and Menindee. The existing 98 km long pipeline from Menindee to Stephens Creek Reservoir would be replaced. Water would be sourced from a weir pool on the Darling River at Ellerslie, NSW, which is 24 km upstream of Wentworth. This pool is formed by a weir on the River Murray downstream of Wentworth.

This option also requires:

- A river lift (pumping) station,
- A number of pumping stations along the route,
- The transfer of raw water from Mica Street WTP to Stephens Creek Reservoir for storage.

Under this option, Broken Hill may continue to access water from the Menindee Lakes system, pending water availability, quality, licences and system design. Stephens Creek Reservoir would be used as a raw water balancing storage facility and the existing Menindee to Stephens Creek pipeline could be decommissioned once the new pipeline is operational.
4.2.4 Option 2 - Menindee Lakes and Talyawalka Borefield

This option involves a shallow aquifer at Talyawalka to supplement existing Menindee Lakes water supply during low surface water availability, or poor surface water quality, periods. The Reverse Osmosis (RO) plant and brine ponds at Broken Hill would be used to treat saline water as required. To maintain current water supply arrangements, significant investment is required to replace the failing Menindee to Broken Hill pipeline. A Lake Menindee deep water aquifer was excluded as representing substantial additional cost.

The borefield would supplement the existing Menindee Lakes water supply during low surface water availability, or poor surface water quality periods. Broken Hill may continue to access water from the Menindee Lakes system, pending water availability and quality.

This option requires:

- Replacing the 98 km pipeline from Menindee to Stephens Creek Reservoir
- Constructing the Talyawalka borefield, including 26-30 bores and a 20 km long pipeline from the borefield to Menindee
- Expanded RO Plant capacity at Mica Street WTP to produce 37.4ML/day treated water, post blending, to a maximum of 1,000EC to comply with the ADWG
- New brine pond, concentrator, evaporator, reclaimed water pumping station and return pipeline to Mica Street WTP. This is required to manage brine produced by the RO plant at Mica Street WTP
- Micro RO Plant to be constructed at Silverton
- 20 km pipeline from Menindee WTP to Sunset Strip
- The construction of three pumping stations.

4.2.5 Option 3 - The Unsolicited Proposal for a River Murray Water Transport Offer

The private sector proposal to construct a pipeline from an offtake at Booborowie, SA on the River Murray, transporting treated (potable) water to the Mica Street WTP over a minimum of 30 years on a capital and specified user charge basis.

This option involves constructing a 350 km long pipeline from an offtake on the Morgan to Whyalla pipeline located at Booborowie, to transport treated (potable) water to the Mica Street WTP over a minimum of 30 years on a capital and specified user charge basis.

This option would require two pumping stations to deliver water to Mica Street WTP. It would decouple Broken Hill’s water supply from the Menindee Lakes system, however Menindee and Sunset Strip would retain Menindee Lakes as its primary source. Menindee and Sunset Strip would also retain use of the Menindee Common borefield as a supplementary source.

4.2.6 Base Case or ‘Do Nothing’ Option

The “Do Nothing” Option involves the continuation of the existing water supply system and policy.

The Menindee Lakes system is drawn upon during periods of water availability and the first stage of the Broken Hill Short-Term Water Supply Strategy is implemented; bulk water carting is applied when the shallow bore field is exhausted. To maintain current water supply arrangements, significant investment is required to replace the failing Menindee to
Broken Hill pipeline. The ‘Do Nothing’ Option fails to meet the NSW Guidelines on Assuring Future Urban Water Security. The ‘Do Nothing’ Option is not considered to be acceptable in terms of meeting the objectives of the project.

4.3 Preferred Option

4.3.1 Selecting the Preferred Option

Shortlisted options were assessed against the project objectives (section 3.4.2) and the results are summarised in Table 4-2. Option 3 was excluded from this analysis as it was unable to deliver sufficient water supply until at least 2035 and, as such, did not meet the threshold objectives of water security, water supply and water quality.

Options 1a, 1b and 2 met the threshold criteria of water security, water supply and water quality. These options were analysed in detail which involved feasibility assessments, including water modelling, engineering design and detailed financial and economic analysis.

The Preferred Option is Option 1a, the NSW River Murray Western Route Option, as this provides the greatest confidence around the solution being able to meet the proposal objectives sustainably over at least a 30 year period. Options 1a and 1b provide a secure long-term water source, as the River Murray provides greater confidence in long-term security compared to Option 2.

In terms of social sustainability, Option 1a and 1b would deliver sufficient water to support the sustainability of the community of Broken Hill, the town’s infrastructure and the region’s employment market. Whilst Option 2 would be capable of delivering sufficient water supply, the groundwater source may be less acceptable to the community as a long-term solution. The Base Case increases the likelihood of water restrictions being imposed, limiting health and economic outcomes for residents.

In terms of environmental sustainability, all options that source water from the River Murray, either in NSW or SA, limit environmental impacts by sourcing water from a highly reliable river system. Additionally, the proposed pipeline routes primarily follow existing road easements, limiting the impact on environment.

The environmental impact of Option 2 is likely to be higher than Option 1a or 1b given the potential for environmental impacts of extracting water from a borefield. It is possible that this may disrupt the ecology of flora including groundwater dependent ecosystems that draw upon Talyawalka groundwater for survival. This would include vegetation communities that are within the Kinchega National Park which is on the western side of the Darling River, adjacent to the indicative location of the Talyawalka borefield.

Option 1a is preferred over Option 1b because it is a shorter and more direct pipeline and delivers greater value for money.

This REF assesses the potential impacts of Option 1a as described in section 5.

4.3.2 Delivery of Option 1a

Subsequent to the selection of Option 1a NSW Government determined that Option 1a would be delivered in two stages.
In November 2016, the Minister for Primary Industries and Regional Water issued a Direction to the board of WaterNSW under section 20P of the *State Owned Corporations Act 1989* to:

- arrange for the construction, operation and maintenance of a pipeline from the River Murray to deliver low salinity raw water to the existing Mica Street Water Treatment Plant in Broken Hill
- use best endeavours to make the pipeline operational by December 2018
- fund the capital costs for constructing the pipeline from existing resources, or otherwise borrow the required funds.

The Menindee and Sunset Strip works contemplated in Option 1a would be undertaken by Essential Water as a separate undertaking in the future and is not part of this REF assessment.

Further refinements to the project were also undertaken based on the findings of environmental and engineering investigations, and consultation with potentially affected stakeholders. This has involved optimising the pipeline alignment, transfer pump station locations, and bulk water storage location to minimise impacts on threatened species, endangered ecological communities, and Aboriginal cultural heritage.

The location of the River Murray offtake, was ultimately determined to be located at the same location as the existing Wentworth Council raw water offtake upstream of the River Murray/Darling River confluence to take advantage of more reliable higher quality water, and noting the time required to obtain the necessary land access and environmental approvals for a route north from Fort Courage were not compatible with the project’s objective of delivery by December 2018.

The final route through the Wentworth township, following consultation with Wentworth Shire Council, was relocated to the eastern side of town to avoid local impacts as much as possible, and includes a number of additional river crossings.

As indicated in section 5, the project will continue to be refined by the Contractor during the detailed design phase and this will involve identifying opportunities to further reduce potential impacts.

### 4.3.3 Evaluation of Waterway Crossing Methodology

Alternative options were also considered to construct the pipeline across watercourse crossings. The evaluation of waterway crossings is detailed in Table 4-2 below.
## Table 4-1 Summary of options evaluation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sub-criteria</th>
<th>Base case</th>
<th>Option 1a – Murray pipeline – western route</th>
<th>Option 1b – Murray pipeline – eastern route</th>
<th>Option 2 – Menindee lakes surface water and Talyawalka borefield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water security</td>
<td>NSW Guidelines on Assuring Future Urban Water Security</td>
<td>☒ Does not meet the 5/10/10 water security threshold</td>
<td>☒ The River Murray as a bulk water source substantially exceeds the 5/10/10 water security threshold</td>
<td>☒ The River Murray as a bulk water source substantially exceeds the 5/10/10 water security threshold</td>
<td>☒ The Menindee Lakes with the Talyawalka borefield as a supplementary water source meets the 5/10/10 water security threshold under current operations.</td>
</tr>
<tr>
<td>Water supply service level requirements</td>
<td>Average annual demand</td>
<td>☒ Existing system cannot reliably supply average annual demand due to insufficient system inflows and failing infrastructure</td>
<td>☒ New infrastructure is capable of transferring annual water demand</td>
<td>☒ New infrastructure is capable of transferring annual water demand</td>
<td>☒ New infrastructure is capable of transferring annual water demand</td>
</tr>
<tr>
<td>Peak daily demand</td>
<td>☒ Existing system, including short term solution, is incapable of meeting the peak daily demand.</td>
<td>☒ Pipeline and balancing storage is designed to meet peak daily demand year-round.</td>
<td>☒ Pipeline and balancing storage is designed to meet peak daily demand year-round.</td>
<td>☒ Borefield and pumps will be capable of extracting peak daily water demand.</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>Australian Drinking Water Guidelines (ADWG)</td>
<td>☒ Mica St WTP can treat 31.5 ML/day and the RO plant, where required, can treat a minimum of 13 ML/day to the AWGD</td>
<td>☒ Mica St WTP can treat 31.5 ML/day of raw River Murray water for reticulation</td>
<td>☒ Mica St WTP can treat 31.5 ML/day of raw River Murray water for reticulation</td>
<td>☒ Mica St WTP and expanded RO facility could treat 31.5 ML/day of water for reticulation</td>
</tr>
<tr>
<td>Value for money</td>
<td>Benefit cost ratio (ranking)</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Financial net present value</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Criteria</td>
<td>Sub-criteria</td>
<td>Base case</td>
<td>Option 1a – Murray pipeline – western route</td>
<td>Option 1b – Murray pipeline – eastern route</td>
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<td>--------------------------------------------</td>
<td>----------------------------------------------------------------</td>
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<tr>
<td>(NPV) (ranking)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative project risk</td>
<td>Financial NPV using quantitative risk (ranking)</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Qualitative systematic risk</td>
<td>Peak daily demand 37. ML/day</td>
<td>Highest</td>
<td>Lower risk</td>
<td>Lower risk</td>
<td>Higher risk</td>
</tr>
<tr>
<td>Pipeline Section</td>
<td>Creek</td>
<td>Preferred Installation Method</td>
<td>Justification / Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
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<tr>
<td>Pipeline between the intake pumping station and TPS1</td>
<td>Tuckers Creek</td>
<td>Horizontal directional drilling (HDD)</td>
<td>Open trenching is not feasible due to high river flows, significant cost and environmental impacts. An aerial pipeline is not feasible because there is no bridge at these locations to attach the pipe to. Aerial crossings are very expensive, carry a risk of damage by floods and may result in environmental impacts during construction of pipe supports in the middle of such waterways. HDD is the preferred construction method. Although there is a risk of drilling fluid such as bentonite leaking from the bore and impacting on water quality in these waterways, management measures would be implemented to minimise the risk of this occurring. The drilling fluid would also be an environmentally benign substance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline between TPS1 to TPS2</td>
<td>Great Darling Anabranch</td>
<td>Open Trenching</td>
<td>Large diameter high pressure pipes cannot easily be attached to the bridge decks. It would need to be determined that hanging a large diameter pipe to the beams under the bridge deck would not have adverse impacts on the bridge performance and the bridge life. It is also not easy to provide supports for the vertical bends at the ends. This bridge is heritage classified. The pipeline is expected to last 70-100 years. If the bridge is replaced by RMS in the near future, the water authority has to bear the replacement /relocation costs of the pipeline. The pipeline would be located about 30m from the bridge. At this location, the river is shallow and runs dry most the year. There is no reason to bring the pipeline closer to the road to fix to the bridge. HDD would be expensive and has the risk of environmental damages due to potential leaking of the bentonite slurry from the bore into the creek bed (no bedrock, permeable soil, etc, and accidental spills and poor management of drilling fluids etc. Open trenching of the pipeline across the river (with erosion prevention measures during construction and operation) is the preferred construction method.</td>
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<tr>
<td>Pipeline Section</td>
<td>Creek</td>
<td>Preferred Installation Method</td>
<td>Justification / Requirements</td>
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<tr>
<td>Pipeline between TPS1 to TPS2</td>
<td>Two Miles Break Creek Four Miles Creek (2 crossings) Tingha Creek</td>
<td>Open Trenching</td>
<td>These creeks are dry most of the year, or at least for one or two weeks which is sufficient for construction. These are very wide shallow creeks and therefore it is not economical to adopt expensive methods such as HDD. The pipeline would be located approximately 30m away from the bridge/culverts and the creek bed at this location is like a shallow depression. Using the road bridges to span the creek is not practicable because large diameter, high pressure pipes cannot be attached to the culvert headwalls or bridge decks. Open trenching can be carried out during dry periods with appropriate erosion protection methods during construction and operation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline section between TPS2 to TPS3</td>
<td>Coombah Creek Pine Creek</td>
<td>Open Trenching</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline section between TPS3 to Broken Hill</td>
<td>Kellys Creek</td>
<td>Open Trenching</td>
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</tr>
</tbody>
</table>
4.4 Water Access Licence – Option Evaluation

4.4.1 Options

The operation of the project will require a new WAL under the WM Act for the River Murray Intake to operate. Three scenarios have been considered to obtain this WAL, these being;

1. Fully relinquish WAL 8584 (all allocations) and purchase a new WAL to meet all the Essential Water’s water needs.

2. Partially relinquish WAL 8584, maintaining sufficient water to meet local needs at and near Menindee only and purchase a new water entitlement for the River Murray Intake.

3. Retain WAL 8584 in full (based on existing the water supply works at Menindee) and seek to transfer the allocation (annually or permanently) to the new water supply works for the River Murray Intake. This would involve applying for a Local Water Utility Special Purpose WAL without purchasing any water entitlements).

These options are discussed below. Essential Water would consult with DPI Water to confirm the preferred option to obtain the WAL. There are a number of factors to be considered when determining the preferred WAL option including the possible future impact of a cessation or reduction in demand for water by Essential Water (or the future owners) from the WAL.

4.4.2 Considerations

Extreme drought

A repeat of extreme drought conditions upstream driven by a repeat of the 2006-2009 drought, causing the suspension of the WSP by the NSW Water Minister may alter the conditions for both using and trading the water allocation generated by the WAL 8485:

- During the period from the 11 October 2006 until 16 September 2011 the NSW Regulated Murray and Lower Darling Water Sharing Plan suffered an extended ministerial suspension. During this period of drought and water shortages, a number of special provisions and actions were endorsed by the NSW Water Minister and implemented, primarily to secure water for essential services such as the water supply for Broken Hill. These provisions impacted announced allocations, temporarily changed some water allocation- trade rules and restricted water access in urban communities throughout the Murray and Darling River communities.

- During this period, the need to secure the Country Energy/Essential Water allocation from its entitlements drove water resource management decisions in the Lower Darling River system, i.e. the preservation of a water supply within the Menindee Lakes complex, capable of providing water for Broken Hill during an extended period of no-flow in the Darling River drove a number of actions including the suspension of access to water for a large number of upstream users, the installation of pumps and pipelines to extract dead-storage within the Menindee Lakes and reduction of even the minimum levels of water releases into the Lower Darling River. If the requirement to maintain a residual supply for Broken Hill is
removed or greatly diminished due to the project being commissioned, then it is likely water management decisions during future dry periods will change significantly - possibly resulting in greater releases of water from the lakes into the Lower Darling River earlier, and lower evaporative losses from the lakes being incurred.

Reconfiguration of Menindee Lakes operations
The NSW Government has explored a scope of works and operational changes that could allow Menindee Lakes to be operated in a way that achieves significant water savings, in line with a triple-bottom line approach that will help NSW meet its Basin Plan commitments without relying on water buybacks.

Changes in current management of the Menindee Lakes as a result of a NSW proposed SDL off-set initiative is currently being assessed by the Commonwealth.

Since 2007 a number of initiatives have been considered to improve the ability of the Menindee Lakes to store water more efficiently, and to improve environmental outcomes. (Refer SKM Report: Darling River Water Savings Report- Part B, March 2007). These initiatives include proposed new regulating structures, and an increase in the capacity of the Menindee regulator, to improve water management and to enable greater controlled daily releases from the Menindee Lakes complex for environmental flows, and for inter-valley water-transfers.

The description of the project in the published register is broad, but is likely to be based on the earlier work developed and reported-on by SKM.

“This project is a package of operational changes and infrastructure works designed to improve the efficiency of the Menindee Lakes system. The enhanced Menindee project introduces some new works and measures to incorporate a wider range of infrastructure, operations, regulatory and adjustment options which in combination will deliver greater water efficiency savings. The proponent acknowledges the need for consultation with communities and the need to set out transparent governance arrangements.”

In June 2017, Webster Ltd announced the sale of all water entitlements held at their previously irrigated Tandou property near the Menindee Lakes. This means that there is no longer any need to supply regulated Darling River allocation water directly from the Lake Cawndilla outlet at the southern end of the Menindee Lakes complex to Tandou for irrigation. As a result, further storage efficiencies may be possible, particularly if Cawndilla and Menindee Lakes are physically separated through the construction of a bank with a regulating structure.

The impacts of the changes already implemented and outlined for future implementation are yet to be finalised, as the impacts on Regulated and Unregulated Lower Darling water security and annual allocations have not been fully assessed. The potential of these changes will affect, and probably improve, the security, annual yield and utility of the allocations generated by the current Country Energy/Essential Energy Water Utility WAL 8584.
4.4.3 **Comparison of Water Access Licence Options**

Broken Hill had an estimated population of 18,027 people in 2016 and a significant demand for water from mining company operations. Menindee had a population of 449 in 2011. Based on water use being proportionate to the population, the Menindee population alone would need only 2.4% of the water of the combined population when Broken Hill is served by the project. In addition, it is understood the Menindee population can be supplied through the Menindee Common groundwater bores, if Lower Darling (Lake Menindee) supplies are not available.

Although Broken Hill represents the largest demand for urban consumption, the options considered ensure adequate supply to the towns of Menindee and Sunset Strip, as listed below:

- **Option 1** - Fully relinquish WAL 8584, resulting in the complete cessation of water extraction from Menindee Lakes, and

- **Option 2** - Partially relinquish WAL 8584, resulting in a reduction in extraction, leaving only the need to supply to Menindee and Sunset Strip customers.

These options are considered in Table 4-3 and Table 4-4. The results are very similar as the demand from Menindee and Sunset Strip is relatively small.

A possible third option (Option 3) is that Essential Water retain WAL 8584 and secure further water entitlements from the NSW River Murray. This option is likely to have very little extra cost when compared with Option 1, as relinquishing the WAL 8584 licence would not have any financial (cost) advantage, and if retained may provide an opportunistic benefit to the WAL owner during a repeat of very dry periods, such as if the Minister allows allocation trade and/or transfer of special purpose WAL 8584 to other Darling River and River Murray users in future. However, it is possible after a period of redundancy, DPI Water may seek to extinguish all or most of the special purpose WAL, based on it being no longer used for the special purpose for which it was granted.

In the event that such an arrangement was allowed, it would likely lead to small improvements in water quality and improvements in all other tabulated indicators, as the water would be retained within the lakes, or released into the Lower-Darling River. All three options are compared in Table 4-5.

A preferred option has not been selected and will be determined by Essential Water who is responsible for amending existing and or obtaining any new WALs.
Table 4-3 Option 1 - Fully relinquish water extraction under licence WAL 8584

<table>
<thead>
<tr>
<th>Measure to be considered</th>
<th>Resulting outcome</th>
<th>Comments, rationale and practical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Impacts on water sources</td>
<td>Slight improvement</td>
<td>Assumes that water source is stored in the Menindee Lakes complex.</td>
</tr>
<tr>
<td>• Average volume held in Menindee Lakes (source)</td>
<td>Slightly higher volume held on average</td>
<td>Relinquishment of the only significant local water utility (LWU) licence in the Regulated Lower Darling will enable water managers to increase the risks related to water management – particularly measures to address the risk of effectively running out of water in the Lakes system. This will enable greater annual releases when water is available and will reduce evaporative losses that are experienced when water held during extended periods of no-flow is stored in remnant shallow storages.</td>
</tr>
<tr>
<td>• Water quality of water held in Menindee Lakes</td>
<td>Small improvement in water quality</td>
<td>This will be dependent on water management within the lakes system, and is largely determined by the volume and quality of annual inflows to the lakes.</td>
</tr>
<tr>
<td>2 Impacts on indigenous, cultural, heritage or spiritual matters</td>
<td>Improved volumes released from Menindee into Lower Darling River</td>
<td>Despite the relatively small volume relinquished from the LWU WAL 8584 relative to the capacity of the Menindee Lakes, and the average flow in the Darling River, if the licence is fully relinquished, water managers may be able to introduce flow sequences in the Lower Darling River that better resemble natural flows which may in turn improve indigenous, cultural and spiritual outcomes.</td>
</tr>
<tr>
<td>3 Impacts on water users (urban, basic landholder rights and irrigation)</td>
<td>Improvements in most key indicators</td>
<td>Lower demand from the LWU WAL 8584 would slightly increase water allocation availability for other users.</td>
</tr>
<tr>
<td>• Water security for direct-from-Menindee Lakes (Lower Darling) water users – including (remaining) basic landholder rights and HS and GS irrigation licences.</td>
<td>Small improvement in water security</td>
<td>The impacts on water users will be minimal. The increased flexibility for water managers may lead to slightly higher allocations for General Security and for High Security water</td>
</tr>
<tr>
<td>• Water security for irrigation (HS, GS) customers on the Lower Darling River b/w B Menindee and</td>
<td>More water available for other licence holders</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Measure to be considered</th>
<th>Resulting outcome</th>
<th>Comments, rationale and practical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wentworth</td>
<td></td>
<td>users on the Lower Darling, as reserves to maintain LWU WAL 8584 allocation volumes during prolonged droughts may not have to be held.</td>
</tr>
<tr>
<td>• Water security for Darling R pastoral users D/S of Menindee (Basic Landholder rights)</td>
<td>Slight improvement</td>
<td>Greater opportunity to maintain low flows in Lower Darling, as reserving water for LWU not required. Likely to improve water availability during future periods of drought induced. Water plan suspension (Water Sharing Plan, or Water Resource Plan post June 2019) depending in future demand and use of E-Water, which will dominate water demand in the Lower Darling River and the Great Anabranch.</td>
</tr>
<tr>
<td>• Water security for Pooncarie township</td>
<td>Increase</td>
<td>Will depend on water management of the Menindee Lakes in future (a far, more important factor). Reduction in demand for water for the LWU WAL 8584 will enable improved flows in the Lower Darling, benefitting Pooncarie’s water demand.</td>
</tr>
<tr>
<td>4 Maximising social and economic benefits</td>
<td>No significant change</td>
<td>Because the volume is so small relative to average annual flows, and the total capacity of the Menindee Lakes, other factors, for example the future management of Lower Darling E-Water allocations, will have a far greater impact on social and economic benefits for the region than the relinquishing of the allocation derived from the LWU WAL 8584. Slight decrease in employment of staff related to pump and pipe work maintenance in Menindee, as a smaller system is likely to replace the current pump works.</td>
</tr>
</tbody>
</table>

Note: measures to be considered items 1-4 reflect NSW legislation: *General Principles outlined in Access Licence Dealing Principles Order 2004 – (as amended)*. No change would be required to 2004 Water Sharing Plan.
### Table 4-4 Option 2 - Partially relinquish the annual extraction under licence WAL 8584 to reflect local demand only (i.e. excluding Broken Hill)

<table>
<thead>
<tr>
<th>Measure to be considered</th>
<th>Resulting outcome</th>
<th>comments, rationale and practical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Impacts on water sources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average volume held in Menindee Lakes (source)</td>
<td>Slightly higher volume held on average</td>
<td>Partial relinquishment of the only significant LWU licence in the Regulated Lower Darling may enable water managers to slightly increase the acceptable risks related to water management – particularly measures to address the risk of effectively running out of water in the Lakes system. This will be more likely if Menindee and Pooncarie have the opportunity to access a drought-supply of water during a repeat of past extreme drought periods.</td>
</tr>
<tr>
<td>Water quality of water held in Menindee Lakes</td>
<td>Small improvement in water quality</td>
<td>This will be far more dependent on water management within the lakes system (rather than how much water is used from the available allocation to WAL 8485), and is largely determined by the volume and quality of annual inflows to the lakes.</td>
</tr>
<tr>
<td><strong>2. Impacts on indigenous, cultural, heritage or spiritual matters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slightly improved volumes released from Menindee into Lower Darling River</td>
<td>Despite the relatively small volume partially relinquished from the LWU WAL 8584 relative to the capacity of the Menindee Lakes (9.95GL of 1,750GL), and the average annual flow in the Darling River, if the licence is only partially relinquished, water managers may be able to introduce some more flow sequences in the Lower Darling River that better resemble natural flows which may in turn improve indigenous, cultural and spiritual outcomes. This will be not be quite as significant compared to the full relinquishment of the licence, and will be heavily dependent on policies adopted to reserve water for future season allocations for WAL 8485.</td>
</tr>
<tr>
<td><strong>3. Impacts on water users (urban, basic landholder rights and irrigation)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water security for direct-from-</td>
<td>Improvements in most key indicators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small improvement in water</td>
<td>Lower demand from the LWU WAL 8584 would slightly increase water allocation availability for other users,</td>
</tr>
<tr>
<td>Measure to be considered</td>
<td>Resulting outcome</td>
<td>comments, rationale and practical considerations</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Menindee Lakes (Lower Darling) water users – including (remaining) basic landholder rights and HS and GS irrigation licences.</td>
<td>security</td>
<td>proportionally to the reduction in demand. The much more significant factor than the volume of allocation used will be the extent that water managers reserve water each year to be confident water will be available for WAL 8485 in a future season.</td>
</tr>
<tr>
<td>• Water security for irrigation (HS, GS) customers on the Lower Darling River b/w B Menindee and Wentworth</td>
<td>No change – probably no more water available for other licence holders</td>
<td>The impacts on water users will be minimal, as previous season-reserves to maintain LWU WAL 8584 allocation volumes during prolonged droughts may still be needed- if any allocation is needed to meet urban water demand.</td>
</tr>
<tr>
<td>• Water security for Darling R pastoral users D/S of Menindee (Basic Landholder rights)</td>
<td>Little change</td>
<td>The impacts on Basic Landowner rights / pastoral water users will be minimal, as previous season-reserves to maintain LWU WAL 8584 allocation volumes during prolonged droughts may still be needed- if any allocation is needed to meet Menindee/Sunset strip urban water demand.</td>
</tr>
<tr>
<td>• Water security for Pooncarie township</td>
<td>No change / little increase</td>
<td>Will depend on water management of the Menindee Lakes in future (a far, more important factor). Reduction in demand for water for the LWU WAL 8584 will enable improved flows in the Lower Darling, benefitting Pooncarie’s water demand against its WAL provided there is enough water available for the run-of-river.</td>
</tr>
<tr>
<td>4. Maximising social and economic benefits</td>
<td>No significant change</td>
<td>Because the volume is so small relative to average annual flows, and the total capacity of the Menindee Lakes, other factors, for example the future management of Lower Darling E-Water allocations, will have a far greater impact on social and economic benefits for the region than the relinquishing of the allocation derived from the LWU WAL 8584. Slight decrease in employment of staff related to pump and pipe work maintenance in Menindee, as a smaller system is likely to replace the current pump works.</td>
</tr>
</tbody>
</table>

Note: measures to be considered items 1-4 reflect NSW legislation: General Principles outlined in Access Licence Dealing Principles Order 2004 – (as amended). No changes to 2004 NSW Regulated Murray and Lower Darling WSP required.
### Table 4-5 Option Analysis

<table>
<thead>
<tr>
<th>Options</th>
<th>Cost Considerations</th>
<th>Flow and Environmental impacts</th>
<th>Comments, rationale and Practical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fully relinquish WAL 8584 (all allocations) and purchase a new WAL to meet all the Essential Water water needs (ie purchase 10,000 ML high security water entitlement).</td>
<td>Water purchased will cost $33M at 2017 prices if NSW high security Murray entitlements are purchased.</td>
<td>Would lead to more water being stored at almost all times. Would enable increase flexibility for operator at Menindee, as reserving large volumes of water between seasons to secure urban supplies and evaporative losses would not be required.</td>
<td>Simplest option. High associated cost.</td>
</tr>
<tr>
<td>2. Partially relinquish WAL 8584, maintaining sufficient water to meet local needs at and near Menindee only and purchase a new Murray water entitlements for the River Murray Intake.</td>
<td>Very similar to Option 1, because the Broken Hill demand dominates the total demand.</td>
<td>Improvements in all key indicators</td>
<td>Very similar to Option 1, because retained water allocation is very small if it is based only on future utility demand in Menindee.</td>
</tr>
<tr>
<td>3. Retain WAL 8584 in full (based on the existing water supply works at Menindee) and seek to transfer allocation (annually or permanently) to the new water supply works for the River Murray Intake.</td>
<td>Low cost for water entitlements, but requires development of a compelling case for Ministerial endorsement, and possibly legislative change and changes to the WSP.</td>
<td>The application will increase flows in Lower Darling (to meet demand from new works). River operator may request losses are accounted for, further increasing flows in Lower Darling. Risk of entering Murray water markets in extreme drought seasons unless water supply for Broken Hill is actually deemed.</td>
<td>Administratively most difficult.</td>
</tr>
</tbody>
</table>
5 Scope of Works

This section describes the proposal which is assessed in this REF. Information for this section has been taken from the Water NSW Murray to Broken Hill Pipeline Volume 4 - Output Specifications (GHD, 2017).

5.1 Introduction

The project involves the construction of a pipeline commencing at the River Murray in Wentworth, upstream of its confluence with the Darling River, to transport and discharge up to 37.4 ML/d of water directly to the Mica Street WTP in Broken Hill.

The project will be procured on a Design Build Own Operate basis, and therefore exact details of the infrastructure will be determined by the successful contractor. The following description of the works is based on the preliminary concept development documents and is subject to change and / or further refinement as the design progresses.

5.2 Overview of the Project

The proposal involves the transfer of water from the River Murray in Wentworth to the town of Broken Hill. The main components of the proposal are summarised as:

- A lift pump station at the River Murray with associated inlet works (referred to as the River Murray intake) located adjacent to the existing Wentworth Town Water Supply pumping station (PS) in Wentworth. This would also involve demolition of the disused wet well associated with the Wentworth Town Water Supply PS;
- A below ground delivery pipeline from the River Murray intake to a raw water balance tank at a new dosing plant;
- A new dosing plant and TPS 1 approximately 8.5 km north of Wentworth,
- A main pipeline comprising 750 mm diameter mild steel concrete lined (MSCL) pipes located predominantly within the Silver City Highway road reserve on the western side of the highway. The total pipeline length is approximately 270 km;
- Two additional transfer pumping stations (TPS2 and TPS3), and associated balance tanks and photovoltaic power generation system, located along the main pipeline alignment adjacent to the Silver City Highway (it is noted that three possible locations are being considered for TPS2);
- A bulk water storage, approximately 20 km south of Broken Hill;
- Terminal balance tank and associated pipework at Mica Street WTP; and
- Associated electrical, telemetry, mechanical and civil works, including ancillary infrastructure such as scour valves and air valves.

A description of the main infrastructure is detailed in the sections below. An overview of the scheme is provided in Figure 1-2 with concept plans provided in Appendix C.

5.2.1 River Murray Intake

The River Murray intake and pumping station would be located in the Ski Reserve area, immediately east of the existing Wentworth raw water pump station. The site located is on the northern bank of the River Murray, south of the hospital, and upstream of the confluence with the Darling River (see Figure 5-1). The pump station will pump raw water
from the River Murray to the dosing plant. The pump building and all electrical works will be constructed above the 1 in 100 year flood level (as defined by the Wentworth Shire Council flood mapping data) and would be contained within Lot 1 and Lot 2 (part) DP817572 as owned by Wentworth Shire Council.

The River Murray intake is likely to consist of the following main components:

- a reinforced concrete wet well with two duty submersible pumps and one standby pump. The wet well will have an approximate diameter of 5 m and a depth of 9 m;
- inlet pipes extending approximately 20 m into the river (from the edge of the river bank);
- two or three stainless steel river intake screens. The screen apertures will be up to 3 mm and the approach velocity to the intake structure is less than 0.1 m/s to minimise the risk of debris and fish/fish larvae entering the pumping system;
- screen air burst automatic cleaning system to perform a minimum of three air burst cleaning operations in rapid succession;
- a switch room building, approximately 10 m x 3 m, to accommodate electrical systems. The switch room will be air-conditioned in order to house a variable speed drive for the pumps; and
- transformer yard, instruments and electrical substation (this infrastructure is assessed in a separate REF that will be determined by Essential Energy and relates to the power supply to the intake pumping station).

The existing operational Wentworth Shire Council intake pump station would be connected to the new wet well via a new DN500 interconnecting pipework and valve. A concept layout of the River Murray intake is provided in Appendix C.

5.2.2 Dosing Plant

The dosing plant would contain the ability to dose (lime and CO₂) if required to correct the pH in the raw water. The dosing plant will be located approximately 8 km north of Wentworth (see Figure 5-1) and will occupy an area approximately 20 ha. The exact details of the dosing method (including types and volumes of chemicals) and infrastructure would be confirmed by the contractor during detailed design. All chemicals would be stored and used in accordance with Australian Standards and Codes of Practice.

TPS1 would also be located at the site for the dosing plant and would pump water from this site to TPS2.

5.2.3 Pipeline

The main pipeline associated with the project is likely to comprise 750 mm diameter mild steel concrete lined (MSCL) pipe, however this would be confirmed by the contractor during detailed design. The total pipeline length is approximately 270 km and would be largely located within the western road reserve of the Silver City Highway. The pipeline would be buried with a minimum cover of 750 mm.

The pipeline would include ancillary infrastructure such as air values and scour valves for maintenance and flushing. The air valves would be located at high points along the pipeline and scour valves would be located at low points along the pipeline. A number of
offtake valves may also be provided to allow for water distribution to landowners along the alignment.

Thrust blocks would be installed along the pipeline to minimise the risk of damage to the pipeline that may be caused by unsupported pipe movement. The location of the thrust blocks would be confirmed during detailed design and is likely to be required in locations where the pipe changes direction, changes size, at terminal points. The thrust blocks are likely to be constructed using cast in situ concrete.

**Pipeline from River Murray Intake to the Dosing Plant**

The pipeline route from the River Murray Intake (Figure 5-1) travels from the River Murray pump station across Ski Reserve Road, turns east near Hospital Road and turns north to cross the Silver City Highway and Tuckers Creek. On the northern side of Tuckers Creek the pipeline travels northwest and then north to the intersection of Pooncarie Road / Wentworth Street and Perry Street East. The pipeline then travels north within the Pooncarie Road corridor for approximately 420 m before turning north west to the Darling River. The pipeline crosses beneath the Darling River then follows Sheoak Lane towards to the Silver City Highway, turns north and travels along the Silver City Highway corridor. The pipeline crossings of Tuckers Creek and the Darling River would be installed using trenchless construction techniques.

**Transfer Main from Dosing Plant to Broken Hill (Main Pipeline)**

The main pipeline alignment runs predominantly north-south following the Silver City Highway from the dosing plant in Wentworth to Broken Hill.

**Transfer Main within Broken Hill**

At the northern end of the alignment within Broken Hill, the proposed pipeline route turns west off Silver City Highway into Kanandah Road, crossing from the western side of the highway to the northern side of Kanandah Road. It follows Kanandah Road before turning east into Griffith Street and then north into Slag Street and onto Slag Lane. The pipeline travels along Slag Lane before meeting up with Gaffney Street then left onto Garnet Street before terminating at the Mica Street WTP.
Figure 5-1 Location of the pipeline alignment and dosing plant at Wentworth

5.2.4 Transfer Pumping Stations

Three TPS are proposed as part of the River Murray to Broken Hill Pipeline Project;

- TPS1 - located at the dosing plant,
TPS2 – Three options were considered and Option 2 has been discounted. The following two options are being considered:

- TPS2 - Option 1 100 km from Wentworth,
- TPS2 - Option 3 193 km from Wentworth

TPS3 - 226 km from Wentworth,

The pumping stations share common design elements to reduce the complexity of their construction and maintenance. The pumping station buildings for the transfer main will be constructed from tilt up concrete panel walls supported by steel frames and metal clad roofing. The pumping station sites are likely to consist of:

- Main pump room housing the pumps, motors and gantry crane with sufficient space for a truck to back up into the room for unloading/loading of equipment.
- Workshop room within the main pump room.
- Low voltage switchroom.
- Amenities room with space for lunch area and a workstation.
- Disabled access toilet.
- Air-conditioning for the low voltage switchroom and the amenities room.
- Concrete balance tank with metal clad roofing and an indicative capacity of about one megalitre. The balance tank is needed so water is stored at a constant level above the pump inlet to ensure safe operation of the pumping station.
- Scour facilities
- A separate tilt-up concrete High Voltage building housing the high voltage switchboards. The High Voltage building and associated equipment is part of the power supply infrastructure that is assessed in a separate REF.
- Transformer yard housing the Low Voltage and High Voltage transformers separated by a concrete masonry blast wall.
- Access roads.
- 1.8 m high chainmesh security fence around the whole site with a wide lockable access gate to allow heavy vehicle access.
- Rainwater tank for onsite usage.
- Septic tank.
- Photovoltaic (PV) power generation system
- Discharge lagoon to capture sediments from pigging

5.2.5 Bulk water storage

The Bulk Water Storage would receive and store the water transferred from the River Murray before it is pumped to the Mica Street WTP. It would provide storage capacity along the pipeline to ensure that water supply can be maintained if there is an outage on
the pipeline between the intake pumping station and the storage. The storage would be located near Broken Hill and would include related bypass, valving, sampling, aeration, flow and water quality measurement and other related assets.

The embankments be constructed from earth excavated from within the storage. The storage would have a synthetic liner on the inside of the embankment to minimise infiltration, hold a volume of between 250-720 ML, and be between 4-6m deep.

### 5.2.6 Mica Street WTP

The pipeline will terminate at the Mica Street WTP. A terminal balance tank and associated pipeline connections are proposed at the Mica Street WTP. The approximate location of the balance tank is provided in Figure 5-2. Details with respect to the design, size and capacity will be determined by the contractor, however it is likely to be about seven metres high and have a capacity of about seven megalitres.
5.2.7 Power Supply

A high voltage power supply will be provided to the TPS sites in addition to the PV cells. The assessment of the construction and operation of the power supply is being undertaken separately, to be determined by Essential Energy as the relevant electricity authority. Once the power supply to the project has been constructed and commissioned,
ownership of this infrastructure would be transferred to Essential Energy who would then be responsible for its operation and maintenance.

5.2.8 Telemetry
The telemetry network required for the project includes a series of towers and repeater stations. The contractor would develop the design for the telemetry system and confirm the location of all infrastructure. The telemetry system would be subject to separate environmental assessment, including field investigations if it involves work outside the corridor assessed in this REF.

5.3 Capital Investment
The total capital investment value of the project is estimated to be approximately $500 million.

5.4 Land Access Strategy
A Land Access Strategy has been developed to determine land ownership details and the approval requirements needed to implement the project.

Where Council owned or managed land is to be used or affected, negotiations similar to those for private land would be undertaken. Prior to construction, negotiations will be undertaken with the relevant Councils to enter into Deeds of Occupation to cover such things as the term of occupation, rent, fencing, access, indemnity, ownership of improvements, rectification of damages and future acquisition intentions.

Negotiations would also be undertaken with holders of other interests in the land such as any affected leaseholders or easement rights holders (including Native Title holders) to determine the impact on their rights over the land and if impacted, to obtain consent to the works.

Following construction, acquisition would commence subject to compensation being agreed for the land or easements acquired as defined under the Land Acquisition (Just Terms Compensation) Act 1991 and generally determined by the Valuer General. Land boundary surveys are required to create plans which legally define the dimensions and area of the subject land and easements that are to be acquired. This is the case for all types of land tenure.

A summary of the expected land ownership categories and the relevant approval strategy is provided in Table 5-1.

**Table 5-1 Land Ownership Categories and Strategies**

<table>
<thead>
<tr>
<th>Land Ownership Category</th>
<th>Sub categories</th>
<th>Strategies</th>
</tr>
</thead>
</table>
| Crown Land              | Crown Roads Water bodies Reserves under *Crown Lands Act* Town Commons Travelling Stock Routes | Negotiate with DoI – Lands & Forestry to gain approval to construct, subject (as appropriate) to:  
  - Deed of Occupation (or Licence) |
<table>
<thead>
<tr>
<th>Land Ownership Category</th>
<th>Sub categories</th>
<th>Strategies</th>
</tr>
</thead>
</table>
|                         | Native title interests | • Lease  
|                         | Land subject to Aboriginal Land Claims | • Land acquisition  
|                         |                               | • Easement acquisition  
|                         |                               | Additionally negotiate and gain approval as appropriate from:  
|                         |                               | • Reserve or Common Trusts  
|                         |                               | • Local Land Services  
|                         |                               | • Owners of other affected interests e.g. licences or easements  
|                         |                               | • Native Title rights holders where Native Title is determined  
|                         |                               | • Aboriginal Land Councils where an Aboriginal Land Claim has been lodged |
| Western Lands Leases    | N/A                        | Negotiations with the lessor to enter into a Deed of Occupation and/or land or easement acquisition  
|                         |                               | Application to DoI - Lands & Forestry for approval |
| Native Title            | Native Title is determined to exist over land | Three possible options;  
|                         |                               | 1. Section 24KA of Native Title Act 1993 - facilities for services to the public;  
|                         |                               | 2. Sections 24MD of Native Title Act 1993 - acts that "pass the freehold test" (compulsory acquisition); or  
|                         | Native Title is not determined | Application of procedural rights (Native Title Act) |
| Private Freehold        | N/A                        | Negotiations with landholder for Deed of Occupation and/or acquisition  
|                         |                               | Negotiations with holders of other affected interests in the land such as any affected leases or easements |
5.5 Construction Methodology

The project is to be executed under a Design Build Own Operate contract, with exact construction methodology being determined by the successful construction contractor.

This REF has been prepared based on an indicative construction methodology for the project. This methodology has been developed based on the preliminary concept design and experience with similar pipeline and water supply projects.

5.5.1 Construction Workforce and Accommodation

The number of personnel working on site at any one time will vary over the construction period. Depending on the contractor’s method and program, it is estimated that the number of construction workers on site could range from 500 to 600.

It is anticipated that construction staff would either stay at Mildura, Wentworth or Broken Hill and would be transported to construction sites daily, or alternatively would be accommodated in temporary construction camps that may be established at the site of the transfer pumping stations.

The exact layout, facilities and storage requirements for the construction campsite(s) would be determined by the successful contractor as part of the construction methodology, as would the number of staff accommodated at each site. Should the contractor choose to establish temporary construction campsites, it is anticipated that they would be self-contained and include facilities such as accommodation, construction offices, workshops, construction depot, fuel and water storage, dining hall, laundry, toilets, and waste disposal / recycling facilities. Energy required for the camps is expected to be provided by diesel generators.

It is assumed for the purposes of this REF that the contractor would source all water requirements for the campsites from Essential Water and that toilets would be portable and pump out style with suitable sized waste tank based on the number of construction
staff utilising the site. This REF has not assessed on-site sewage treatment or disposal facilities.

Camps would be dismantled and the site rehabilitated upon completion of the construction works.

5.5.2 Construction Compounds

Large construction compounds (either associated with the campsites or independent of them) may be established at TPS2 and TPS3 sites. It is anticipated that these sites would accommodate storage of machinery, fuels, materials and large deliveries. Smaller mobile site sheds are likely to be established along the pipeline alignment and would be relocated as construction progresses.

A suitable fuel storage area would be established and fuel storage tanks would be located in bunded areas capable of containing 110% of the largest tank capacity. Storage tanks would be located on bunded concrete slabs to ensure that the full volume can be contained (even during a rainfall event) should any leakage occur. All fuels and combustible liquids would be managed and handled in accordance with AS 1940 The storage and handling of flammable liquids and relevant WorkCover guidelines (see Section 6.8.1 for further details).

5.5.3 Construction Hours

The extreme temperature variations, coupled with a tight construction program, mean that construction is likely to take place 24 hours a day, 7 days a week for work outside the town boundaries (ie outside urban areas) to take advantage of the cooler night time temperatures and allow rest in the middle of the day. In addition, standard EPA hours defined in the Interim Construction Noise Guidelines (ICNG) may need to be varied on occasion for unusual or particular types of work such as testing/monitoring. The need for this will depend upon the contractor’s construction methodology.

For construction within the urban areas, the standard EPA working hours and days defined in the ICNG will apply (ie 7am to 6pm from Monday to Friday, 7am to 1pm on Saturday, and no work on Sunday or public holidays).

Shift work (one, two and/or three shifts) is likely to be implemented for sections of the project that involve construction outside standard working hours. The Contractor’s Work Health and Safety (WH&S) Management Plan will address shift and night-time work and identify controls that will be implemented.

Similarly, noise control measures will be addressed by the Contractor as part of the Construction Environmental Management Plan and this will detail all reasonable and feasible measures to be implemented to minimise noise impacts in accordance with the ICNG.

5.5.4 River Murray Intake

The methodology for constructing the River Murray intake is likely to involve the following:

- Demolish the existing Wentworth PS
- Construct temporary cofferdam and dewater. The contractor would determine whether a sheet pile or earth bund cofferdam is used (see below).
• Excavate for intake works
• Remove the old well and suction main
• Construct headwall, inlet pipe and install screens
• Construct wet well
• Supply and install pumps
• Supply and install pipework, valves and fittings
• Install instrumentation, electrical control gear, telemetry and SCADA
• Site rehabilitation and landscaping with native vegetation
• Site disestablishment

Cofferdam Options
To allow works within the River Murray at the intake structure to be undertaken in dry conditions a cofferdam will be required. Two cofferdam options are available to undertake the works; either an earth bund or sheet pile wall. An example of a sheet pile cofferdam is provided in Figure 5-3.

The earth cofferdam would have a larger footprint and be difficult to construct without impacting adversely on water quality. Earth cofferdams are generally more suited to low-level waters with low velocity and therefore this option is unlikely to be used for the intake. The steel sheet pile wall is likely to be easier to construct and provide a much smaller footprint in the waterway with little impact on water quality. However this is likely to be the more expensive option and therefore consideration of the two options, including a description of the likely construction method, has been provided below.

Water would be pumped out, settled in baffle tanks or similar (if required) and discharged to the river in compliance with section 120 of the PEPO Act, leaving the interior dry for bank excavation and subsequent construction of the headwall.

Sheet Pile Wall
The piling for the sheet pile wall would be driven into river bed from a barge. The top of the piling would need to be at least to bank level to cater for in river flows (the contractor would determine the required level). Once the cofferdam is constructed, water would be pumped out and construction would commence.

Earth Bund
The construction of the earth bund cofferdam would involve the delivery of earth to the site placement around the works area using dump trucks and excavators. The earthen walls would need to be designed with suitable batters to ensure that the embankments remain stable and are not impacted by wave action. Once the cofferdam is constructed, water would be pumped out and construction would commence.
Figure 5-3 Example of sheet pile cofferdam

5.5.5 Pipeline

The 750 mm diameter MSCL pipe would typically be located between 25 to 30m from the edge of the road shoulder. The total width by construction works for the pipeline corridor is 25 m and this would include a trench that is about 2.6 m wide, and an area of between 4 m to 7 m wide to accommodate access tracks, set down points and storage areas. At sensitive locations the pipeline may be closer to the road shoulder alignment to reduce ecological or cultural heritage impacts. The width of the construction corridor would also be reduced to 10 m for a short section along the Silver City Highway where it would impact on Purple–wood wattle which is a threatened species listed under the TSC Act.

The proposed construction method would depend on a number of factors including the final pipe alignment and the contractor’s installation method, equipment and program. Trenching would generally be carried out using excavators and a compactor. Rock excavation may potentially be required at certain points along the alignment, particularly on the approach to Broken Hill where rock is likely to be present at near the land surface. The pipeline would be installed by open trenching with underboring undertaken at major waterway, rail and highway crossings, as described below.

Pipes would be delivered by trucks along the route as excavation proceeds. Pipe laying would be undertaken progressively and would occur 24 hours per day outside the urban areas of Wentworth and Broken Hill. It is assumed that up to five pipe laying crews would work concurrently at different locations along the alignment. Depending on the local geological conditions, pipe laying is assumed to occur at a rate of 1,000 m / crew / shift.

It is likely that the TPS sites would be used for major compounds for stockpiling of materials and storage.
The methodology for the pipe laying works is likely to involve the following steps:

- Establish worker compound, fencing, storage and set down areas
- Establish environmental and traffic controls
- Stringing pipes along the alignment
- Excavate trenches. Trench excavations would be approximately 2 m deep and up to 2.6 m wide. The typical trench dimension is provided in Figure 5-4. Vehicles and materials would be stored in close proximity to, and within cleared areas (where available) of the proposed pipeline alignments. Excavated material would be placed adjacent to the trench
- Stockpile excavated topsoil separately
- Lay bedding material within the trench, install pipeline and all fittings
- Backfill pipeline trench using excavated soil and topsoil. The disturbed areas would be stabilised
- Spread excess spoil within the 25 m disturbance corridor or transport it for use in other areas of the project,
- Restore disturbed areas through backfilling, replacement of topsoil and, deep ripping compacted areas to a depth of approximately 150-200mm

Thrust blocks would be installed along the pipeline and this is likely to require cast *in situ* concrete.
Figure 5-4 Typical Trench dimension

Temporary Construction Access

Temporary access points (ramps) to the construction site would be established approximately every 5 km along the Silver City Highway.

Rail and Road Crossing

The pipeline construction will include a Silver City Highway crossing and a rail track crossing in Kanadah Road, Broken Hill. Trenchless construction methods would be used for both road and rail crossings and this is likely to involve pipe-jacking or HDD. The trenchless sections will be perpendicular to the centreline of the road and rail track.

HDD generally involves the following activities:

- clearing vegetation, as required
- installing fencing and security measures
- establishing and excavating pits at the start and end of the section to be drilled, including any necessary trench support. The pits would be within construction compounds about 20 m long and 20 m wide.
- mobilising the drill equipment and installing measures to manage groundwater if required
using a bentonite-based drilling fluid to lubricate the drilling head and flush the drilled hole. Drill cuttings would be removed and contained, collected and recycled at the drill launch site. The drill fluid recycling plant would be self-contained and powered by an on-site generator. Excess spoil, cuttings and slurry that cannot be used in site restoration would be disposed at a licensed facility.

- when the required diameter of the hole is reached, inserting a casing pipe and then pulling the product pipe through and grouting the annulus.

- pulling a pipe through the HDD bore by the drill head.

Pipe-jacking involves using an auger machine or micro-tunnel boring machine to excavate a tunnel from a launch shaft to a reception shaft. As the tunnel is excavated pipes are installed. This generally involves the following activities:

- establishing launch and reception shafts, each about 20 m by 20 m
- installing a jacking frame, launch headwall and retrieval headwall (if required)
- installing the auger or boring machine in the launch pit. The machine is then remotely controlled by hydraulics, using a laser guidance system from the launch pit to the rear of the cutting head
- slurry or cuttings are usually removed via vacuum extraction or a re-circulating slurry disposal system
- Grout annular space between the pipe exterior with the initially installed jacking pipe

For both methods:

- tanks would be used to enable drilling fluid to be recirculated
- once complete, the pipe would be commissioned by hydrostatic testing to check it has been successfully installed
- excess drilling fluids (likely to be bentonite which is environmentally benign) and spoil would be disposed of
- the trenchless section of pipe would be connected to the adjacent trenched sections of pipe
- equipment would be removed and affected areas would be restored as near as possible to the pre-construction conditions, including backfilling the bore shafts.

The pipeline must be encased at least 1.6 m below the road level unless otherwise required by RMS, and at least 3 m below the rail track level unless otherwise advised by ARTC.

The trenchless pipe sections will include the road carriageway, shoulder, table drain and up to 2 m outside the table drain on either side. For the rail track, thrust-boring pits are to be located outside the fence on the southern side and outside the track embankment on the northern side, about 3 m-5 m from the top of the retaining wall of the road.

RMS and ARTC have been consulted during development of the concept design as owners/managers of the relevant road and rail assets. The contractor would develop the final design and construction method in consultation with RMS and ARTC.
The compounds for the shafts at either end of the bore would be within the corridor assessed in this REF.

**Darling River and Tuckers Creek Crossings**

The section of the pipeline from the River Murray intake to the dosing plant and TPS1 will include crossings the Darling River and Tuckers Creek and the pipeline would be installed across these waterways using HDD as outlined above.

The construction for the shafts would remain within the width of the construction corridor for the pipeline.

**Other Creek Crossings**

The pipeline will require seven additional waterway crossings, with most of these waterways comprising small ephemeral creeks. The location of the creek crossings and description of the construction method is provided in Table 5-2 and concept plans and cross sections of a typical crossing are provided in Appendix C.

Open trenching is the preferred method of pipeline installation across ephemeral creeks. DPI Fisheries has been consulted and agreed in principle to the open trenching of pipelines across the small ephemeral creeks. The agreed method for open trenching through the creek crossings is:

- Works to occur in the dry periods where possible;
- The depth of cover would average 800 mm below natural creek bed level;
- Soil / natural creek bed material will be placed over rock when backfilling to facilitate natural revegetation; and
- Creek banks to be profiled and reinstated as near as practicable to their former profile following construction.

### Table 5-2 Watercourse Crossing Locations and Construction Methods

<table>
<thead>
<tr>
<th>Pipeline Section</th>
<th>Creek</th>
<th>Installation Method</th>
</tr>
</thead>
</table>
| Pipeline from the intake pumping station to TPS1 | Tuckers Creek  
Darling River | HDD                                 |
| Pipeline between TPS1 to TPS2           | Great Darling Anabranch                  | Open Trenching      |
| Pipeline between TPS1 to TPS2           | Two Miles Break Creek  
Four Miles Creek (two crossings)  
Tingha Creek | Open Trenching                        |
| Pipeline section between TPS2 to TPS3   | Coombah Creek  
Pine Creek | Open Trenching                        |
| Pipeline section                        | Kellys Creek                             |                     |
5.5.6 Transfer Pumping Stations

The methodology for the construction of the TPSs is likely to involve the following steps:

**Preparatory Works**
Preparatory works would involve activities including but not limited to:
- Site establishment, construction compounds, fencing etc,
- Environmental management (including no go zones)
- Installation of sediment and erosion controls
- Establish site access and traffic management controls,

**Construction**
Construction would involve activities including but not limited to:
- Clearing and grubbing of vegetation from the works area.
- Foundation stripping and forming foundations using cast *in situ* concrete
- Excavation and levelling
- Supply and install pumps
- Supply and install pipework, valves and fittings
- Site rehabilitation and landscaping with native vegetation
- Site disestablishment

**Permanent Access**
Permanent access driveways would be required at the TPSs and this will be designed to in consultation with RMS to comply with their requirements.

Initial discussions with RMS confirmed that access to TPS sites from Silver City Highway can be designed as Rural Property Access, provided a clear line of sight distance of 300m is available. Based on this, the permanent access points will need to meet the following design criteria:
- At least 10m length (measured from the edge of the highway) of the access driveway to the pumping stations needs to be bitumen sealed, preferably using a 2-coat seal.
- There is no need for any signs on the road or within the reserve. All sign boards for the pumping station should be located within the pumping station premises.

5.5.7 Spoil Management
An indicative estimate of the volume of total material to be excavated is around 810,000 m³, as detailed in Table 5-3. This would be confirmed by the contractor based on the final construction method.
Table 5-3 Spoil Volume Indicative Estimate

<table>
<thead>
<tr>
<th>Infrastructure / site</th>
<th>Total excavated Volume (m³)</th>
<th>Total used in construction / backfill (m³)</th>
<th>Excess Spoil volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>600,000</td>
<td>370,000 – 400,000</td>
<td>Up to 230,000</td>
</tr>
<tr>
<td>bulk water storage site</td>
<td>160,000</td>
<td>150,000</td>
<td>10,000</td>
</tr>
<tr>
<td>TPS sites, PV array sites, Camp location</td>
<td>50,000</td>
<td>45,000</td>
<td>5,000</td>
</tr>
</tbody>
</table>

It is anticipated that about 80% of the excavated material will be reused during the construction either through backfilling or in the construction of other infrastructure components. The majority of the excess spoil would be spread on site along the disturbance area for the pipeline corridor. The total disturbance area for the pipeline would be approximately 25 m wide (including the pipe trench, access track and storage areas) and therefore when spread within the full width of the disturbed corridor, the excess material layer would be 100-150 mm above natural ground level.

It is estimated that the only material to be removed from site would be the excavated material associated with the pipeline construction in and around Wentworth and Broken Hill. This is predicted to be approximately 25,000 m³ and is likely to be taken to Council landfill sites.

Top soil will be removed and stockpiled and will be replaced following backfilling and spreading the excess material. Natural drainage pathways will not be blocked either during construction or when spreading excess material. This would minimise the risk of changes in topography leading to local ponding following rainfall.

The spoil excavated between Wentworth and Broken Hill is considered likely to meet the EPA’s definition of virgin excavated natural material' (VENM). VENM is defined under the POEO Act as:

‘natural material (such as clay, gravel, sand, soil or rock fines):

(a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities and

(b) that does not contain any sulfidic ores or soils or any other waste

At some locations excavated material could consist of fill, which would be classified as ‘excavated natural material’ (ENM), and the spoil excavated from the pipeline route within the roads of Wentworth and Broken Hill would be classified as excavated public road material. The excavated spoil is therefore likely to suitable for backfilling and land application; however this would be subject to confirmation via waste classification by the contractor during construction.
5.5.8 Waste Management

Predicted waste streams as a result of the construction works include:

- excess spoil (see Section 5.5.7 above),
- drill cuttings and drill mud (associated with the HDD and microtunnelling),
- redundant pumping infrastructure associated with the demolition of the old Wentworth pumping station,
- cleared vegetation,
- general building and miscellaneous wastes such as packaging, off cuts, excess materials and
- workers wastes such as packaging, containers, food scraps, etc.

The exact quantities of waste are unknown at this stage and would be detailed in the contractors waste management plan. The waste management plan would be prepared in accordance with the Waste Classification Guidelines (EPA 2014) in that all waste removed from the site is to be classified and disposed of appropriately.

5.5.9 Site Rehabilitation

Post construction, site rehabilitation will involve removal of construction material and waste, surface contouring, respreading topsoil and respreading vegetation. Urban areas disturbed during construction would be restored to pre-construction condition.

Revegetation in rural areas would largely be achieved via natural regeneration. Disturbed areas along rural sections of the pipeline would be scarified or ripped to trap native seeds and runoff thus promoting germination. Topsoil would be reinstated and the area allowed to naturally revegetate in conjunction with weed management. Cleared vegetation would be placed over the prepared area to protect topsoil and further encourage revegetation.

Erosion control measures would remain in erosion prone areas until the land surface has stabilised. Reseeding / revegetation would be undertaken on a risk based approach, focussing on areas with an elevated potential for sediment loss or in the vicinity of waterways.

All fences and gates would be restored post construction.

Site rehabilitation procedures would be documented in a site specific rehabilitation management plan that would be developed by the contractor.

5.6 Construction Equipment

The majority of this construction equipment would be delivered to site and then move progressively along the pipeline alignment, or until work is complete at the static work sites. Construction plant and equipment envisaged to be used include, but not limited to, the following:

- Excavators of varying capacities, most likely from 10 tonne to 90 tonne
- Dozers most likely D6 to D8
- Backhoes
- Compactors of varying capacities, most likely around 8 tonne to 12 tonne
- Cranes of varying capacities, most likely from 50 tonne to 100 tonne
- Dump trucks
- Concrete mixers
- Rock hammer
- Pile drilling rig should hard rock be encountered (if required)
- Attachments such as brooms to keep the roads clean and safe, buckets of various widths and capacities, hammers for rock breaking, rock saws (if required), rippers to remove fractured rocks, vibrating heads for installation and retrieval of steel sheet piles for construction of temporary coffer dam/shoring, pile driver (if required), dog trailers.

Mechanical plant and equipment will need to be refuelled in the field. Fuel is likely to be stored at the TPS sites, dosing plant or bulk storage sites (to be confirmed by the contractor).

The majority of concrete required for construction would be precast panels that would be erected by cranes to form buildings at the intake pumping station, TPSs, bulk water storage and Mica Street WTP sites. Cast in situ concrete would be required for building and tank foundations, and thrust blocks along the pipeline.

Confirmation of construction plant will be based on geotechnical results. There may be the requirement for rock breaking works on the approach to Broken Hill.

5.6.1 Refuelling

Construction plant and equipment would need to be refuelled in the field, and it is likely that the contractor would choose to store fuels at designated locations in the vicinity of the active construction sites. Refuelling activities would be undertaken in accordance with WorkCover guidelines and more than 50 m from a drainage line.

5.7 Construction Program

Construction of the project is predicted to take approximately 14 months followed by a six month commissioning period. Handover will occur at the conclusion of the commissioning period.

Construction of the pipeline is expected to commence in January 2018 (based on tenders being awarded in October 2017) and be complete by the end of 2018, and commissioning by April 2019.

5.8 Construction and Operation Management

5.8.1 Environmental Management Plans

Construction and operation of the proposal would be undertaken in accordance with a Construction Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) respectively. The CEMP would be prepared by the construction contractor/s and approved by WaterNSW prior to commencement. The CEMP is to be consistent with the Australian Pipeline Industry Association Ltd publication; *Code of Environmental Practice, Onshore Pipelines* (APIA, 2013)
The owner of the asset (to be confirmed) will prepare the OEMP for the operation phase. Both plans would incorporate all of the mitigation measures identified in this REF as well as any conditions of approval and any other licence/approval conditions. They would also incorporate an emergency response plan in case of a pollution incident, a complaints handling procedure and a 24 hour telephone contact number. The complete list of the mitigation measures recommended in this REF is provided in Section 7 of this report.
5.9 Operation

5.9.1 Water Extraction

The River Murray to Broken Hill Pipeline Project has been designed to extract water at a rate of 37.4 ML/d. Water would be taken from the intake located on the River Murray at Wentworth. Anticipated extraction rates are detailed in Table 5-4 and peak extraction is predicted to occur over the summer months and drop over winter.

**Table 5-4 Predicted Water Extraction**

<table>
<thead>
<tr>
<th>Demand</th>
<th>Volume</th>
<th>Description / definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast Demand</td>
<td>N/A</td>
<td>The expected volume of water that Essential Water will extract from the Broken Hill delivery point (Mica Street WTP) over the relevant week</td>
</tr>
<tr>
<td>Peak season (December – March)</td>
<td>Peak Flow</td>
<td>The maximum volume that Essential Water will extract from the Broken Hill delivery point over the peak season</td>
</tr>
<tr>
<td></td>
<td>3,708 ML for peak season</td>
<td></td>
</tr>
<tr>
<td>Peak day demand</td>
<td>37.4 ML / day</td>
<td>The maximum volume of water that Essential Water will extract from the Broken Hill delivery point over any day.</td>
</tr>
<tr>
<td>Peak week demand</td>
<td>226.4 ML / week</td>
<td>The maximum volume of water that Essential Water will extract from the Broken Hill delivery point over any week.</td>
</tr>
<tr>
<td>Peak month demand</td>
<td>927.4 ML / month</td>
<td>The maximum volume of water that Essential Water will extract from the Broken Hill delivery point over any month.</td>
</tr>
<tr>
<td>Peak annual demand</td>
<td>7,586.6 ML / year</td>
<td>The maximum volume of water that Essential Water will extract from the Broken Hill delivery point over any year.</td>
</tr>
<tr>
<td>Minimum demand</td>
<td>56 ML per week (based on an average of 8.0 ML / day)</td>
<td>The minimum volume of water that Essential Water must extract from the Broken Hill delivery point over any week (excluding during a shutdown or forced majority event).</td>
</tr>
</tbody>
</table>
5.9.2 Maintenance

Pipeline Cleaning
The pipeline will have scour valves at every low point and/or at regular spacing for:

- regular flushing to remove any deposits in the pipeline if any,
- removing silt and sludge during pigging operation, and
- draining the pipeline in case of a pipe repair.

Scour valve arrangement typically consists of a “T” branch of the main pipeline with a valve, a hydrant outlet and a discharge pipe to road table drain or natural drainage path. In environmentally sensitive areas, the discharge pipe is connected to a pump out pit (not to natural drainage) to facilitate natural evaporation or infiltration of discharges. It is estimated that there will be up to 300 scour points along the pipeline alignment consisting of 150mm diameter scour valves. Typical valve operations are described below.

Regular Flushing
The water conveyed in the Wentworth to Broken Hill pipeline is unlikely to contain significant amount of silt. Silt deposits along the pipeline would be removed by regular flushing.

Scour valves would be opened for a few seconds to discharge silt and this would release relatively small volumes of water. Regular flushing is likely to occur as part of routine annual maintenance work.

Pigging
The frequency of pigging of the pipeline depends on the volume of silt deposited in the pipeline. Pigging is not a regular operation and may occur only once every 10 years or more. Pigging of pipelines is a complex operation and requires a lot of planning. A series of pigs are launched at the starting point of the pipeline and then recovered at the end of the pipeline. When the pigs start moving, scour valves are opened one by one following the pigs. The discharges from the scour valves during pigging would contain silts and other deposits and therefore will be transferred to tankers using the hydrant outlets. The pig recovery point which is generally the end point of the pipeline, would consist of a sedimentation pond to collect all the remaining discharges from the pipeline.

Relatively small volumes of sludge is expected to be released through scour valves during pigging and this would be collected in tankers. Larger volumes of sludge are expected to be collected at the pig recovery points and this would be discharged to sedimentation ponds. Pig launch and recovery points, and associated sedimentation lagoons would be provided at each TPS and at intermediate locations along the pipeline. The intermediate pig recovery points and sedimentation lagoons would be determined by the contractor and are likely to be located within the project area (as defined by the figures in Appendix C).

5.10 Changes to the Project

The project would be executed under a Design Build Own Operate contract, with the final construction methodology and design to be determined by the successful construction contractor. Should the contractor propose a design and/or construction methodology that differs from that described in this REF, including but not limited to activities outside the corridor assessed in this REF (refer to section 6.2), further assessment to determine the
significance of any potential impacts in accordance with Part 5 of the NSW *Environmental Planning and Assessment Act* 1979 will be required.
6 Environmental Assessment

This section identifies and characterises the likely potential impacts associated with the construction and operation of the proposed works. Where considered necessary, mitigation measures are identified.

6.1 Assessment Methodology

The key objectives of this assessment are to:

- Identify those facets of the environment likely to be affected by the project
- Identify the sensitivity of the site
- Identify and characterise the associated impacts (both construction and operation)
- Identify and evaluate mitigation measures for the identified impacts

Environmental issues of potential relevance to the proposal include impacts associated with:

- Location and land use
- Traffic and access
- Noise and vibration
- Air quality and emissions
- Topography, soils and geology
- Water quality and hydrology
- Terrestrial Flora and fauna
- Aquatic flora and fauna
- Aboriginal archaeology
- Historic heritage
- Waste management
- Contamination and hazards
- Socio-economic

The project has been evaluated with due consideration of the provisions of Clause 228 of the EP&A Reg (refer to Appendix A).

6.1.1 Environmental Management Plans

The mitigation measures provided in this section will be incorporated into the CEMP or OEMP as discussed in Section 7. The CEMP will be endorsed by WaterNSW before construction commences.

The CEMP will include a risk assessment that is undertaken once contractor has confirmed the construction methodology and developed the design. The risk assessment would be used to verify the suitability of the mitigation measures provided in this REF and
to identify any additional safeguards that need to be implemented to ensure the surrounding environment is adequately protected.

6.2 Impact Footprint Summary

The infrastructure components of the project including locations and predicted footprint is summarised in Table 6-1 and shown in the plans provided in Appendix C. The REF has been prepared based on works being limited to these locations.

Table 6-1 Summary of infrastructure components and predicted footprint

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Location</th>
<th>Construction Footprint (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Murray Intake</td>
<td>Two Rivers Ski and Recreation Reserve, River Murray</td>
<td>1.5 ha</td>
</tr>
<tr>
<td></td>
<td>(1.4 ha of land and less than 0.1 ha instream)</td>
<td></td>
</tr>
<tr>
<td>Dosing plant and</td>
<td>8.5 km from Wentworth. Adjacent to the Silver City Highway (western side)</td>
<td>500 m x 400 m 20 ha</td>
</tr>
<tr>
<td>TPS1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipeline</td>
<td>A 25 m wide corridor on the western side of the Silver City Highway, typically between the boundary fence and a point 15m from the edge of the pavement. Some sections located in the urban areas of Wentworth and Broken Hill</td>
<td>25 m x 270 km 675 ha</td>
</tr>
<tr>
<td>TPS2 - Option 1</td>
<td>100 km from Wentworth, Adjacent to the Silver City Highway (western side)</td>
<td>1200 m x 800m 96 ha</td>
</tr>
<tr>
<td>TPS2 - Option 3</td>
<td>193 km from Wentworth Adjacent to the Silver City Highway (western side)</td>
<td>500 m x 500 m 25 ha</td>
</tr>
<tr>
<td>TPS3</td>
<td>228 km from Wentworth, Adjacent to the Silver City Highway (western side)</td>
<td>600 m x 400 m 25 ha</td>
</tr>
<tr>
<td>Bulk Water Storage</td>
<td>250 km from Wentworth Adjacent to the Silver City Highway (western side)</td>
<td>800 m x 800 m 64 ha</td>
</tr>
<tr>
<td>Mica Street WTP</td>
<td>Mica Street, Broken Hill</td>
<td>Within WTP site boundary</td>
</tr>
</tbody>
</table>
6.3 Location and Land Use

The proposed works would be located in Western NSW extending from Wentworth to Broken Hill. The region is generally sparsely populated with a few small towns including Wentworth with a population of 2,500 (ABS, 2011) and the larger regional centre of Broken Hill (population approximately 19,000). Wentworth lies at the junction of the lower Darling River and the River Murray.

The region experiences a hot and persistently semi-arid climate, with low rainfall, and regular high temperatures (Table 6-2). Land use in the region generally reflects the climatic conditions and is predominately agricultural based, comprising beef cattle and sheep grazing for wool as well as goat production. Tourism is also important to the local economy with inland waterways providing for recreational fishing and national parks catering for walking and camping based recreation (WRI, 2016).

Table 6-2 Broken Hill mean rainfall and temperature

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Max Temp (°C)</td>
<td>33.5</td>
<td>32.4</td>
<td>29</td>
<td>24.3</td>
<td>19.2</td>
<td>15.9</td>
<td>15.5</td>
<td>17.8</td>
<td>21.6</td>
<td>25.5</td>
<td>28.8</td>
<td>31.4</td>
<td>24.6</td>
</tr>
<tr>
<td>Mean minimum temp (°C)</td>
<td>19.1</td>
<td>18.5</td>
<td>15.3</td>
<td>11.3</td>
<td>7.9</td>
<td>5.5</td>
<td>4.8</td>
<td>5.6</td>
<td>8.4</td>
<td>11.5</td>
<td>14.7</td>
<td>17.2</td>
<td>11.6</td>
</tr>
<tr>
<td>Rainfall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean rainfall (mm)</td>
<td>28.7</td>
<td>19.3</td>
<td>20.5</td>
<td>20.9</td>
<td>20.4</td>
<td>15.3</td>
<td>17.8</td>
<td>18.6</td>
<td>22</td>
<td>24.4</td>
<td>21.1</td>
<td>22</td>
<td>255.5</td>
</tr>
</tbody>
</table>

Source: BOM, 2017

The Silver City Highway road reserve is generally 100 m wide (50m on either side from road centre line). With the exception of an NBN cable, the road reserve is generally unoccupied. The infrastructure associated with the project would be installed on a number of different land allotments and tenure types, including Crown land, Western Land Lease (unincorporated lands), Native Title, private land – freehold, roads and Council owned or managed land (refer to section 1.4).

The proposed river intake and pumping station site would be located on the northern bank of the River Murray, approximately 1 km upstream from to its confluence with the Darling River, and approximately 0.7 km south-east of the town’s centre. The site is an existing raw water pumping station complex, which is a part of the Wentworth Water Supply Scheme. The existing raw water pumping station complex has been constructed on a mound approximately 2.5 m in height with variable batter slopes. There are two wells at the site; the eastern well, constructed in 1935 (see Section 6.12), has been abandoned and a new well and intake was constructed post-1989.

The proposed intake site is located within the Two Rivers Ski and Recreation Reserve and adjacent to the Junction Island Nature Reserve and Walking Track, which comprises the peninsular of land between the Darling and River Murrays. This area has significant
cultural heritage values and is a popular recreation and tourist site. The reserve includes a boat ramp, toilet block, picnic tables and pedestrian walking bridge.

![Existing Wentworth Pumping Station at the River Murray intake](image1)

![Site of the new intake pipeline](image2)

**Figure 6-1 Wentworth Pumping Station**

### 6.3.1 Construction Impacts

The infrastructure components associated with the project including the locations and assessed footprints are summarised in Table 6-1 and shown on the plans provided in Appendix C.

**River Murray Intake**

The proposed river intake pumping station would be located at the site of the existing abandoned well. The old well and suction main will be removed as part of the project and the new intake constructed comprising a concrete wet well with submersible pumps, inlet pipes and associated screens, switch room and associated electrical and mechanical components as described within Section 5.2.1.

The likely footprint required for the construction of the intake is predicted to be 1.5 ha and is shown in Figure 6-2. Construction of the intake is estimated to take three months. Construction activities associated with the intake have the potential to temporarily impact on the recreational use of the surrounding reserve and river through noise, traffic and access impacts. However these impacts would be limited in scope and would not impact upon access to the majority of the reserve. Safeguards such as signage and fencing would be put in place to minimise impacts to users of this area during construction activities.
Construction would require works within the River Murray and an exclusion zone would be required around the construction site. Navigation markers would be installed in accordance with RMS requirements to warn those using the waterway of the exclusion zone. This would temporarily reduce the area within the River Murray that is available for boating and other recreational uses. This impact would be minor and short term.

![Figure 6-2 River Murray Intake construction footprint](image-url)

Two Rivers Ski and Recreation Reserve, River Murray intake site

River Murray intake site
Silver City Highway, leaving Wentworth

Alignment - eastern side of Wentworth, adjacent to levee

General landscape of pipeline alignment

General landscape of pipeline alignment

Coombah Roadhouse

Coombah Roadhouse
The TPS, bulk storage and dosing plant sites are located on privately occupied western land leases that are used for agricultural purposes and would need to be acquired. The project would impact on a small proportion of land that is part of these land holdings, and acquisition is unlikely to impact on the overall ability to use the remainder of the properties for agricultural purposes. All affected land owners would be compensated. As discussed in Section 5.5.1, there is the potential that these sites may accommodate construction compounds and/or temporary camp sites. The camps would be confined to the established and defined boundaries (see Table 6-1) and would be fenced off from the surrounding land thus minimising any potential impacts associated with stock accessing the site. The sites are not located in proximity to any surrounding homesteads or sensitive receivers. Given the remote locations, temporary work camps are expected to have minimum impact on land use. The impact to surrounding land and road users would be reduced through decreased traffic movements.

The contractor would ensure effective and ongoing consultation with affected landowners.
Figure 6-4 Sensitive land uses in the vicinity of the River Murray Intake
Pipeline

The pipeline alignment runs south-north predominantly following the Silver City Highway between the towns of Wentworth and Broken Hill. The impact footprint of the works is largely linear and located almost entirely within the western Silver City Highway road reserve. The concept pipeline alignment is located 10-15 m from the boundary fence and about 25-30 m from the road edge in line with RMS. The pipeline alignment has been designed to minimise the risk of impacting existing services within the Silver City Highway.

Whilst some limited infrastructure associated with the project will be located within the urban areas of Wentworth and Broken Hill (less than 5 km of pipeline), the majority of the works would be in remote locations isolated from residential areas or other sensitive receptors. The main component of the project is the construction of a 270 km long pipeline to be located almost entirely within the Silver City Highway road corridor. Construction of the pipeline will generally require a corridor 25 m wide for the trenching and spoil placement, pipeline stringing, (laying of lengths of pipe end to end beside the trench), welding and laying. This impact corridor would be restricted in some sensitive locations including waterway crossings, areas of significant ecology and archaeology (see section 6.9, 6.10 and 6.11) though delineating the area to the minimum required to construct the works.

Construction works associated with the proposed pipeline may cause some temporary disruption to local roads and adjoining private landowners. However, these impacts are not anticipated to be significant, assuming implementation of the mitigation measures listed below. Impacts associated with traffic, noise and dust are discussed in Sections 6.4, 6.5 and 6.6 of this REF. Given the isolated nature of the construction area, the operation of 24 hour construction crews outside urban areas is unlikely to result in adverse impacts to the surrounding land use.

The pipeline alignment would largely avoid residential or commercial areas of the Wentworth and Broken Hill townships. The impact of noise and light spill on residents and other sensitive receivers such as the Wentworth Hospital which is adjacent to the alignment would be managed by avoiding night time works within the townships and implementing all reasonable and feasible mitigation measures in accordance with the ICNG. The establishment of temporary workers camps at the transfer pumping station sites (if undertaken) would reduce traffic impacts and rent increases due to increased demand for accommodation within the townships.

Broken Hill

The pipeline would be installed within a mix of land uses within the Broken Hill township including residential, commercial and industrial areas. The alignment would pass Broken Hill High School (Figure 6-5) and the Duke of Cornwall Park. Works undertaken within the Mica Street WTP would be in close proximity to the Broken Hill Public School (Figure 6-5). No other sensitive land uses in the vicinity of works have been identified.

The pipeline would be installed within the road reserve within Broken Hill and therefore some inconvenience to local land users would be expected during the construction, such as through elevated noise and dust, and traffic and access disruptions (see Sections 6.4, 6.5 and 6.6 below). These impacts would be temporary and managed through the contractor’s safety, noise and traffic management plans.
Figure 6-5 Broken Hill sensitive land uses
Some limited works would be required within the Peterborough Broken Hill rail corridor in Broken Hill. The project would not impact on the use of the rail corridor because it would be designed and constructed in accordance with AS 4799 - Installation of underground utility services and pipelines within railway boundaries and ARTC compliance document ETG1701.

### 6.3.2 Operational Impacts

The scheme would introduce new infrastructure in a largely remote and rural setting. The new above ground components would include:

- River Murray intake and associated infrastructure (pump building and switch room) to be contained on the council owned lot,
- Dosing plant and TPS 1,
- TPS2 and TPS3 and associated infrastructure (lagoons, PV cells and balance tanks),
- Bulk water storage

Air valves, scour values along pipeline, which could extend approximately 300 mm above ground

The pipeline would be underground and all areas of disturbance would be restored post construction.

Overall, the operation of the project would have minimal impact on current land use practices of adjoining land.

Concept plans of the above infrastructure are provided in Appendix C.

#### TPS, Bulk Storage and Dosing Plant Sites

As discussed in Section 6.3.1 it would be necessary to acquire the land required for the TPSs, bulk storage and dosing plant. The area required for these infrastructure components is relatively small (see Table 6-1) in comparison to the overall land parcels and is therefore unlikely to impact on the current land uses. All infrastructure would be contained within fenced site boundaries with locked gates and no impacts with regards to stock management on adjoining properties is predicted. There would be minimal operational access requirements for the TPSs, bulk storage and dosing plant sites. Given the isolated location minimal impact to surrounding land use is predicted.

#### River Murray Intake

The new intake structure would be contained on the site of the now redundant Wentworth pump well. MREP No.2 includes specific principles relating to access that seek to ensure the River Murray and foreshore area are not alienated from private or public purposes. The proposed site is located on the existing pump station site and would therefore be consistent with the current land use. The construction of the intake would require minimal clearing and the operation would not impact upon access to the foreshore area. The *Two Rivers Ski and Recreation Reserve Draft Management Plan* (GHD, 2017) indicates that the site currently has a high use for active and passive recreation and specifies management objectives for the site in order to achieve desired management outcomes, as described in Section 2.5.5. Although the intake would be located within the reserve, due to the small footprint of the pump station and associated infrastructure, the operation of the
intake would have a minimal impact on the ongoing recreational use of the area including the river and surrounding recreational reserve.

**Pipeline**

The pipeline would require an easement and licence to occupy the road reserve to be obtained from Crown Lands (DoI - Lands & Forestry). Ongoing consultation with the RMS has ensured that the design of the pipeline within the Silver City Highway road reserve would have minimum impact on the operation and maintenance of road assets or any future road developments proposed in the road corridor. An existing telecommunications (NBN) cable is located within the road reserve corridor. The design of the pipeline has been undertaken to avoid this cable and operation of the pipeline is not predicted to impact upon it.

Whilst the pipeline corridor will be highly visible immediately post construction, the area is expected to naturally revegetate over time.

Overall operation of the project is expected to have a minimal impact on land use.

### 6.3.3 Mitigation Measures

#### Detailed Design

- Any works proposed outside the areas indicated in Table 6-1 would be subject to further environmental assessment in accordance with Part 5 of the EP&A Act.
- Where possible, air valves and scour valves shall be located in areas where disturbance to existing land or land use is minimised.
- Consultation is to be maintained with RMS during the detailed design process, particularly in relation to:
  - the height and size of the TPS infrastructure
  - lighting proposed at the TPS sites
  - temporary access point locations and spacings as required for the pipeline construction
  - confirmation of ongoing maintenance access requirements for the pipeline and whether any temporary access points are to be used permanently.

#### Pre-construction

- All necessary approvals are to be obtained and access arrangements / agreements (see Section 5.3) confirmed prior to commencement of construction activities (including site establishment, tree clearing, stockpiling etc).
- Negotiations would be undertaken with affected landowners where access to private land is impacted (i.e. across driveways / access points). The outcomes of any access arrangements would be documented in the CEMP prior to construction commencing.
- Consultation would be undertaken with Wentworth Shire Council regarding construction works for the River Murray intake and safeguards required to address potential impacts on public use of the Two Rivers Ski and Recreation Reserve. These safeguards, which would include appropriate measures to ensure the safety of the general public and minimise impacts/disruptions to public use of this site.
during construction, would be documented in the CEMP prior to construction commencing.

- Navigation markers would be installed near the intake site in accordance with RMS requirements to warn those using the waterway of the exclusion zone around the construction site.
- The contractor is to notify adjoining landowners at least 14 days prior to the commencement of works onsite.

**During Construction**

- The contractor would be required to ensure the necessary care and maintenance of property facilities and operations including fences, gates and stock. However, if any damage did occur to property it would be restored to a condition equivalent to the original condition. Temporary fencing and gates would be installed where necessary to exclude animals (stock and ground dwelling native fauna) from the work sites. Any temporary fencing or gates no longer required would be removed at the completion of the construction works.
- Sufficient closure and/or barricading of the area is to be in place for the duration of the construction works.
- No works outside standard construction hours detailed in the ICNG would occur within the Wentworth and Broken Hill townships, Coombah Roadhouse or in the vicinity of Red Earth Motel or Willowbend Caravan Park at Wentworth.
- The construction contractor is to provide a 24-hour telephone number so that any issues / complaints during construction can be recorded and appropriately dealt with.
- All areas impacted by the works are to be rehabilitated in accordance with a site specific rehabilitation management plan.

**Rail Corridor**

- Approval is required from ARTC prior to any works within the ARTC rail corridor. The pipeline would be designed to ensure it is consistent with ARTC engineering requirements.
- The construction methodology would be consistent with ARTC requirements for works within the rail corridor to ensure the safety of construction and rail personnel.
- A spotter will be required to monitor any works within the rail corridor to ensure no interference or damage to rail infrastructure occurs and to monitor train movements. ARTC requires this to be a contract obligation.
- Works within the rail corridor are to occur in accordance with *AS 4799: Installation of underground utility services and pipelines within railway boundaries* and ARTC compliance document *ETG1701*
- Any geotechnical investigations within the rail corridor must be kept a minimum distance from the track as agreed with ARTC.
Post Construction / Operation

- Post construction landscaping is to be undertaken at the dosing plant and TPS sites to screen the infrastructure and minimise visual impacts.
- Adequate procedures must be established and detailed in the OEMP, including notification requirements to EPA, for incidents that cause material harm to the environment.
- The OEMP is to detail ongoing consultation requirements with ARTC, DPI Fisheries, Essential Water and other relevant stakeholders.

6.4 Traffic and Access

A specialist Traffic Impact Assessment (TIA) was prepared for this proposal by Samsa Consulting Pty Ltd, June 2017. This report is provided in Appendix F and a summary of the assessment provided below.

Traffic Volumes and Operations

Existing traffic volumes in the urban areas of Wentworth and Broken Hill were provided by RMS, which was obtained from traffic surveys undertaken during December 2016 at a number of locations relevant to the project area and associated transport routes.

Site observations and spot counts on most sections of the roads were undertaken to confirm that the surveyed traffic flows were of the same order as those recorded by the RMS surveys. The peak background traffic volumes varied significantly between road sections. Outside of the urban areas, peak traffic volumes also varied significantly between days and hours so a meaningful peak period was not able to be determined. While specific peak hours were not available from the RMS counts within the urban areas of Broken Hill and Wentworth, sample counts as part of the traffic assessment and on-site observations indicated peak background traffic periods to be generally between 7:30 am and 9:00 am. These peaks were noted as being quite 'mild' and did not create peak traffic conditions typically experienced in larger urban areas. Peak hour traffic flows have been assumed to be between 10% and 15% of daily traffic flows.

Existing traffic volumes in vehicles per day (vpd) and vehicles per (peak) hour (vph) for the relevant road network are shown in Table 6-3 below.
Table 6-3 Existing Traffic Volumes

<table>
<thead>
<tr>
<th>Road</th>
<th>Vehicles Per Day (vpd)</th>
<th>Vehicles Per Hour (vph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wentworth area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver City Highway – at bridge over Two Mile Break, approximately 1 km north of Renmark Road, Wentworth</td>
<td>1,016</td>
<td>120</td>
</tr>
<tr>
<td>Silver City Highway – west of Darling River Bridge, Wentworth</td>
<td>3,614</td>
<td>400</td>
</tr>
<tr>
<td>Silver City Highway – north of Tuckers Creek Bridge, Wentworth</td>
<td>3,461</td>
<td>380</td>
</tr>
<tr>
<td><strong>Broken Hill area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver City Highway – east of Gypsum Street, near RSPCA, Broken Hill</td>
<td>7,835</td>
<td>800</td>
</tr>
<tr>
<td>Kanandah Road – approximately 1 km west of Silver City Highway, Broken Hill</td>
<td>618</td>
<td>80</td>
</tr>
<tr>
<td>Silver City Highway – at Kellys Creek approximately 10 km south of Broken Hill</td>
<td>481</td>
<td>48</td>
</tr>
</tbody>
</table>

Note: Traffic volume data obtained from RMS traffic surveys undertaken during December 2016.

# Hourly traffic flows have been assumed to be between 10% and 15% of daily traffic flows.

As expected from the relatively low traffic volumes throughout the minor road network, intersection performance is adequate at all intersections along the transport routes to all project sections. During site visits, observation of all intersections and the surrounding road network during peak background traffic (between 7:30 am and 9:00 am) periods indicates that the road network is operating adequately and has significant spare capacity.

Broken Hill High School is located on Garnet Street in Broken Hill (adjacent to the proposed pipeline alignment) and Broken Hill Primary School is located on Mica Street adjacent to the Mica Street WTP (see Figure 6-5).

Although none were identified during the site inspection, there is the potential that temporary stock crossings of the highway may arise. Stock crossings are largely seasonal and move from place to place and therefore would need to be considered if and when they were to occur.

**Major Road Network**

The major road network consists of Silver City Highway (Route B79) and provides road transport access to both Wentworth in the south and Broken Hill in the north. Silver City Highway is almost 700 km long linking Buronga, NSW (in the south at Sturt Highway –
Route A20) to the Queensland border via Wentworth and Broken Hill in the Far West region of New South Wales.

In the north at Broken Hill, the Silver City Highway route connects with the major east-west Barrier Highway route (Route A32), while in the south at Wentworth (Mildura), Silver City Highway connects with Sturt Highway (Route A20). These provide road transport access from any required locations / directions.

Traffic volumes are relatively low with intersection operations and the road network having significant spare capacity. The Silver City Highway route passes through largely flat terrain that predominantly forms pastures for grazing in the south with the land becoming arid in the north approaching Broken Hill.

Silver City Highway provides a relatively high standard of road infrastructure, suitable for transport by heavy vehicles as per current operations where vehicles up to road-train size operate. It has relatively wide carriageways and road formations, pavement linemarking, and controlled access to side roads. It has a 110 km/h speed limit between the urban areas of Wentworth and Broken Hill.

At either end of the Silver City Highway, the urban road networks of Wentworth and Broken Hill will be required to access the pipeline corridor sites along two distinct areas in the south and the north, as follows:

- Southern section access via Ski Reserve Road, Silver City Highway (east) and Pooncarie Road before connecting to Silver City Highway (north) in the vicinity of Renmark Road.

- Northern section access via Kanandah Road, Kanandah Place, Ryan Street, Griffith Street, Slag Street (extension), Harris Street, Gaffney Street, Silver City Highway (South Road), Garnet Street and Mica Street.

**6.4.1 Construction Impacts**

During the construction phase, several activities would generate traffic, including:

- Initial site set-up and access construction during the pre-construction period;

- Construction staff movements, pipe and fittings deliveries, concrete material deliveries and other general deliveries during construction works; and

- Reinstatement (rehabilitation) construction activities.

It is assumed that up to five pipe laying crews would work concurrently at different locations along the project alignment. For the purpose of the traffic assessment pipe, laying was conservatively assumed to occur at a rate of approximately one kilometre per crew per day.

Construction is proposed to commence in early 2018 and anticipated to take 14-months.

**Assessment Methodology**

The assessment of transportation of the pipeline and ancillary infrastructure components to site involves the separate consideration of the transport mode between:

- Origins of pipe manufacturing plants located in Australia to the project site;
Transportation along the rail network to Broken Hill;

Transportation along the major and minor public road network, including through towns and urban areas along the transport routes; and

Site access off the public road network onto the project site.

The location of pipe manufacturing plants has not yet been determined. However, it is likely that they would be located at either Melbourne or Adelaide. Therefore, this assessment assumes potential transport routes from the south / south-west.

Both rail and road transport modes have been considered for transporting the major pipeline components.

**Rail Transport**

Rail as a transport option is feasible via the main cross-country rail network that runs to Broken Hill from both Sydney on the eastern seaboard and Adelaide / Port Augusta to the south-west. There is no rail network serving the Wentworth / Mildura area at the southern end of the project.

The Western NSW line extends from Orange in the central west all the way to Broken Hill and then into South Australia and on to Adelaide. On the way it passes through Parkes, which is one of the major freight interchange points of the network. It is an important link for east / west rail operations in Australia and apart from much of the trans-continental freight it is also used as a trans-continental passenger train service.

While the transport of major project components (eg. pipes) is preferred using the rail network to Broken Hill, for the minor project components, the extent of transportation handling is such that it would be less desirable to use rail transport for minor components.

In any case, even with rail transport, there would be a need for both major and minor project components to be transported from the Broken Hill rail hub to the site along the proposed pipeline route. Therefore, for the purposes of this transport assessment, road transport would be required for transporting all project components to their end destination with major components delivered to Broken Hill by rail.

**Road Transport**

All road routes to Broken Hill, Wentworth and locations along the pipeline corridor route are via either National Routes or State Highways and can readily accommodate the proposed transportation of pipe components as well as other project materials. The road network has the flexibility to provide a single transportation mode from origin to the project site without the need for additional loading and handling operations, if required.

**Traffic Generation**

Typically, the contractor would use plant and equipment such as excavators, backhoes, skid steers, tip-trucks, low-loaders, rock hammers, concrete trucks, cranes, bulldozers, rollers, utilities and compressors. Delivery of the following construction material would be required:

- Pipe sections and fittings;
- Ready-mix concrete;
- Select bedding material;
- Pre-cast concrete pump station components, bricks and other building materials;
- Pumps, electrical cabinets and switchgear;
- Steel reinforcement;
- Fencing materials;
- Steel for balance tanks;
- Road base; and
- Construction plant.

Total heavy vehicle (truck) movements are anticipated to be in the order of 30,000 trips (two-way) along the length of the project site (ie. 270 km) over approximately 420 working days (estimated duration of the project). This includes the delivery of materials (including pipes) to, and disposal of construction debris (including excess and/or unsuitable excavated material) from, the 270 km long work site. This traffic generation assumes that up to 80% of excavated material could be reused. A conservative approach has been undertaken for the purposes of the traffic assessment and assumed 50% reuse, noting that the impacts will be less should a higher level of spoil reuse be achieved.

Pipe would be delivered either by rail transport to Broken Hill and transported by truck to the main construction compounds or by road from a site in Victoria. The Silver City Highway is a designated B-triple route and plant and material may be transported to site using a combination of semi trailers, B-double, and B-triple vehicles. The pipe would be delivered in sections that are about 12.2 m – 13.4 m long. If a semi trailer is used, eight to nine pipes would be transported each load, and 16 – 18 pipes per load if a B-double is used.

The number of heavy vehicle movements would be determined by the Contractor’s work method and split between semi trailers, B-doubles and B-triples. It is estimated that the total heavy vehicle movements for the construction of the project would be split up as follows:

- 50 low-loader loads (100 vehicle movements) for plant deliveries;
- 2,500 loads (5,000 vehicle movements) for pipe and fitting deliveries. This is a conservative estimate based on a mix of semi trailers and B-doubles being used to transport pipe and fittings;
- 75 ready-mix concrete truck loads (150 vehicle movements);
- 6,500 truck’n’dog loads (13,000 vehicle movements) for reuse of excavated material as fill and/or pipe bedding;
- 3,000 truck’n’dog loads (6,000 vehicle movements) for disposal of construction debris and overburden (spoil) (assumes 50% reuse);
- 150 flatbed truck loads (300 vehicle movements) for delivery of building materials, pumps, electrical equipment, etc;
- 2,000 re-fuelling truck loads (4,000 vehicle movements); and
Based on the above total working days and total heavy vehicle movements, this averages approximately 70 heavy vehicle movements (35 heavy vehicle loads) per day.

As the majority of material deliveries would be transported at a relatively steady rate over the construction duration and along a dispersed 270 km worksite, it is anticipated that peak traffic generation would only occur during tasks such as concrete pours when ready-mix concrete trucks would need to arrive during a short time period, such as at TPS locations.

In order to estimate a maximum traffic generation per day, it has been assumed that the project’s heavy vehicle transport activities could potentially peak at double the average daily traffic generation (140 heavy vehicle movements per day) and that this would coincide with 50 ready-mix concrete truck movements (for one transfer pump station site) arriving on a given day. This would generate a peak (maximum) daily traffic generation for materials deliveries of some 190 heavy vehicle trips (95 heavy vehicle loads) per day. This worst case scenario is unlikely to significant impact any particular transport route on any given day due to the length of the project area and dispersed nature of the work sites.

For peak hourly traffic generation, it is assumed that half of the daily ready-mix concrete truck movements would arrive / depart in any one peak hour in conjunction with some of the other materials deliveries. As a worst case, it is estimated that the peak hourly heavy vehicle generation would be 25 trips along any particular transport route during any given hour (based on an average daily rate of 190 heavy vehicles over 7.5 hours). There is the potential that concreting works may be undertaken at night.

Materials other than the major components such as pipe sections (eg. pump station components, pumps, electrical cabinets and switchgear, etc.) would likely originate from the nearest major urban centres including from the west in South Australia, from the south in Victoria and from the east in NSW. The remainder of materials deliveries (eg. building materials, steel reinforcement, fencing materials, road base select bedding material) could potentially be sourced from closer, local centres, such as Mildura and delivered directly to construction sites. Regardless of the origins, materials deliveries would still need to travel along the main Silver City Highway route and/or the urban transport routes into and through Wentworth and Broken Hill.

The number of construction staff working on site at any one time is likely to vary considerably. During peak construction periods, when construction tasks for all project components may overlap (eg. pipeline laying, pump station and balance tank construction, it is anticipated that on-site construction staff numbers would average some 500 staff (peaking to approximately 600 staff) for an approximate nine-month period coinciding with the construction of pump stations and balance tanks.

It is likely that construction staff would either stay at Mildura, Wentworth or Broken Hill and be transported to construction sites daily via a project organised mini bus, or alternatively construction staff may be accommodated in temporary construction camps to be established at the site of the TPSs.

With regards to the option to bus staff to site, assuming the maximum of five pipe-laying crews as well as some additional construction staff working concurrently on other project components (eg. TPSs), this would generate a maximum of some 50 light vehicles (mini-vans / cars) or 100 light vehicle trips per day (on any given day depending on the work area) along the pipeline alignment’s road network during peak staffing periods.
The above sections provide the basis for estimating the average total traffic generation over the construction period. Traffic generation used in the transport assessment is based on a conservative (high) scenario that peak construction staff numbers would coincide with other peak traffic generating activities such as concrete pours.

Traffic generation is shown in Table 6-4 below and has been classified into daily movement trips (ie. two-way trips), shown as vehicles per day (vpd) and peak hour trips, shown as vehicles per hour (vph).

The hourly traffic generation associated with concrete deliveries and light vehicles is based on a worst case scenario in that all loads arrive (or depart) within a particular peak hour, hence 25 loads in one hour for concrete deliveries is provided. While this is unlikely to occur, it has been used as a worst case scenario.

**Table 6-4 Project Traffic Generation (trips per day and per hour)**

<table>
<thead>
<tr>
<th>Traffic Generating Activity</th>
<th>Vehicles Per Day (vpd)</th>
<th>Vehicles Per Peak Hour (vph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General materials deliveries including pipes (heavy vehicles)</td>
<td>140</td>
<td>25</td>
</tr>
<tr>
<td>Ready-mix concrete deliveries (heavy vehicles)</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Construction staff (light vehicles only)</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td><strong>TOTAL Light vehicles</strong></td>
<td><strong>50</strong></td>
<td><strong>25</strong></td>
</tr>
<tr>
<td><strong>TOTAL Heavy vehicles</strong></td>
<td><strong>190</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

The addition of heavy vehicle and construction staff traffic generation during peak construction periods is able to be readily absorbed by the relevant road network and transport access routes to be used.

Outside of peak traffic periods, the impacts on the local road network and road users would be reduced as compared to the impacts described above.

**Road Network Impacts & Closures**

Short-term partial road closures would likely occur along Ski Reserve Road, Silver City Highway (east and north of Wentworth), Armstrong Avenue and Pooncarie Road in Wentworth as well as along Kanandah Road, Kanandah Place, Ryan Street, Griffith Street, Gaffney Street, Gossan Street and Mica Street in Broken Hill where the pipeline route crosses and/or encroaches onto the road carriageway. All public roads would remain open with controlled single direction traffic flow (as required) through the works areas.

The impact associated with road closures would be minor and measures would be implemented to minimise disruption. Access for essential services would be maintained, such as vehicle access to the Wentworth Hospital located adjacent to the project corridor (see Figure 6-4).
A small section of pipeline construction would be required in the vicinity of Broken Hill High School, which would result in some short-term traffic increases in this area. Provided the works are undertaken outside of school zone (drop of and pick up) periods, only minimal impacts would be expected.

Although none were identified during the site inspection, there is the potential that temporary stock crossings of the highway may arise. Stock crossings are largely seasonal and move from place to place and therefore would need to be considered if and when they were to occur. The construction works are not considered to have an adverse impact on stock movements or access to local properties.

**Access & Parking**

Construction traffic is proposed to access the various construction areas (compounds and pipeline route) via the public road network. Site access locations would be temporary and would move along the alignment in line with the progress of the pipe-laying. At TPS locations and other static components, suitable access would be confirmed where adequate sight distance is available to/from the public road network.

Sufficient parking for construction staff vehicles, heavy vehicles and plant would be available within the site compounds and along the pipeline corridor (outside of urban areas). It is expected that parking requirements for the pipeline construction within urban areas would be minor. No parking would be necessary along the adjacent public road network outside the construction corridor.

Suitable on-site manoeuvring areas would be available so that larger vehicles are able to safely manoeuvre into the site off the public road network, around the site and out of the site onto the public road network. This would be achieved within the existing works corridor and site access tracks along the pipeline alignment.

All vehicles would enter and exit the site area to/from the public road network in a forward direction only. All vehicles associated with construction staff would be accommodated within on-site parking areas at the various compounds.

As construction of the pipeline progresses, it may be necessary to temporarily close some property access roads for a short period, especially within the Wentworth and Broken Hill urban areas. Any affected property owners would be fully notified in advance and the closures would typically be less than one day. Alternative access arrangements would be provided where practicable.

**Road Safety**

To ensure adequate road safety is maintained across the whole project generally, a comprehensive Construction Traffic Management Plan (CTMP) would be prepared by the successful contractor in conjunction with relevant road authorities. Typical details that would be covered by the CTMP are described in Section 6.4.3 below.

**Rail Infrastructure Impacts**

There would be available capacity along the rail network in the western areas of NSW should pipes be delivered by rail. However, scheduling rail services and possible restrictions on track capacity that may affect delivery, would require negotiation and confirmation with rail operators. Notwithstanding, this transport mode is considered feasible and any impacts are considered to be minor and able to be readily overcome.
The impacts on the rail network during construction would be managed by ensuring that work is undertaken in accordance with permit obtained from ARTC.

**Road Surfaces**

The use of heavy vehicles as part of the construction works has the potential to result in structural wear to road pavements. Deterioration of road surfaces may result in potholes or other defects to the road condition, which could lead to safety issues if not rectified. The contractor would monitor road conditions and reticify as required.

**Cumulative Impacts**

The construction of the project would coincide with the construction and installation of the power supply for the project which would result in additional traffic movements over the 14 month construction period. Traffic estimations for the construction of the power supply infrastructure are unknown, however it is expected to require less labour and construction equipment than that predicted for the project. It is acknowledged that some cumulative impacts with regards to traffic movements would be expected, however this is not expected to be significant.

6.4.2 **Operational Impacts**

Plant and equipment that would typically be used during maintenance and operation tasks would be maintenance vehicles, utilities, cranes, mowers, and trucks (up to approximately 3-tonne).

Pump station maintenance tasks would typically consist of 26 visits per year by technicians using 4WD utilities (weekly visits when pump stations are operating) and four visits per year by technicians using 3-tonne trucks.

Pipeline maintenance would typically consist of two visits per year to inspect the pipeline and exercise scour and air valves using a 4WD utility.

Unplanned maintenance may also be required from time to time. An allowance of one visit per year has been assumed by a maintenance team using a 3-tonne truck and backhoe (note: this is not anticipated to be required for at least 5 to 10 years after commissioning).

Based on the relatively minor traffic generation during operations described above, traffic and road network impacts would be negligible. The current road network has significant spare capacity and is currently used regularly by the types of vehicles that are proposed to be used for servicing the various sites.

All vehicles generated by operations staff would be accommodated within on-site parking areas.

6.4.3 **Mitigation Measures**

**Construction**

For management of potential impacts during the construction phase, the following general measures would need to be undertaken:

- A comprehensive CTMP would be prepared by the contractor. The CTMP would detail appropriate construction traffic controls and management measures and all aspects would be implemented in co-ordination with the relevant local Councils and RMS. The CTMP would be prepared in accordance with;
The CTMP would include, but not be limited to, provisions for the following:

- Scheduling of transport deliveries outside peak background traffic periods and outside school zone periods.
- Undertaking community consultation before and during all transport and haulage activities, including contact details to ensure community concerns are logged and addressed.
- Upgrading road infrastructure including surface treatment and/or stabilisation of unsealed road sections, as appropriate (if required).
- Managing transport operations including provision of warning and guidance signage, traffic control devices, temporary construction speed zones and other temporary traffic control measures.
- Compliance with a ‘Transport Code of Conduct’ for all staff and contractors detailing designated transport routes, road behavioural requirements, speed limits, etc.
- All heavy vehicles shall travel along the nominated transport routes.
- Heavy vehicles shall travel within daylight hours, where practicable.
- Mud and other debris shall be removed from the wheels and bodies of construction vehicles and equipment prior to leaving the project site and before entering the sealed public road network.
- Consideration of property accesses that have sub-standard sight distances onto the road network due to tight horizontal and vertical road alignments.
- Consideration of adverse traffic conditions on the road network due to dust, sun glare, etc.
- Consideration of surrounding stock crossings and the potential for stock and/or native fauna on the road network.
- Procedure to monitor traffic impacts and respond to impacts rapidly.

- Prepare road dilapidation reports covering pavement, drainage and bridge structures in consultation with relevant road authorities for all of the proposed transport routes before and after construction. Any damage resulting from construction traffic, except that resulting from normal wear and tear, would be repaired to pre-existing conditions.

- Prior to the commencement of construction the construction contractor shall provide plans and supporting documentation of proposed construction workers’ camps to Roads and Maritime Service for comment.

- At the completion of the project, the construction contractor shall provide Works-As-Executed plans to RMS, Wentworth Shire Council and Broken Hill City Council indicating final levels, distances and location of the pipeline and associated infrastructure.
Post Construction / Operation

- Establish a procedure to ensure the ongoing maintenance of the internal on-site access roads and access points during the operation phase. This maintenance may include sedimentation and erosion control structures, where necessary.

6.5 Noise and Vibration

A specialist Noise and Vibration Impact Assessment (noise assessment) was prepared for this project by Renzo Tonin and Associates Pty Ltd, in August 2017. The report is provided in Appendix G and summarised as follows.

The noise environment in the project area, including the Wentworth and Broken Hill suburban areas and along the pipeline alignment, is generally controlled by natural sounds (eg. birds, insects, trees rustling, etc.) with additional noise from industry and traffic.

Existing background and ambient noise levels were recorded at seven long term (one to two weeks) monitoring locations within residential properties in Wentworth and Broken Hill for the project. The background and ambient noise levels at these locations are included below in Table 6-5. The noise catchment areas and monitoring locations are in Figures 1 to 9 in the noise assessment report in Appendix G.

Table 6-5 Measured Background ($L_{A90}$) and Ambient ($L_{ Aeq}$) Noise Levels, dB(A)

<table>
<thead>
<tr>
<th>Noise Monitoring location and Noise catchment Area (NCA)</th>
<th>$L_{A90}$ Rating Background Level (RBL)</th>
<th>$L_{Aeq}$ Ambient noise levels</th>
<th>Day</th>
<th>Evening</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location M1 – Darling Street, Wentworth (Willowbend Caravan Park), NCA 1</td>
<td>38</td>
<td>33</td>
<td>29</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>Location M2 – 198 Adams Street, Wentworth (Two Rivers Motel), NCA 5</td>
<td>33</td>
<td>32</td>
<td>24</td>
<td>59</td>
<td>56</td>
</tr>
<tr>
<td>Location M3 – 45 Ryans Street, Broken Hill, NCA 8</td>
<td>38</td>
<td>33</td>
<td>31</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>Location M4 – 165 Gaffney Lane, Broken Hill, NCA 9</td>
<td>40</td>
<td>41</td>
<td>33</td>
<td>57</td>
<td>56</td>
</tr>
<tr>
<td>Location M5 – 13 South Road, Broken Hill, NCA 10</td>
<td>44</td>
<td>41</td>
<td>32</td>
<td>59</td>
<td>63</td>
</tr>
<tr>
<td>Location M6 – 21B Arrandale Lane, Wentworth, NCA 6</td>
<td>27</td>
<td>19</td>
<td>19</td>
<td>46</td>
<td>40</td>
</tr>
<tr>
<td>Location M7 - 21 Mica Street, Broken Hill, NCA 13</td>
<td>32</td>
<td>32</td>
<td>27</td>
<td>48</td>
<td>41</td>
</tr>
</tbody>
</table>
Notes:

1. Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays
2. Evening: 18:00-22:00 Monday to Sunday & Public Holidays
3. Night: 22:00-07:00 Monday to Saturday and 22:00-08:00 Sundays & Public Holidays
4. As required by the INP, the external ambient noise levels presented are free-field noise levels. (ie. no façade reflection)

Short term noise measurements were also undertaken at six locations in Wentworth and Broken Hill over 1-hour periods to complement the long-term noise monitoring. The measurements are representative of the day time period and were generally conducted during the mid-morning to midday time period. The short-term measurement locations and measurement results are presented in Table 6-6 below.

Table 6-6 Measured Short term Background (L90) and Ambient (Leq) Noise Levels, dB(A)

<table>
<thead>
<tr>
<th>Noise Monitoring location and Noise catchment Area (NCA)</th>
<th>Date</th>
<th>Time</th>
<th>L_{A90} Rating Background Level (RBL)</th>
<th>L_{Aeq} Ambient noise levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 – 2920 Silver City Highway, Wentworth, NCA 2</td>
<td>07/07/2017</td>
<td>10:15am – 11:15am</td>
<td>43</td>
<td>59</td>
</tr>
<tr>
<td>S2 – Armstrong Avenue (near 44 Armstrong Ave), Wentworth, NCA 3</td>
<td>23/06/2017</td>
<td>11:00am – 12:00pm</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>S3 – 112-132 Wentworth Street, Wentworth, NCA 4</td>
<td>23/06/2017</td>
<td>9:45am – 10:45am</td>
<td>35</td>
<td>59</td>
</tr>
<tr>
<td>S4 – Corner of Garnet Street and Argent Street, NCA 11</td>
<td>22/06/2017</td>
<td>12:00pm – 1:00pm</td>
<td>44</td>
<td>61</td>
</tr>
<tr>
<td>S5 – Corner of Beryl Street and Braceman Street, NCA 12</td>
<td>06/07/2017</td>
<td>11:00am – 12:00pm</td>
<td>42</td>
<td>51</td>
</tr>
<tr>
<td>S6 – Coombah Roadhouse, Scotia</td>
<td>17/10/2016</td>
<td>12:15pm – 12:45pm</td>
<td>33</td>
<td>60</td>
</tr>
</tbody>
</table>

Notes:

1. Day: 07:00-18:00 Monday to Saturday and 08:00-18:00 Sundays & Public Holidays.
2. As required by the INP, the external noise levels presented are free-field noise levels. [ie. no façade reflection]

### 6.5.1 Construction Impacts

Construction noise management levels are determined by the NSW ‘Interim Construction Noise Guideline’ (ICNG, DECC 2009). Under the ICNG the construction noise
management levels (NMLs) for projects where the construction duration is greater than three weeks is the rating background noise plus 10 dB(A).

Table 6-7 identifies the adopted construction NMLs for the residential receivers in the NCAs identified within Table 6-5 and Table 6-6. The NMLs for the residential receivers are derived from the rating background noise levels represented by the background noise levels measured at the monitoring locations. As construction in the suburban areas would only occur during the daytime period, only the daytime NMLs are presented.

Table 6-7 Summary of Construction Noise Management Levels at Residential Receivers, dB(A)

<table>
<thead>
<tr>
<th>Noise catchment Area (NCA)</th>
<th>Noise Management Level, LAeq (15 min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA 1</td>
<td>38 + 10 = 48</td>
</tr>
<tr>
<td>NCA 2</td>
<td>43 + 10 = 53</td>
</tr>
<tr>
<td>NCA 3</td>
<td>30 + 10 = 40</td>
</tr>
<tr>
<td>NCA 4</td>
<td>35 + 10 = 45</td>
</tr>
<tr>
<td>NCA 5</td>
<td>33 + 10 = 43</td>
</tr>
<tr>
<td>NCA 6</td>
<td>30 + 10 = 40</td>
</tr>
<tr>
<td>NCA 8</td>
<td>38 + 10 = 48</td>
</tr>
<tr>
<td>NCA 9</td>
<td>40 + 10 = 50</td>
</tr>
<tr>
<td>NCA 10</td>
<td>44 + 10 = 54</td>
</tr>
<tr>
<td>NCA 11</td>
<td>44 + 10 = 54</td>
</tr>
<tr>
<td>NCA 12</td>
<td>42 + 10 = 52</td>
</tr>
<tr>
<td>NCA 13</td>
<td>32 + 10 = 42</td>
</tr>
</tbody>
</table>

The construction NMLs at the ‘Coombah Roadhouse’ restaurant in Scotia was determined to be 43 dB(A), 35 dB(A) and 35 dB(A) for the day, evening and night periods respectively. The NML for the Wentworth Hospital (see Figure 6-4) was determined to be 55 dB(A) (external noise level).

Noise emissions were determined by modelling the noise sources, receiver locations, topographical features of the intervening area and buildings surrounding the project area using the Cadna-A (version 2017) noise modelling program. The program calculates the contribution of each noise source at each specified receptor point and allows for the prediction of the total noise from a site.
### Construction Noise Sources

The following table lists the proposed construction activities for the construction works associated with the project. The associated plant and equipment likely to be used by the contractor to carry out the construction works with their corresponding sound power levels are also detailed in the table below. The information was sourced from information from past projects and information held in the Renzo Tonin & Associates database.

#### Table 6-8 Typical Sound Power Levels for Construction Plant & Equipment, dB(A)

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Sound Power Level, LAeq dB(A) re. 1pW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline Alignment</td>
<td></td>
</tr>
<tr>
<td>Rock Breaker Attachment(^1)</td>
<td>117</td>
</tr>
<tr>
<td>Thrust-boring (Auger boring)</td>
<td>111</td>
</tr>
<tr>
<td>Compactor, 12T</td>
<td>108</td>
</tr>
<tr>
<td>Excavator, 40T</td>
<td>105</td>
</tr>
<tr>
<td>Dump Truck</td>
<td>105</td>
</tr>
<tr>
<td>Mobile Crane, 80T</td>
<td>104</td>
</tr>
<tr>
<td>Dozer, D8</td>
<td>103</td>
</tr>
<tr>
<td>Backhoe</td>
<td>100</td>
</tr>
<tr>
<td>Lift Pump Station (River Murray Intake), Wentworth</td>
<td></td>
</tr>
<tr>
<td>Rock Breaker Attachment</td>
<td>117</td>
</tr>
<tr>
<td>Sheet Pile Vibrating Attachment</td>
<td>116</td>
</tr>
<tr>
<td>Excavator, 40T</td>
<td>105</td>
</tr>
<tr>
<td>Dozer, D8</td>
<td>103</td>
</tr>
<tr>
<td>Power Tools</td>
<td>100</td>
</tr>
<tr>
<td>Pump</td>
<td>99</td>
</tr>
<tr>
<td>Tuckers Creek Crossing, Darling River Crossing, Wentworth</td>
<td></td>
</tr>
<tr>
<td>Horizontal Directional Drilling Rig</td>
<td>111</td>
</tr>
<tr>
<td>Excavator, 40T</td>
<td>105</td>
</tr>
<tr>
<td>Dozer D8</td>
<td>103</td>
</tr>
<tr>
<td>Pump</td>
<td>99</td>
</tr>
<tr>
<td>Generator</td>
<td>95</td>
</tr>
<tr>
<td>Dosing Plant, Wentworth</td>
<td></td>
</tr>
<tr>
<td>Compactor, 12T</td>
<td>108</td>
</tr>
<tr>
<td>Excavator, 40T</td>
<td>105</td>
</tr>
<tr>
<td>Dump Truck</td>
<td>105</td>
</tr>
<tr>
<td>Mobile Crane, 80T</td>
<td>104</td>
</tr>
<tr>
<td>Dozer D8</td>
<td>103</td>
</tr>
<tr>
<td>Backhoe</td>
<td>100</td>
</tr>
<tr>
<td>Power Tools</td>
<td>100</td>
</tr>
<tr>
<td>Mica Street Water Treatment Plant Works, Broken Hill</td>
<td></td>
</tr>
<tr>
<td>Concrete Truck</td>
<td>108</td>
</tr>
</tbody>
</table>

\(^1\) Note: The sound power level of the Rock Breaker Attachment includes the work of the Excavator, 40T.
Plant Description | Sound Power Level, LAeq dB(A) re. 1pW
--- | ---
Dump Truck | 105
Excavator, 40T | 105
Mobile Crane, 80T | 104
Dozer D8 | 103
Backhoe | 100
Power Tools | 100

Noise and vibration emissions from the construction of the proposed pipeline alignment, river crossings, lift pump station and dosing plant in the residential areas of Wentworth (NCA 1,2,3,4 5 and 6) and Broken Hill (NCA 8,9,10, 11, 12 and 13) (see Table 6-5 and Table 6-6) were calculated at the potentially most affected residential receivers, based on the results of the short and long term noise monitoring results and in accordance with ICNG.

**Wentworth Suburban Area**

The results from the noise assessment indicate that for activities associated with the construction of the pipeline, noise levels are predicted to exceed the relevant NML for most sensitive receivers. There were nine (9) receivers predicted to be highly noise affected ie. >75dB(A) when all plant and equipment are concurrently operating. Despite periods may be required for those receivers (see Table 4.11 of the noise and vibration assessment, Appendix G). Construction of the pipeline would exceed the recommended NML (of 55 dB(A)) at the Wentworth District Hospital, when all equipment is operated concurrently (predicted to be 67 dB(A)). However construction of the pipeline in the vicinity of the hospital would be limited (up to a two weeks) and the operation of all equipment simultaneously is only expected to occur intermittently, and therefore the impact is not expected to be significant.

Construction activities for the Darling River crossing indicate that noise levels may exceed day time NMLs at four locations when all plant and equipment are operating concurrently; however, there were no receivers predicted to be highly noise affected.

Construction activities for the River Murray Intake was predicted to comply with the NMLs for the majority of receivers except for the nearest sensitive receivers, including the Wentworth District Hospital (maximum noise predicted to be 58 dB(A)). However, no receivers were predicted to be highly noise affected, >75dB(A). Construction of the Intake would take approximately three months and the operation of all equipment simultaneously is only expected to occur intermittently. Only a minor exceedance above the recommended NML is predicted at the hospital site and therefore the impact is not expected to be significant.

Similarly, construction activities for the Tuckers Creek crossing were predicted to impact the majority of receiver locations and exceed the NMLs when all plant and equipment are operating concurrently; however, there were no receivers predicted to be highly noise affected.
Construction of the dosing plant was predicted to have a negligible noise impact at the closest sensitive receivers.

Overall, the noise assessment recommended that a feasible and reasonable approach towards noise management measures should be applied in Wentworth during construction to reduce noise levels. Given the temporary nature of the works and the restriction of construction hours in accordance with normal daytime construction hours within the Wentworth township, noise impacts resulting from the works are not expected to be significant. Noise mitigation and management measures are provided in Section 6.5.3 below.

**Broken Hill Suburban Area**

The results of the noise assessment indicate that construction noise at the majority of receiver locations in the Broken Hill township are predicted to exceed the NMLs during the construction of the pipeline alignment. Many receivers located close to the pipeline alignment construction works are also predicted to also be highly noise affected >75 dB(A) when all plant and equipment being used concurrently, including both the Broken Hill High School and Primary School. As a result, all reasonable and feasible management measures would be implemented and respite periods may be required for those receivers, especially if rock hammering is required.

The predicted results indicate that almost all sensitive receivers located around the Mica Street WTP site (particularly NCA 13, which includes the Broken Hill Primary School) will be noise affected for works associated with the terminal balance tank and pipeline works when all plant and equipment are operating concurrently. One property at 79 Marks Street Broken Hill that was predicted to be highly noise affected during these works.

Pipe laying within Broken Hill is likely to take longer than the average pipeline production rate (of 1km per day per crew) due to the urban environment and potential for rock to be present. Nevertheless the works would be temporary and would be move progressively along the alignment which reduces the duration that individual sensitive receptors would be impacted.

Accordingly, management measures should be applied in Broken Hill to reduce construction noise levels as much as possible. This should include avoiding, where possible, noisy works during school hours in the vicinity of Broken Hill High School and Broken Hill Primary School. The ICNG indicate that all reasonable and feasible measures should be implemented to reduce noise emissions. Given the temporary nature of the works and the restriction of construction hours in accordance with normal daytime construction hours, it is not considered feasible to implement measures to achieve the NML at all sensitive receivers within Broken Hill. Whilst noise resulting from the works would be expected to cause some inconvenience, the impacts are not expected to be significant.

**Other Noise Receivers along the Silver City Highway**

The ‘Coombah Roadhouse’ restaurant located alongside the Silver City Highway in Scotia and the residential property located opposite the restaurant across the Silver City highway may be exposed to construction noise as the pipeline alignment is constructed alongside the highway. Construction works would comply with the EPA’s standard construction hours as per the ICNG and no 24 hour works would be undertaken near these locations.
Noise predictions presented in the assessment indicate that the NML for the Coombah Roadhouse will be exceeded by 2 dB(A) when all plant and equipment are operating concurrently.

**Construction Traffic Noise**

The NSW Road Noise Policy (RNP) is used to assess the potential noise impact from traffic associated with the project travelling on public roads. The RNP stipulates different land use developments and road categories and lists the respective criteria for each (see Table 6-9 below). The criteria stipulated in the RNP is applicable to permanent traffic increases due to upgraded roads or permanent long term developments, however it has been used as part of the noise assessment to assess temporary construction traffic noise.

### Table 6-9 Road Traffic Noise Criteria for Project Construction Traffic Route

<table>
<thead>
<tr>
<th>Road Category</th>
<th>Type of Project/ Land Use</th>
<th>Assessment Criteria, dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day (7am-10pm)</td>
</tr>
<tr>
<td>Freeway / arterial / sub-arterial</td>
<td>Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments</td>
<td>LAeq(15hr) 60 dB(A)</td>
</tr>
<tr>
<td>roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Roads</td>
<td>Existing residences affected by additional traffic on existing local road generated by land use developments</td>
<td>LAeq(1hr) 55 dB(A)</td>
</tr>
</tbody>
</table>

The magnitude of truck movements involved with the proposal has been estimated to be 190 heavy vehicle movements on average per day. This includes the transportation of materials, disposal of construction debris and spoil and the delivery of pipe. It is estimated that five different pipe laying crews would work concurrently at different locations along the pipeline alignment.

It is expected that the majority of heavy vehicle movements would occur on the Silver City Highway between Wentworth and Broken Hill to transport personnel and materials during the pipe laying works. Hence, the RNP criteria would apply to the single residence along the Silver City Highway between Wentworth and Broken Hill, opposite 'Coombah Roadhouse', Scotia.

Construction hours are limited to standard hours within suburban areas and therefore only the day time noise assessment criteria apply.

In order to achieve the road traffic criteria presented in the RNP (Table 6-9), it was determined that heavy vehicles on local roads (within 10 m of residences) would need to be limited to four (4) movements during a one hour period in the day time period and 140 heavy vehicle movements during the day time (15 hour period) on arterial roads. It is considered unlikely that the road traffic criteria would be exceeded at the resident located along Silver City Highway the property due to the large distance (approximately 350 m) to the road from the property.
With regards to light vehicle movements such as those associated with the transport of construction staff, in order to meet the road traffic criteria a maximum of 16 vehicle movements per hour on local roads and 160 vehicle movements per night on highway, arterial or sub-arterial roads would be required. The calculated light vehicle movements associated with construction personnel travel would comply with the RNP road traffic noise criteria for residential land uses during the night time period.

Traffic noise associated with the construction of the pipeline alignment would vary depending on the location of the works. The construction traffic generation will be temporary in nature as construction works progress along the pipeline alignment route through the suburban areas of Wentworth and Broken Hill.
Construction Vibration

The vibration generated from construction works would vary depending on the level and type of activity carried out at each site during each activity. Potential vibration generated to receivers for the works would be dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration and the receiver structure.

Dominant vibration generating plant and activities associated with the works and the recommended minimum buffer are shown in the Table 6-10 below.

**Table 6-10 Construction Vibration Buffer Distances**

<table>
<thead>
<tr>
<th>Plant Item</th>
<th>Recommended Minimum Buffer Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling</td>
<td>5</td>
</tr>
<tr>
<td>Bulldozer</td>
<td>5</td>
</tr>
<tr>
<td>Excavator</td>
<td>10</td>
</tr>
<tr>
<td>Compactor</td>
<td>10</td>
</tr>
<tr>
<td>Truck movements along unsealed roads</td>
<td>10</td>
</tr>
<tr>
<td>Rock Breaker (heavy)</td>
<td>15</td>
</tr>
<tr>
<td>Sheet piling</td>
<td>20</td>
</tr>
</tbody>
</table>

In Wentworth and Broken Hill suburban areas, the nearest affected receivers may be located as close as 10 m from the nearest construction activities for the pipeline.

Table 6-10 represents the recommended minimum buffer distances between residential premises along the pipeline route and various construction plant, including rock breakers, drills, bulldozers, excavators, truck movements and sheet piling. Plant operating inside these minimum buffer distances could exceed the set limits for human comfort. Vibration levels from other equipment are unlikely to exceed the set limits. The human comfort criteria are more stringent than the structural damage criteria, therefore vibration from construction plant and equipment associated with the proposed works are not expected to cause structural damage to dwellings.

If rock hammering or sheet piling is not required, vibration from the pipeline alignment construction works is not likely to cause structural damage to the nearest affected receivers as the majority of buildings would be outside the recommended buffer distances presented in Table 6-10 above.

However, it is recommended that the required site specific buffer distances for vibration significant plant items (e.g. vibratory rollers, compactors, pile drilling) be determined on site where works are within 10-15 m from a building or structure (except for sheet piling where buildings up to 100 m from the piling activity may be affected) depending on the blow energy used as, unlike noise, vibration cannot be readily predicted.

For residences located within the above buffer distances (Table 6-10), more accurate buffer distances should be determined on site by measuring vibration emission levels from each plant item prior to its operation or alternative construction methods and equipment.
are to be used. This should include sensitive receivers such as Wentworth Hospital (which is located approximately 60 m from the pipeline alignment see Figure 6-4).

For construction activities in the rural and remote areas, the nearest affected residences are more than 50 m from the proposed construction works, which exceeds the above buffer distances. The noise and vibration assessment has concluded that it is unlikely that there will be any adverse vibration impacts to residences in these areas. It is extremely unlikely that livestock would be impacted by vibration during the proposed works in rural areas. Noise and vibration from the works would also deter any livestock from grazing near the site during the works.

Rock formations are located at shallow depth along the proposed pipeline route approaching Broken Hill. Wherever rock is encountered, a rock breaker and possibly use of non-explosive expandable agents may be required. Blasting is not anticipated to be required. If blasting is undertaken, the allowable maximum instantaneous charge (MIC) required for different distances before the set criteria are exceeded has been determined Table 6-11.

**Table 6-11 Allowable MIC to Achieve Compliance at Different Distances**

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria</th>
<th>20m</th>
<th>40m</th>
<th>60m</th>
<th>80m</th>
<th>100m</th>
<th>120m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airblast Overpressure 115dB(Lin peak)</td>
<td></td>
<td>0.004</td>
<td>0.005</td>
<td>0.02</td>
<td>0.05</td>
<td>0.12</td>
<td>0.23</td>
</tr>
<tr>
<td>Airblast Overpressure 120dB(Lin peak)</td>
<td></td>
<td>0.002</td>
<td>0.027</td>
<td>0.12</td>
<td>0.32</td>
<td>0.7</td>
<td>1.34</td>
</tr>
<tr>
<td>Ground Vibration 5mm/s (ppv)</td>
<td></td>
<td>1.27</td>
<td>5.06</td>
<td>11.38</td>
<td>20.24</td>
<td>31.62</td>
<td>45.53</td>
</tr>
</tbody>
</table>

In the unlikely event that a small number of blasts is required for the construction of the pipeline, it is considered reasonable to allow a maximum limit of 120 dB (Lin peak).

It is recommended that noise management measures be applied during construction works manage the impact from construction vibration. Vibration mitigation and management measures are provided in Section 6.5.3 below.

### 6.5.2 Operational Impacts

Noise impact from the general operation of the project has been assessed against the *NSW Industrial Noise Policy* (EPA, 2009) (INP). The assessment procedure in terms of the INP has two components:

- Controlling intrusive noise impacts in the short term for noise sensitive land uses such as residences
- Maintaining noise level amenity for particular noise sensitive land uses such as residences.

In assessing noise impact of industrial noise sources, both components must be taken into account for residential receivers.

The applicable operational project specific noise levels (PSNLs) (including intrusive and amenity criteria) are presented in the table below. The intrusiveness criteria is taken to be
the operational PSNL for residential receivers and the amenity criteria for the Wentworth Hospital and industrial premises.

**Table 6-12 applicable PSNLs (including intrusive and amenity criteria)**

<table>
<thead>
<tr>
<th>Noise Catchment Area</th>
<th>Intrusiveness Criteria, ( L_{Aeq}, ) (15min)(^1)</th>
<th>Amenity Criteria, ( L_{Aeq}, ) period</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA 1 (Wentworth)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>NCA 2 (Wentworth)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>NCA 5 (Wentworth)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>NCA 6 (Wentworth)</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Public park</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>Industrial premises</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Hospital Ward – external</td>
<td>-</td>
<td>50</td>
</tr>
</tbody>
</table>

*Notes: 1. Intrusiveness criterion only applicable for residential receivers.*

**Operational Noise Sources**

Operational noise sources for the project include the lift pump station associated with the River Murray intake, the dosing plant incorporating TPS1 located in Wentworth and the two additional TPSs. Indicative noise estimations for these infrastructure components are detailed below.

Based on the proposed plant and equipment and similar projects assessed in the past, the estimated internal sound power levels would be a total of 100 dB(A) within the lift pump station building. This is based on a lift pump station comprising of two river offtake pumps and two filtration units with a total power consumption of 780 kW.

The estimation of operational noise from TPS1 located 8.5 km north of Wentworth has been based on the operation of four booster pumps enclosed within a brick building with mechanical ventilation. Based on similar projects assessed previously, booster pumps with a total power consumption of 405kW would each have a sound power level of 99 dB(A).

**Predicted Operational Noise Levels**

Noise emissions were predicted by modelling the noise sources and receiver locations. TPS1 in Wentworth is not anticipated to have any significant noise contribution to the closest sensitive receivers during operation, due to the relatively large distances (over 2 km) between the closest receivers and the site. The operation of the dosing plant and TPS1 would comply with the INP.

There are two transfer pump stations located along the Silver City Highway (TPS2 and TPS3); however, they are not located near any sensitive receivers and are not expected to
cause any significant noise impact. The operation of TPS 2 and 3 would comply with the INP (EPA, 1999).

Based on the results of the noise assessment, operational noise levels from the lift pump station associated with the River Murray Intake would comply with the intrusiveness and amenity criteria (Table 6-12) at all receiver locations. Therefore, no further noise mitigation measures would be required.

Within the Broken Hill area, the proposed pipeline will connect to existing infrastructure at the Mica Street WTP and the only addition infrastructure at the WTP would be a terminal balance tank. The terminal balance tank does not comprise any additional mechanical plant that would generate noise at the Mica Street WTP site. Therefore, it is expected that the operational noise would not change from what is currently being experienced by sensitive receivers in Broken Hill.

The bulk water storage reservoir and the pump station at this location is approximately 15 km south of Broken Hill. There are no nearby noise sensitive receivers and operation of this site will therefore have negligible noise impacts on sensitive receivers in Broken Hill.

Accordingly, noise mitigation treatment is not required to be provided for operational noise impacts, although the recommendations below have been provided to maintain noise compliance at the nearest affected sensitive receivers.

The exact specifications of the equipment, building construction and positioning of the pumping stations would be confirmed by the contractor during detailed design. Therefore, once the actual details of the pumping stations are finalised, assistance of an acoustic consultant should be sought to confirm that the project would comply with the INP. Should noise impacts from the pumping stations and dosing plant be determined to exceed the relevant noise criteria during the detailed design stage, additional noise mitigation measures would be considered to comply with the INP.

6.5.3 Mitigation Measures

Detailed Design

Once the actual details of the pumping stations are finalised, assistance of an acoustic consultant should be sought during the detailed design stage of the project. The design of the pumping stations and dosing plant are to achieve operational noise level of 35 dB(A) as per the INP.

Pre-construction & During Construction

- Implement community consultation measures including a Community Liaison Plan to inform the community of construction activity and potential impacts
- All employees, contractors and subcontractors are to receive a project induction. The environmental component may be covered in toolbox talks and should include:
  - all relevant project specific and standard noise mitigation measures as detailed in a project specific construction noise and vibration management plan prepared by the contractor;
  - relevant licence and approval conditions;
permissible hours of work;
any limitations on high noise generating activities;
location of nearest sensitive receivers;
construction employee parking areas;
designated loading/unloading areas and procedures;
site opening/closing times (including deliveries); and
environmental incident procedures.

- No swearing or unnecessary shouting or loud stereos/radios on site.
- No dropping of materials from height where practicable, throwing of metal items and slamming of doors.
- All construction machinery is to be turned off when not in use.
- Noise monitoring should be considered for the duration of the works in urban areas or where sensitive receptors (including the Wentworth District Hospital, Broken Hill High School and Broken Hill Primary School) have been identified.
- Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Works outside the standard construction hours defined in the ICNG are only to occur outside the town boundaries of Wentworth and Broken Hill.
- Work generating high noise levels should be scheduled during less sensitive time periods if practicable such as outside of school hours in the vicinity of Broken Hill High School and Broken Hill Primary School.
- Noise generating activities with impulsive, tonal or low frequency characteristics (such as rock breaking, etc) should only be carried out:
  - in continuous blocks, up to but not exceeding 3 hours each; and
  - with a minimum respite period of one hour between each block.
- Use quieter and less noise emitting construction methods where feasible and reasonable.
- All plant and equipment to be appropriately maintained to ensure optimum running conditions, with periodic monitoring.
- The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the applicable criteria (provided in Table 6-8).
- Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be limited/ avoided where possible.
- The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practicable.
- Plant used intermittently to be throttled down or shut down when not in use where practicable.
• Noise-emitting plant to be directed away from sensitive receivers where possible.

• Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.

• Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site for periods of over two months where practicable.

• All deliveries occur during standard construction hours where practicable.

• Where reasonable and feasible, use structures to shield residential receivers from noise such as:
  • site shed placement;
  • earth bunds;
  • temporary or mobile noise screens (where practicable)
  • enclosures to shield fixed noise sources such as pumps, compressors, fans etc (where practicable); and
  • consideration of site topography when situating plant.

• High noise generating plant and equipment, such as rock hammers, should be used only when required (if hard rock is encountered) during construction of the pipeline alignment in suburban areas in Wentworth and Broken Hill.

• Where potential noise impacts are predicted to be up to 15 dB(A) above the noise management level (as presented in Table 4.11 and Table 4.12 of the noise assessment in Appendix G), reasonable and feasible noise reduction measures should be investigated. When possible, the operation of all equipment and mechanical plant simultaneously should be avoided.

• Where potential noise impacts are predicted to be more than 15 dB(A) above the noise management levels (as presented in Table 4.11 and Table 4.12 of the noise assessment in Appendix G), all reasonable and feasible noise control measures should be implemented prior to the commencement of construction works. Noise levels during construction should be monitored when required (eg. to address complaints) and where exceeded, further noise reduction measures (where reasonable and feasible) should be implemented eg. restrict working hours, use silencing equipment, etc.

• A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits (see Table 6-11), appropriate amelioration measures should be put in place to mitigate future occurrences.

• Where vibration is found to be excessive (above the criteria provided in Table 6-8), management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.
• Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.

• The contractor is to undertake a risk assessment to identify buildings and structures that have the potential to be affected by vibration and then undertake the dilapidation survey as required. These surveys are used to address potential community concerns that perceived vibration may have caused damage to property.

Operation

• Noise verification is to be undertaken at the dosing plant and River Murray Intake to ensure compliance with the INP (noise emission not greater than 35 dB(A)).

6.6 Air Quality and Emissions

Due to the rural and isolated setting across the majority of the project area, air quality is good. The major contributor to reduced air quality is from vehicle emissions from the Silver City Highway and dust generation from cleared agricultural land. Broken Hill contains naturally high levels of lead in the soils which is a recognised health risk.

There are seven facilities in Broken Hill registered on the National Pollution Inventory (NPI) which emit a total of listed 33 substances. These NPI listed facilities are mostly associated with the mining industry. There are no NPI registered industries located in Wentworth.

Wind rose data taken from Broken Hill airport and Mildura are provided in Appendix J. Historic weather records from Broken Hill airport since 1947 indicate the prevailing winds (both morning and afternoon) are from the south approximately 20 percent of the time and average wind speeds range between 13 km/hr to 21 km/hr (BOM April 2017). Historic weather records from Mildura airport (approximately 25 km southeast of Wentworth) since 1946 indicate the prevailing winds are from the south in the morning shifting to the south, southwest and west in the afternoon for approximately 20 percent of the time and average wind speeds range between 9 km/hr to 19 km/hr (BOM April 2017). Wind speeds rarely exceed 30 km/hr.

6.6.1 Construction Impacts

The main air quality impacts to arise from the construction works would be dust due to clearing, grading, excavation, stockpiling, backfilling and vehicle movement. The level of dust generation would largely be a factor of the soil and substrate material being excavated / disturbed and the wind strength. As noted above, wind speeds rarely exceed 30 km/hr in the general area and are predominately from the south.

The pipeline would traverse a range of soil profiles with differing potential to cause dust (see Section 6.7). Areas of clay and silts have an increased likelihood to result in dust impacts and sands, which are generally coarser, have less potential. There is the potential that rock hammering may be required for the northern section (Chainage 243,500 m to Chainage 261,500 m) of the pipeline near and within Broken Hill, and therefore the potential for dust generation may be increased in these areas.
Due to the extent and scale of the project, it is not considered feasible to implement dust suppression along the entire length of the pipeline. As endorsed by the EPA (see Table 2-4), a risk based approach to dust management is proposed. Given the isolated nature of the majority of the alignment (less than 5 km proposed in urban areas) and the generally low wind speeds, dust and air quality impacts are likely to be short term and localised; therefore, unlikely to impact on the community. Furthermore, the proposed pipeline alignment would be located away from the edge of the road in close proximity to the road reserve boundary.

Sensitive dust receptors in the project area have been identified as:

- the communities of Broken Hill and Wentworth, particularly urban areas, Wentworth Hospital, local schools and the Two Rivers Ski and Recreation Reserve,
- Coombah Roadhouse,
- Road users,
- Waterways / drainage lines due to increased water quality risk (see Section 6.8 for watercourses in the project area).

Given the progressive nature of the pipe laying activities, the construction works in any one location along the pipeline alignment would be of limited duration, reducing the potential for adverse air quality impacts. Construction works for non-linear infrastructure, notably the River Murray intake, TPS1 and Mica Street WTP, have a greater potential for air quality impacts. This is due to the longer duration of works in these locations and the more sensitive nature of surrounding land uses. However the construction footprint in these areas is generally limited (particularly at the River Murray Intake) and based on the local climatic and landscape conditions, it assessed that provided mitigation measures as detailed below are implemented, significant impacts associated with air quality are not predicted.

### 6.6.2 Operational Impacts

The operation of the project will not result in any emissions and therefore there will be no long term reduction in air quality.

Whilst a high voltage power supply will be provided (subject to a separate assessment), photovoltaic (PV) solar cells are proposed at the dosing plant and all TPS sites which would reduce the CO₂ emissions associated with the scheme operation. The size and capacity of the PV system would be subject to detailed design.

The PV system will allow each pumping station to operate during daylight hours for much of the year without drawing electricity from the grid, which would minimise electricity costs. Electricity rates (energy, transport and demand) during the day are at peak and shoulder rates. The pumping stations would not normally be operated during the peak and shoulder periods unless the water demand made this necessary. However, the availability of PV energy does avoid energy, transport and demand costs for each TPS. A preliminary estimate has indicated that the operation of the PV cells may save approximately $1.28 million per annum in operation costs.
6.6.3 Mitigation Measures

- All reasonable and feasible measures would be undertaken to minimise dust impacts from the construction works, with a particular focus on identified sensitive areas, these being; the communities of Broken Hill and Wentworth, the Coombah Roadhouse, road users and waterways.
- A specific Air Impact Management and Monitoring Plan is to be developed by the contractor and incorporated into the CEMP. The Plan is to be developed in reference to the document Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (DEC, 2005).
- Existing climate and conditions should be evaluated to determine the most appropriate dust suppression methodology, having regard to limited water resource availability in dry climates or drought conditions.
- No works are to be undertaken during extremely windy conditions or when dust has the potential to be a hazard to road users (such as through poor visibility), unless dust can be adequately suppressed.
- Dust suppression is to be undertaken in sensitive areas including within the towns of Wentworth and Broken Hill, in the vicinity of the Coombah Roadhouse and near watercourses.
- Potential dust impacts would be managed by limiting the area of bare ground exposed at any one time (such as through progressive land clearing). Sediment and erosion control measures are to be installed prior to the use of water carts in the vicinity of waterways / drainage lines.
- The time that trenches are left open during the pipeline laying works should be minimised as far as practicable.
- Any stockpiled spoil/fill is to be protected to minimise dust generation.
- Vehicles transporting spoil from the project sites are to be covered.
- Construction vehicles and equipment are to be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period. The excessive use of vehicles and powered construction equipment is to be avoided.
- All construction machinery is to be turned off when not in use to minimise emissions.

6.7 Topography, Soils and Geology

A detailed geotechnical investigation was undertaken by Public Works Advisory in 2016 (PWA, 2017) as part of the concept design phase. This involved an extensive program of bore logs taken along the entire pipeline alignment and at major infrastructure locations.

Topography

The overall project area extends from the Murray and Darling Rivers in the south to the Barrier Ranges in the north. The topography varies along the alignment. The topography is relatively flat at the start of the pipeline on the lower terrace alluvial floodplain of the lower Darling and River Murrays, then begins to climb from the lower terrace to the upper terrace floodplain, and gently undulating with topographic highs and lows. Elevation ranges from 320 m above sea level at Broken Hill to 0 m at the River Murray.
Geology

Geology maps for the alignment are provided in Appendix L. Based on the geotechnical investigation results, the approximate distribution of various geological units along the alignment can be broadly summarised as follows:

- Woorinen Formation and equivalents (120.52 km (45.1%)).
- Lowland Sand and other dune fields (8.28 km (3.1%)).
- Undifferentiated lunettes (5.6 km (2.1%)).
- Coonambidgal Formation and other undifferentiated alluvial deposits associated with existing creeks floodplains and outwash areas (32.96 km (12.3%)).
- Upper terrace (older alluvium, 1.66 km (0.62%)).
- Blanchetown Clay (4.82 km (1.8%)).
- Lacustrine deposits (2.9 km (1.1%)).
- Undifferentiated Sandplain flanking the Mallee region (40.42 km (15.1%)).
- Residual and Colluvial Deposits (16.58 km (6.2%)).
- Willyama Complex suite of rocks (23.1 km (8.7%)).

A total of 126 boreholes were augered to depths of between 0.5 m - 8.0 m and a total meterage of 378.55 m. In addition, three deep boreholes were drilled at the Darling River crossing, to depths of between 6 m and 19.5 m, using a combination of augering and wash boring techniques.

A major part of the pipeline alignment from Ch. 0 m (River Murray Intake) to approximate Ch. 245,000 m is located within Quaternary sediments which are fluvial, lacustrine or aeolian in origin. It is likely to be founded within stiff (locally firm) cohesive sediments comprising silty clays, silty clays of high plasticity, clayey silts with varying concentrations of fine sand of medium plasticity, medium dense silty and clayey sand, very stiff to hard silty sandy clays, very stiff sandy clay, very stiff lacustrine clays and very stiff alluvial silty and sandy clays within the Darling River crossing section.

The remaining part of the alignment (Ch. 245,000 m to Ch. 267,112.3 m) is generally located within meta-sediments of the Willyama Complex which are mantled by thick (footslopes) to thin (ranges) cover of colluvial/residual and Cainozoic deposits; and, locally, Quaternary sediments associated with the existing creeks and drainage depressions. It is likely that the pipeline alignment is located within suite of rock of the Willyama Supergroup, which in sections, is obscured by colluvium/residuum. The bedrock can be variably weathered and in parts, the changes in weathering may occur over relatively short distances.

Soils

Soils vary along the pipeline alignment according to landforms. In the lower terrace floodplain of River Murray/Darling River and Great Darling Anabranch, mid to dark grey and grey-brown silty clays overlying interbedded sediments (silty clays and silts) occur. Lakes and depressions also have silty clay floors.
On the dunefields, red brown calcareous silty and clayey sands occur with higher clay concentrations in the swales. On the sandplains the soils tends to be heavier with gradational profiles from clayey sands to sandy clays. Calcrete is also commonly developed near the surface of these plains. Lunettes, associated with former and present-day lakes, comprise varying soils from relatively clean sand, clayey sand and mixed sand and clay.

Soils were not identified as dispersive or highly erodible.

**Corrosion, Scaling Assessment and Resistivity**

A total of eight (8) samples, representative of various sediments encountered along the alignment, were selected and analysed for:

- pH 1:5 extract ratio;
- Electrical Conductivity (EC) 1:5 extract ratio;
- Soluble Sulphate (SO₄);
- Soluble Chloride (Cl); and
- Soil Resistivity.

The testing was carried out by Sydney Environmental and Soil Laboratory Pty Ltd (SESL) for the purposes of assessment of soil aggressivity towards concrete and steel, in accordance with *Australian Standard AS2159-2009 (Piling Design and Installation)*. The results of the testing suggest that along the majority of the alignment, the Quaternary sediments are very saline and highly saline soils. The highly saline soils appear to be more pronounced in parts of the alignment located in close proximity to the Darling Anabranch channel and bordering lakes systems, especially in topographic lows.

**Sulfate**

The testing yielded a large scatter in sulfate levels, ranging from 10 mg SO₄/kg to 12,270 mg SO₄/kg. The majority of the tested samples recorded sulfate levels below 5,000 mg SO₄/kg which places the sediments in the “non-aggressive” exposure classification. However, the samples from two boreholes recorded sulfate levels in excess of 10,000 mg SO₄/kg which places the sediments in a “mild” exposure classification. Testing for acid sulfate soils was not undertaken, however based on the sulfate testing results, there is considered to be a low likelihood of acid sulfate soils being present.

**6.7.1 Construction Impacts**

Construction of the project would result in ground and soil disturbance associated with clearing, grading and excavation works. Pipe trenches are predicted be 2 m deep and approximately 2.6 m wide. An additional area of 22 m (total disturbance corridor of 25 m) would be required to accommodate access tracks and storage areas along the majority of the 270 km alignment with a narrower disturbance corridor in areas identified as containing sensitive habitat (see Sections 6.9 and 6.10). The pipeline would generally be located between 25 to 30 m from road edge. The bulk water storage, TPS1, TPS2 and TPS3 would be located on relatively flat sites, however some cut and fill may be required to provide a level construction area.
The geotechnical investigation for the works determined that excavations in all deposits, apart from bedrock, should be readily achievable using conventional earth moving equipment; however, firm digging conditions and lesser production rates may be expected in areas where hard sandy clays were encountered (PWA, 2017). Excavations in bedrock will be required within the Broken Hill area. It is anticipated that a large hydraulic excavator (say 30 tonne) will be required. Assistance from a rock breaker and possibly use of non-explosive expandable agents has been identified as potentially being required in some sections of the alignment.

Given the extent and scale of the earthworks proposed, there is a potential for erosion and movement of excavated materials off-site which could result in sedimentation of drainage lines and waterbodies (see Section 6.8 below). However, the majority of the pipeline alignment traverses low and flat terrain which would reduce the potential for significant sediment movement associated with ground disturbance. In addition, the region experiences low rainfall and generally low wind speeds (see Sections 6.3 and 6.6), further reducing the potential for soil movement offsite.

No dispersive or highly erodible soils were identified during the geotechnical investigation and therefore large settling basins are unlikely to be required.

Erosion and sediment controls would be required during construction in those areas identified as having a high risk of erosion such as across slopes, around stockpiles and storage areas and near natural drainage lines and waterways along the pipeline route as necessary. Sediment and erosion controls would be documented in a project-specific Soil and Water Management Plan (SWMP) to be prepared by the construction contractor and based on the final design and construction methodology. Although a number of mitigation measures to reduce sediment loss and to protect water quality have been listed in this REF, further site specific erosion control plans and mitigation measures would be included in the SWMP.

Although a substantial volume of earthworks are proposed, it is assessed that the impacts can be adequately managed through the implementation of appropriate and targeted mitigation measures to minimise soil loss and erosion, and therefore the overall impact is assessed to be low to moderate.

**Saline Soils**

As discussed above, highly saline soils were identified in proximity to the Darling Anabranch channel and bordering lakes systems. Construction in these areas would be managed to minimise the risk of offsite impacts (discussed in 6.8.1).

### 6.7.2 Operational Impacts

Provided the areas of disturbance have been suitably stabilised and monitored following construction works, the potential impacts to soils are predicted to be low.

### 6.7.3 Mitigation Measures

- A detailed SWMP will be prepared as part of the CEMP. The SWMP would describe the site specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication *Managing Urban Stormwater: Soils and Construction*, 4th edition (“The Blue Book”) and Volume 2a Installation of Services.
The SWMP would be site specific and developed on a risk based approach to address the following issues with the aim to minimise erosion, sediment loss and water quality impacts:

- Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas.
- Minimisation of disturbance to soil and water adjacent to, and within, all sensitive areas (refer to Figure 6-6) and watercourses in the works area.
- Identification of site specific sediment and erosion control measures wherever erosion is likely to occur such as across slopes, around stockpiles and storage areas and near natural drainage lines and waterways.

Requirements for vegetation clearing to be kept to a minimum required to construct the works. Consideration is to be given to vegetation slashing as the preferred construction methodology where possible.

- Vegetation removal to be undertaken in stages in line with the pipeline laying activities.
- Backfilling of trenches once pipelines are installed to be undertaken as soon as practicable.
- Deep ripping to be implemented as the preferred site stabilisation method.
- Construction compounds to be located at least 50 m from any drainage lines.
- Stockpiles to be located at least 50 m away from any drainage lines.
- All erosion and sediment controls would be regularly inspected and maintained, especially when rain is expected and directly after any rain events.
- Excavated spoil will be temporarily stockpiled on flat, cleared land where possible and would be backfilled as soon as practicable.
- All areas where ground disturbance has occurred would be stabilised following completion of works to minimise the erosion hazard. This would involve, where required, re-application of topsoil excavated from the site and deep ripping, to facilitate the natural re-establishment of vegetation cover.
- Any excess spoil would either be spread across the ground in nearby areas in such a manner as to avoid creating an erosion hazard, or removed off site for disposal in accordance with relevant EPA requirements.
- The contractor is to identify areas where saline soils are present (in reference to the geotechnical report) and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes, this should include:
  - minimise disturbance of saline soils;
  - ensuring saline soils are keep stockpiled separately and protected from runoff;
  - monitoring should be undertaken to ensure that rehabilitation in suspected saline soil areas is successful.
6.8 Surface and Groundwater

The proposed project is located within the Murray and Darling River catchment areas. Water for Broken Hill is currently sourced from the Menindee Lakes on the lower Darling River catchment and the proposed water extraction point at Wentworth is located within the central River Murray catchment. The project area is located within the New South Wales Murray and Lower Darling water resource plan areas under the MDBA Basin Plan and falls within the Lower Darling SDL resource unit (see Section 2.5.2).

The lower Darling River flows from the Menindee Lakes to its junction with the River Murray at Wentworth. The catchment is located on the semi-arid plains of south-western New South Wales, where most of the landscape has an elevation of less than 100 m and annual rainfall of less than 300 mm (MDBA, 2016). The Lower Darling River catchment receives very little with respect to runoff with nearly all the water flowing through the lower Darling originating from the rivers of southern Queensland and northern New South Wales through the Barwon–Darling river system.

The Menindee Lakes at the head of the lower Darling catchment is a natural system of seven large lakes that was modified for water storage in the 1960s. The water is used to supply urban water to Broken Hill, supplement urban and irrigation water supplies to New South Wales, Victoria and South Australia, and provide irrigation water to landholders near the lakes (MDBA, 2016).

Country Energy (Essential Energy/ Essential Water since March 2011) holds a Local Water Utility (LWU) NSW WAL, no. 8584 for 9,975 ML linked to works at Menindee and Broken Hill. The Murray and Lower Darling Water Sharing Plan confirms that only 10,135 ML of Local Water Utility is held in the Lower Darling system. The 160 ML balance relates to the Pooncarie WAL held by the Wentworth Council.

The existing WAL no. 8584 is a Specific Purpose Access Licence (SPAL). This limits the capacity of the WAL-holder to vary the location of the works, to sell entitlement and transfer water allocations. The terms do not limit trade and transfer of allocation from the WAL, other than at times when groundwater is being pumped to supplement the SPAL supplies.

Surface Water

The town of Wentworth is located on the confluence of the Murray and the Darling Rivers. Wentworth is the junction point for the lower Darling, Lower Murray and central Murray catchments. The intake point, which is lies within the River, commences at the confluence of the River Murray and the Darling River at Wentworth. The River Murray discharges to the Murray Mouth at Goolwa in South Australia. Waterways in the vicinity of the pipeline alignment include the following (see Figure 6-6), although the Murray and Darling Rivers and Tuckers Creek are the only permanent waterways along the route.

- Tuckers Creek
- Darling Anabranch River
- Lake Coombah
- Lake Popiltah
- Two Miles Break Creek
- Four Miles Creek
- Tingha Creek
- Coombah Creek
- Pine Creek
- Kelly Creek

A number of smaller, unnamed ephemeral creeks and drainage lines are also distributed across the area.
River Murray to Broken Hill Pipeline Project
Review of Environmental Factors

Figure 6-6 Topography and waterways in the project area

Source: Niche, 2017
Water Quality

The proposed River Murray Intake would be located within the Lock 10 Weir on the River Murray. According to the MDBA, Lock 10 is managed to ensure variability (in levels) to negate impacts of steady / stagnant weir pool.

The main ongoing water quality consideration for this area of the River Murray is salinity. Salinity is considered to be generally better in the Lock 10 pool (and the site of the proposed intake), but increases downstream of this point due to the more saline inflows from the Darling River and local saline groundwater intrusions (MDBA, 2016). On occasions there may also be water quality issues relating to low dissolved oxygen levels, algal blooms and high turbidity however these system events are not unique to the Lock 10 weir pool and general affect large areas of the river system.

The water quality of the River Murray has been assessed based on recently collected (August 2016) samples (see and the water quality plant logs at Wentworth water treatment plant, and was found to have:

- Moderate to high turbidity
- Highly coloured
- Low alkalinity
- Low calcium hardness
- High aluminium
- High total iron
- Moderate manganese, and
- The presence of algae (The River Murray water is prone to blue-green algal blooms).

Although not detected in the water sampling undertaken in August 2016, there is also the potential for hydrocarbons to be presence due to the intense boating activities on the River Murray.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality document (ANZECC 2000 Guidelines) specifies that guidance on what constitutes good quality drinking water is provided by the Australian Drinking Water Guidelines (NHMRC & ARMCANZ 1996), a companion document of the National Water Quality Management Strategy. The Australian Drinking Water Guidelines are intended to meet the needs of consumers and apply at the point of use; for example, at the tap. They are applicable to any water intended for drinking irrespective of its source (municipal supplies, rainwater tanks, bores, point-of-use treatment devices, etc.) or where it is used (the home, restaurants, camping areas, shops, etc.). The Guidelines provide an authoritative Australian reference on good drinking water quality, covering a wide range of the microbiological, physical, chemical and radiological characteristics that determine water quality.

The ANZECC 2000 Guidelines also include default trigger values for physical and chemical stressors. Trigger values are used to assess risk of adverse effects due to
nutrients, biodegradable organic matter and pH in various ecosystem types, and are concentrations that, if exceeded, will indicate a potential environmental problem. The aquatic ecosystem trigger values for south-east Australia for lowland rivers in slightly disturbed ecosystems are listed in Table 6-13. Note that this table only includes those parameters for which results are listed in Table 6-14 below.

Table 6-13 Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed ecosystems

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Trigger Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>6-50</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>6.5-8</td>
</tr>
<tr>
<td>Apparent colour</td>
<td>HU</td>
<td>-</td>
</tr>
<tr>
<td>True colour</td>
<td>HU</td>
<td>-</td>
</tr>
<tr>
<td>Total iron</td>
<td>mg/L Fe</td>
<td>-</td>
</tr>
<tr>
<td>Soluble iron</td>
<td>mg/L Fe</td>
<td>-</td>
</tr>
<tr>
<td>Total manganese</td>
<td>mg/L Mn</td>
<td>-</td>
</tr>
<tr>
<td>Soluble manganese</td>
<td>mg/L Mn</td>
<td>-</td>
</tr>
<tr>
<td>Total aluminium</td>
<td>mg/L Al</td>
<td>-</td>
</tr>
<tr>
<td>Soluble aluminium</td>
<td>mg/L Al</td>
<td>-</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>mg/L CaCO₃</td>
<td>-</td>
</tr>
<tr>
<td>Conductivity</td>
<td>μS/cm</td>
<td>125-2200</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>-</td>
</tr>
<tr>
<td>UV absorbance at 254μm</td>
<td>cm⁻²</td>
<td>-</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>mg/L CO₂</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 6-14 Water Quality Results – River Murray Intake

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Analysed 22/8/16</th>
<th>Analysed 26/8/16</th>
<th>Analysed 29/8/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>NTU</td>
<td>80.5</td>
<td>77</td>
<td>-</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>7.35</td>
<td>7.35</td>
<td>-</td>
</tr>
<tr>
<td>Apparent colour</td>
<td>HU</td>
<td>752</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>True colour</td>
<td>HU</td>
<td>118</td>
<td>35</td>
<td>27</td>
</tr>
<tr>
<td>Total iron</td>
<td>mg/L Fe</td>
<td>0.520</td>
<td>1.84</td>
<td>-</td>
</tr>
<tr>
<td>Soluble iron</td>
<td>mg/L Fe</td>
<td>0.468</td>
<td>0.324</td>
<td>0.000</td>
</tr>
<tr>
<td>Total manganese</td>
<td>mg/L Mn</td>
<td>0.176</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Soluble manganese</td>
<td>mg/L Mn</td>
<td>0.000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
The NSW Water Quality Objectives are the agreed environmental values and long-term goals for NSW's surface waters for local councils, Catchment Management Authorities and state agencies to consider and include in strategic, catchment and land use planning processes. The Objectives are consistent with the agreed national framework for assessing water quality set out in the ANZECC 2000 Guidelines.

The Barwon Darling and Far Western and Murray catchment Water Quality Objectives provide an agreed framework to assess water quality in terms of whether the water is suitable for a range of environmental values (including human uses). The objectives below are based on measurable environmental values for protecting aquatic ecosystems, recreation, visual amenity, drinking water and agricultural water:

- Aquatic ecosystems - Maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term
- Visual amenity - Aesthetic qualities of waters
- Secondary contact recreation - Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed
- Primary contact recreation - Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed
- Livestock water supply - Protecting water quality to maximise the production of healthy livestock
- Irrigation water supply - Protecting the quality of waters applied to crops and pasture
- Homestead water supply - Protecting water quality for domestic use in homesteads, including drinking, cooking and bathing
- Drinking water - Disinfection only, or Clarification and disinfection, Groundwater - Refers to the quality of drinking water drawn from the raw surface and groundwater sources before any treatment
- Aquatic foods (cooked) - Refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.
• Industrial water supplies - The high economic value of water taken from rivers and lakes for use by industry needs recognition in water quality planning and management.

River Flow

The Barwon Darling and Far Western and Murray catchment River Flow Objectives are high-level goals for surface water flow management. They identify the key elements of the flow regime that protect river health and water quality for ecosystems and human uses. The objectives for Barwon-Darling and Far Western and Murray catchment are provided below:

• Protect pools in dry times - Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows
• Protect natural low flows
• Protect important rises in water levels - Protect or restore a proportion of moderate flows (‘freshes’) and high flows
• Maintain wetland and floodplain inundation - Maintain or restore the natural inundation patterns and distribution of floodwaters supporting natural wetland and floodplain ecosystems
• Mimic natural drying in temporary waterways - Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways
• Maintain natural flow variability - Maintain or mimic natural flow variability in all streams
• Maintain natural rates of change in water levels - Maintain rates of rise and fall of river heights within natural bounds
• Manage groundwater for ecosystems - Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems
• Minimise effects of weirs and other structures - Minimise the impact of instream structures
• Minimise effects of dams on water quality - Minimise downstream water quality impacts of storage releases
• Make water available for unforeseen events - Ensure river flow management provides for contingencies

Groundwater

A summary of groundwater recorded in the project area during the geotechnical investigation is provided in Table 6-15 below.

Groundwater was intersected in two boreholes in the vicinity of the River Murray Intake at a depth of 2.9 m and 3.3 m (refer to Table 6-15), which corresponds to the silty sand interbed. The groundwater level is also at approximate normal river level, which implies a hydraulic connection between the drilled location and the river. Groundwater was also intersected within the Darling Anabranch Creek crossing section at a depth of 6.4 m depth which corresponded to the sand strata underlying the cohesive sediments.

Groundwater was intersected at an approximate depth of 2.2 m at Ch 263906 m (refer to Table 6-15); however, at the conclusion of drilling, the water level had risen to a depth of 1.5 m. Minor groundwater inflow (steady seepage, very low volume) was recorded at a
depth of 2.3 m. At the end of drilling, the water level in the borehole was recorded at 3.2 m depth which indicated very low volume inflow.

Table 6-15 Groundwater levels recorded during the geotechnical investigation

<table>
<thead>
<tr>
<th>Location</th>
<th>Borehole (Chainage m)</th>
<th>Depth to Groundwater (m) (depth at completion of drilling = EOH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wentworth - Intake Pumping Station Site</td>
<td>0 m</td>
<td>2.6</td>
</tr>
<tr>
<td>Wentworth - southern bank of Darling River (near to the intake but not on pipeline alignment)</td>
<td>DC1</td>
<td>3.3</td>
</tr>
<tr>
<td>Darling Anabranch River Crossing</td>
<td>BH84 (Ch 69032 m)</td>
<td>6.4 (6.1 EOH)</td>
</tr>
<tr>
<td>Railway Crossing – Southern side</td>
<td>BH114 (Ch 263906 m)</td>
<td>2.2 (1.5 EOH)</td>
</tr>
<tr>
<td>Railway Crossing – Northern side</td>
<td>BH115 (Ch 263975 m)</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Geomorphology

The project area generally lies in the western/north-western part of the Murray Basin which has been filled with marine and terrestrial sediments. The depositional and erosion patterns over time have been dominated by changing sea levels and incision of river valleys. The sandy sediments have been reworked into dunes and sandplains. The distinctive aeolian landforms and “mallee” vegetation (referred to as the Mallee region) underlie the majority of the alignment.

In addition to the dune fields, the Mallee region contains dry, ephemeral and semi-permanent lakes created as overflow lakes of the Darling River and Great Darling Anabranch (ancient Darling River channel). All lakes have well-formed lunettes on their eastern margins.

In places, the floodplains of Great Darling Anabranch and Darling River have been strongly modified by aeolian processes, and fluvi-lacustrine sediments are frequently overlain by subdued elliptical dunes. Aeolian processes are locally active within the Mallee region; however, most of the Mallee consist of Late Pleistocene landforms.

The following information is taken directly from the Geoarchaeological Report prepared by Huonbrook Environment & Heritage (2017) for the project.
The project area is underlain at a depth of at least several metres between Wentworth and the Darling Anabranch River by the Blanchetown Clay and the landforms are all depositional. The Blanchetown Clay represents the lacustrine fill of palaeo-Lake Bungunnia, which formerly covered more than 40 000 km² of southern Australia from about 2.4 to 1.2 million years ago. The upper part of the Blanchetown Clay is visible in river banks and road cuttings along section of the alignment, and consists of laminated greenish-grey and red-brown clay and silty clay.

The channels of the Murray and Darling Rivers and the Darling Anabranch are incised into the Blanchetown Clay and their alluvial floodplains extend north from Wentworth route for about 10 km. The alluvial plain is flat and consists of a floodplain comprising fine sand, silt and clay sediments and relict channel deposits of varying ages including late Pleistocene to recent deposits. Most of this part of the route has been episodically inundated by large floods throughout the Holocene and continuing during the time since European settlement.

The remainder of the route crosses a slightly but distinctly elevated sandplain capped with extensive discontinuous stabilised east-west oriented dunes up to 4 m high (The Woorinen Formation). The dune sands are generally a mixture of unconsolidated red-brown medium to fine silty sand, red calcareous silty clay, sandy clay, and clay pellet aggregates. Calcrete accumulations are common at the base of the sands forming the sandplains and the overlying dunes.

Woorinen Formation sand dune accumulation began at least 380 thousand years ago with two substantial phases of dune sand accumulation occurring at 72-63 thousand and 38-18 thousand years ago, remaining stable since then. At the northern end of Popiltah Lake there is a 6 km stretch where the linear dunes are higher, less consolidated and with much sharper crests than on the dunes to the south which comprise the Lowan Sand Formation which overlies the older Woorinen Formation.

During the late Pleistocene the main Darling River course followed that of the Darling Anabranch River and its upper reaches north of about Lake Tandou. Loss of efficiency of the winding channel caused a transition to the present river channel alignment around 9-7 thousand years ago.

**Flooding**

Wentworth is located on a floodplain with the town protected against flooding by a series of levee banks. Flood mapping and the extent of flood prone land surrounding Wentworth has been defined in the Wentworth LEP and includes the site of the River Murray Intake, the pipeline alignment in Wentworth located outside the town levee and the Darling River crossing.
6.8.1 Construction Impacts

The key risks to water quality due to the construction of the project include:

- Erosion and sedimentation of receiving waters;
- Water contamination through the release of polluting substances (e.g. concrete, oil, fuel, drilling fluids, litter, sewage effluent) resulting from spillages; and
- Disturbance of saline soils.

Erosion and Sedimentation

The main potential for water quality impacts to occur during construction would be due to sedimentation and erosion. Short term increases in sediment loading and transfer of sequestered nutrients, organic matter and contaminants into the waterways could result from the following activities:

- Clearing, grading, excavation and backfilling associated with the pipeline construction;
- Site clearing, levelling and foundation works at the TPS and bulk storage sites;
- Construction of the River Murray Intake, including the installation, dewatering and dismantling of the coffer dam;
- Creek crossings (open trenched), due to the disturbance of the bed and banks and dewatering; and
- Stockpiling of spoil.

River Murray Intake

Construction of the River Murray intake will require works to be undertaken within and adjacent to the River Murray (see Section 5.5.4 for construction methodology). The main
risk to water quality would be through coffer-damming, dewatering and reduced bank stability (such as through vegetation removal and cofferdaming) adjacent to the intake. In order to ensure that the pump station is constructed above the 1 in 100 year flood level, some importation of spoil (likely to be sourced from the pipeline construction works) would be required which presents an additional water quality risk factor.

Specific principles under the MREP No. 2 requires that all works affecting the use or management of riverine land should seek to reduce pollution caused by salts and nutrients entering the River Murray and otherwise improve the quality of water in the River Murray. Suitable mitigation measures would be implemented for works at the River Murray intake to minimise the potential impacts on water quality.


In accordance with the MREP No.2, disturbance to the shape of the bank and riparian vegetation is to be kept to a minimum in any development of riverfront land. Construction impacts at the intake site would be short term (up to three months). Any adverse water quality impacts would be localised and are unlikely to impact on other waterway users of the including recreation, other licenced extraction etc.

**Waterway Crossings and Drainage Lines**

Aside from the directional drilling of Tuckers Creek and the Darling River, the pipeline will require seven waterway crossings mostly comprising small ephemeral creeks which only flow after heavy or prolonged rainfall events. Open trenching of creek lines would occur during dry periods where possible. The pipeline will have a minimal covering of 800 mm below natural creek bed level. Following backfilling, all waterways would be reinstated with bed material excavated from the creek beds to match the existing sediment stratifications so as minimise potential impacts to creek geomorphology and ongoing movement of sediments post construction. Material would be compacted to match the pre-existing profile of the creek bed.

A number of minor drainage lines could potentially be impacted during the construction works, including during the construction of the bulk water storage. Minor drainage lines would be diverted around infrastructure elements where required.

Due to the ephemeral nature of the waterways in the project area and the low likelihood of flows during construction, sediment controls are expected to be effective in preventing offsite impacts. It is not expected that waterway crossings would result in adverse water quality impacts.

**Pipeline and TPS Construction**

Construction of the pipeline and TPSs would require a substantial volume of earthworks over a large area. Uncontrolled sediment runoff has the potential to increase turbidity and nutrients entering the waterways and nearby drainage lines which, when present in large volumes, may have ecological and water quality impacts. Based on the evaluation of
construction activities and the potential water quality impacts discussed above, mitigation measures would be focused on areas at increased risk of erosion and sediment loss. These areas include slopes, creek banks and spoil stockpiles and mitigation measures would be focused on protecting sensitive receiving environments; notably waterways and drainage lines (see Section 6.8 above for watercourses in the project area) and sensitive vegetation (See Section 6.9).

As discussed in Section 6.7.1, due to the topography and climatic characteristics, and the lack of dispersive or highly erodible soils across the majority of the project area, it is assessed that sediment and erosion controls would be effective in minimising any offsite impacts.

Given that revegetation is not proposed along most of the pipeline alignment, the management of topsoil would be prioritised as it would be the principle tool in rehabilitating the area. Topsoil would be stripped in stages in line with vegetation clearing and stockpiled separately. It would be utilised as a rehabilitation resource via direct return to prepared (ripped) surfaces following backfilling. The scarifying or ripping would serve to trap native seeds and runoff, thus promoting germination. Cleared vegetation would be placed over the prepared area to protect topsoil and further encourage revegetation.

All disturbed areas would be monitored post construction, with a focus on preventing weed infestations, preventing topsoil loss and ensuring that revegetation is successful.

Water will be required for construction activities such as dust suppression, concrete mixing and hydrostatic testing. The water would be obtained from existing surface water sources, as well as water carted to site. The construction contractor will be required to define likely annual water requirements within the CEMP and work with Essential Water with regards to water available within Essential Water’s water allocation.

**Flooding**

There is a low risk of flooding within the worksites following a rainfall event or high flows, due to a lack of permanently flowing waterways in the area, other than the Murray and Darling Rivers. Given the location of the works within the lower Darling River catchment, suitable warning and lead time of flood flows would be available to manage worksites.

The construction contractor would check weather forecasts regularly so that equipment and materials in flood prone areas can be secured prior to flood flows arriving. In the event of flooding, construction works in affected areas would cease during flood events and would not commence until floodwaters have receded. Water collected within the pipe trenches would be pumped and treated before discharge to the environment in accordance with “The Blue Book”.

**Contamination**

Construction activities with the potential to cause contamination include:

- Storage of fuels and refuelling of construction plant and equipment;
- Management of drilling fluids associated with directional drilling; and
- Concreting works (at TPS sites).

Accidental spillage of fuels, hydraulic fluids and lubricating oils used in the operation of construction equipment could result in the release of hydrocarbons and metals to the
waterways. The significance of the impact would depend on the type of fuel or oil used, the quantity spilt, the prevailing weather conditions and rate of flow of the river (i.e. dilution effect). Several mitigation measures are recommended to manage and mitigate against potential spill incidents.

A suitable fuel storage area would be established at construction compounds with fuel storage tanks located in bunded areas capable of containing 110% of the largest tank capacity. Storage tanks will be located on bunded concrete slabs to ensure that the full volume can be contained (even during a rainfall event) should any leakage occur. All fuels and combustible liquids would be managed and handled in accordance with *AS 1940 The storage and handling of flammable liquids* and relevant WorkCover guidelines.

The underboring of the Darling River and Tuckers Creek would require drilling fluid which is likely to consist of a bentonite slurry and is required to transport drill cuttings, cool the drill bit and to seal and support the drilled hole. Bentonite is a naturally occurring clay which is self-sealing and therefore used as a lining material to seal any cracks which may result from the drilling process.

The use of drilling fluid could potentially result in waterway contamination if it is not contained onsite. Drilling fluid would be recirculated and therefore any loss of fluid would adversely affect drilling operations and would be immediately apparent to the drilling rig operators via a loss in pressure and fluid ceasing to be pumped to the drill-head. Management measures would be implemented to ensure drill waters are recycled and contained onsite such as through the use of holding tanks.

The CEMP would include incident management procedures for spills that may occur on site. Spill management procedures would include maintaining an emergency spill kit on site at all times, refuelling of machinery within dedicate areas, storage of chemicals within bunded areas and training of workers in emergency procedures.

Concreting would be required for activities such as forming foundations for buildings and tanks, and construction thrust blocks, and as such there is a risk of caustic concrete washout impacting on waterways. Rainwater polluted with concrete washwater can percolate down through the soil and alter the soil chemistry and contaminate groundwater. No batching plant is proposed as part of the project. Any washdown water from cleaning of ready mixed concrete truck chutes or hoppers would be collected and disposed of in accordance with the Waste Classification Guideline 2014. Management measures would be implemented during concreting works to minimise the potential for offsite impacts. Provided safeguards are implemented the risk is expected to be low.

**Saline Soils**

Given the presence of saline soils in and around the Darling Anabranch and Lake systems, there is a risk that brackish runoff may enter natural waterways causing ecological impacts. If not managed correctly during construction, saline soils can present a risk of reduced success of natural revegetation. Saline soils would need to be carefully managed with the main objective to keep separate from topsoils and ensure they are deeply buried during backfilling.
Groundwater
Given the limited groundwater detected in the project area, groundwater is only anticipated to be intercepted at the River Murray Intake, the rail line crossing and within the vicinity of the Darling Anabranch. Construction in these areas may require dewatering. In addition, the alignment traverses numerous drainage lines, small gullies and minor creeks. Therefore the possibility of encountering seepage should not be totally discounted if the construction is carried out during adverse weather conditions. Dewatering can be adequately managed through standard mitigation measures and no impacts to groundwater quality are predicted.

6.8.2 Operational Impacts

River Murray Intake
The proposed River Murray Intake is located on flood prone land. Given that the flood price component of the intake would be constructed above the 1 in 100 year flood level it is not expected to be impacted by flood waters. Due to the small size of the intake structure and that it will essentially replace an existing structure on the site (this being the old Wentworth town PS) it is not anticipated that the new intake and associated infrastructure would be adversely impact the flow or behaviour of flood waters.

Pipeline Operation
The main potential impact to surface water due to the operation of the pipeline includes the need to undertake routine maintenance works including pipe scouring and swabbing (referred to as “pigging”).

The transportation of raw river water over long distances generally results in changes in the water chemistry due factors such as organic matter in the water, biological growth, consumption of dissolved oxygen and leaching from the internal cement lining of the pipeline. There is the potential also that, if not adequately managed, biofilm growth on the inside walls of the pipeline could reduce the hydraulic capacity of the pipe.

Maintenance scouring and pigging is therefore required to alleviate some of the water quality issues associated with transporting raw water over long distances as is proposed as part of the project.

Scour values would be provided at regular intervals along the pipeline to facilitate draining of the pipeline when required and to remove sediment build up. Scouring requirements are subject to the tenderers’ final design but would be located at low points in the pipeline.

Pigging is likely to occur to control the build-up of sediments. Pig launching and retrieval facilities, along with suitable areas for waste disposal, will need to be provided at relevant sections of the pipeline. It is likely that the lagoons will be provided at each of the TPS sites to manage wastewater resulting from pipe cleaning.

During scouring, pollution of the environment would be prevented by collecting and disposing of water containing silt and sediment within lagoons at each of the TPS sites. These discharges would occur through a controlled operating procedure so as to prevent erosion and sedimentation. There would be a dissipation unit attached to the end of the outlet pipe to reduce velocities prior to release and infiltration to lagoons. Due to the high temperatures, water discharged though maintenance works would be expected to evaporate relatively rapidly and is therefore unlikely to result in adverse impacts.
Balance tanks (located at the TPS sites) may on occasion need to be emptied for maintenance. It is anticipated that these would be drawn down via the pipeline delivery system.

All discharges during the operation of the River Murray to Broken Hill Pipeline Project are to be consistent with the NSW *Water Quality and River Flow Objectives* for the catchment.

**Bank Stability**

Post-construction, there is a risk of reduced bank stability and associated sediment loss and water quality issues adjacent to the River Murray intake structure at Wentworth. However, the intake would be designed and constructed in accordance with the recommendations of the geotechnical investigation (PWA 2017), namely for stability and embankment protection which would reduce the potential for impacts. Ongoing inspection of bank stability during operation will be undertaken and remedial action will be initiated where required which would reduce the potential risk.

**Water Extraction and Menindee Lakes**

The operation of the River Murray to Broken Hill Pipeline Project will require a new WAL for the River Murray Intake to operate the scheme. As discussed in Section 4.4 there are three potential options being considered with respect to the WAL for the River Murray to Broken Hill Pipeline Project;

1. Fully relinquish WAL 8584 (all allocations) and purchase a new WAL to meet all the Essential Water water needs.

2. Partially relinquish WAL 8584, maintaining sufficient water to meet local needs at and near Menindee only and purchase a new water entitlement for the River Murray Intake.

3. Retain WAL 8584 in full (based on existing the water supply works at Menindee) and seek to transfer the allocation (annually or permanently) to the new water supply works for the River Murray Intake. This would involve applying for a Local Water Utility Special Purpose WAL without purchasing any water entitlements).

The preferred WAL option has not been selected and will be determined by Essential Energy who is responsible for amending existing and or obtaining any new WALs.

Based on the analysis provided in Table 4-5, none of the potential options for the WAL would result in an adverse impact to the Menindee Lakes or flows in the Lower Darling River. In summary it was found that;

- Option 1 would lead to a greater volume of water being stored at almost all times within the Menindee Lakes system. This would enable increase flexibility in the operation of Menindee Lakes, as reserving large volumes of water between seasons to secure urban supplies and evaporative losses would not be required.

- Option 2 would result in improvements in all key indicators (these being impacts to source water, cultural heritage, water users and socio and economic benefits).

- Option 3 would result in increased flows in Lower Darling (to meet demand from new works).
Regardless of the option selected, the River Murray to Broken Hill Pipeline Project would operate within the provisions of the NSW Murray and Lower Darling Regulated Rivers WSP which has been developed in line with the MDBA Basin Plan. The extraction volume would be within the overall water allocation and cap as defined for the water catchment.

The operation of the River Murray to Broken Hill Pipeline Project is not expected to result in adverse impacts to the Menindee Lakes system of flows in the Darling River.

**Downstream Users**

The extraction of 34.7 ML/day proposed as part of the River Murray to Broken Hill Pipeline Project represents approximately 0.3% of the existing River Murray cap to meet human water use needs (as per the MDBA Basin Plan). The abstraction of this volume of water from the River Murray is unlikely to have any notable effect on the volume of water available to downstream users. Given that water extraction would be within the established cap for the Murray Darling Basin, no adverse impacts water users downstream of the extraction point is predicted.

**Water Quality**

There is the potential for water quality changes in the transfer system before water reaches the Mica Street WTP. The contractor would ensure that water delivered to Mica Street WTP meets the quality requirements agreed to by Essential Water.

**General**

Any equipment containing fluids / chemicals that have the potential to cause water pollution would be located within a concrete bunded area.

Self-bunded tanks shall be considered in order to avoid the requirement for bunds where practical.

**6.8.3 Mitigation Measures**

**Construction**

- Procedures are to be detailed in the CEMP, including notification requirements to the EPA for incidents that cause material harm to the environment.
- Construction contractor is to define likely annual water requirements within the CEMP and work with Essential Water to ensure water consumed for construction is available within Essential Water’s water allocation.
- Compaction relief shall be undertaken, as required, by ripping or scarifying soils along the contours.
- The pipeline corridor shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features.
- Erosion and sediment control measures are to be documented in the SWMP and are be installed and maintained as necessary to manage the disturbed area.
- All fuels and combustible liquids would be managed and handled in accordance with AS 1940 *The storage and handling of flammable liquids*, the WH&S Act and Regulation and the *Storage and Handling of Dangerous Goods – Code of Practice 2005* (WorkCover 2005).
- A site specific spill management plan would be prepared and include the following requirements:
• Emergency spill kits are to be kept at the site (vehicle kits).
• Refuelling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan.
• Fuels, lubricants and chemicals, including drilling fluids, shall be stored and, where practicable, handled within containment facilities such as bunded areas designed to prevent the release of spilled substances to the environment and capable of storing 120% of the volume of material stored there.
• Bunded areas are to be at least 50 m from any waterway or drainage line.
• Workers would be trained in the spill management plan and the use of the spill kits.
• All concrete washout water and solids are to be collected and retained in leak proof containers and disposed of in accordance with the Waste Classification Guideline 2014.
• Collected concrete washout water and solids are to be recycled.

In the event of flooding being predicted, construction works in affected areas would cease prior to the flood events and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.

• The design and construction of the river/creek crossings would include measures to ensure that:
  • Geomorphology and hydraulics are not affected.
  • Bed levels or profile will not be altered.
  • Pre-stripping and stockpiling of topsoil and bed material (for creek crossings) will be stored separately above the bank and where required stormwater diversion drains are to be placed near to the top of the banks. Bed sediment will be put back on top of the pipeline trench to match the existing bed levels.
  • All necessary erosion protection measures are in place during construction and thereafter for each crossing.

• Watercourse crossings, including temporary access tracks, are to be at right angles to the direction of water flow to minimise scour potential.
• Crossing sites to be selected to avoid unstable banks, bends in the channel, deep pools, and confluences with other channels.
• The quality of water discharged from the cofferdam associated with the River Murray Intake is to be monitored and if necessary treated to ensure compliance with Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).
• All water discharges are to be consistent with s120 of the POEO Act.
• A directional drilling management plan is to be developed as part of the CEMP to detail the appropriate management of drilling slurry so as to avoid off site impacts. This is to include details for the management, treatment and disposal of drilling chemicals.
• Drilling fluids are to be contained within the fluid circulation system (ie mud tanks) during the directional drilling works.
• Drilling fluids are to be recycled where practicable or disposed of in accordance with the waste classification (EPA guidelines).

Operation
• Contractor is responsible for obtaining all necessary approvals and consents to discharge water during pipeline testing and commissioning.
• Pipe scouring and pigging procedures and management controls are to be documented in an operational management plan developed for the project.
• Effective and suitably-sized scour protection must be in place when actively releasing water from scour valves.
• During operation of the project, any water containing silt and sediment generated as a result of scouring pipelines would be treated (if required) and disposed of as appropriate. Depending on the resultant water quality, this is likely to involve discharge to land.
• Any water discharged to a waterway must be consistent with the requirements of the Protection of the Environment Operations Act 1997, specifically s120 in relation to water pollution.
• Work procedures including appropriate safeguards for all routine maintenance works are to be included in the Operations and Maintenance Manual for the system.
• The flood prone elements of the River Murray Intake are to be constructed above the 1 in 100 year flood level.
• All build infrastructure (such as that associated with the dosing plant and TPS sites) are to incorporate suitable drainage to prevent excessive scouring and run off.
• All equipment containing fluids / chemicals that have the potential to cause water pollution would be located within a concrete bunded area.
• Collection of contaminated water and rainwater within the bunded area and provision for connection of bunded water to the water treatment system is to be considered as part of the design.
• Ongoing inspection of watercourses and bank stability at the intake site during operation will be undertaken and remedial action will be initiated where required.

6.9 Terrestrial Flora and Fauna
A flora and fauna assessment of the proposed works has been undertaken by NGH Environmental (2017) (provided in Appendix C). The information for the following section is taken directly from this assessment.

The flora and fauna assessment involved initial literature review and database desktop assessment, and subsequent terrestrial field surveys and aquatic inspections comprised the following project area:
• River Murray intake site and Darling River underbore
• Proposed dosing plant and TPS1 site in Wentworth
- The pipeline route which was defined as the road reserve on both sides of the Silver City Highway located 10-15 m from the boundary fence and about 25-30 m from the road edge, from Wentworth to Broken Hill. The entire road reserve was surveyed.
- TPS2 and TPS3 along the pipeline route.

The vegetation present along the pipeline is dominated by a variety of Chenopod shrublands, with Black Bluebush low open shrubland the most common (NGH, 2017). On sandy hills and rises, Black Oak - Western Rosewood open woodland is common, particularly in the southern and central sections of the alignment. Mallee and Cypress pine communities are present on sandy rises to a lesser degree (NGH, 2017).

**Threatened Flora**

A total of 248 flora species were recorded during the flora surveys comprising 187 native and 61 exotic species. A list of all species recorded according to specific survey locations is provided in the Flora and Fauna Assessment (see Appendix D).

One threatened flora species was recorded during the field surveys of the project area. Purple-wood Wattle *Acacia carneorum* was identified within the Silver City Highway road reserve approximately 60 km south of Broken Hill. The majority of plants were observed within the western road reserve with additional groups of plants on the eastern side but to a lesser degree. Approximately 1500 individual stems were present however, as this species is clonal, the numbers of individuals are likely to be considerably less. This species was also recorded at the bulk water storage site. The distribution of this species within the project area was recorded and is provided in Figure 6-8 and Figure 6-9.

One additional threatened flora species; Yellow Swainson-pea *Swainsona pyrophila* is also considered to have the potential to occur within the study area given the suitability of habitat and its highly cryptic nature. This species generally only appears after fire and was not detected during targeted surveys. No recent records of the species has been recorded in the region with the most recent from 1976 and 1988 and over 50 km from the project area.

Based on a review of OEH’s Bionet database, two additional threatened flora species are considered to have the potential to occur within the study:

- Bluebush Daisy *Cratystylis conocephala*
- Menindee Nightshade *Solanum karsense*

However, none of the species were detected during the field survey. Based on the evaluation of the environmental and landscape features observed during the field inspection, these species are considered unlikely to occur within the project area due to a lack of suitable habitat.
Figure 6-8 Purple Wood Wattle location
Vegetation Communities

Twenty-five native vegetation communities were identified within the project area. The bulk of the vegetation was in moderate condition with some more highly disturbed areas exhibiting lower native diversity and a higher exotic component being in poor condition.
On the flat alluvial plains away from the watercourses, a variety of Chenopod shrublands were dominant with Black Bluebush low open shrubland the most common. On sandy hills and rises, Black Oak - Western Rosewood open woodland was common, particularly in the southern and central sections of the project area. Mallee and Cypress pine communities also occurred on sandy rises to a lesser degree.

The dominant vegetation types present along the waterways and floodplains within the project area include:

- River Red Gum - Lignum very tall open forest or woodland
- River Red Gum open woodland wetland
- Black Box low woodland wetland
- Black Box open woodland wetland with chenopod understorey

Endangered Ecological Communities

Two endangered ecological communities (EEC); the *Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions* (Sandhill Pine Woodland) and the *Acacia loderi* shrublands listed under the TSC Act were identified within the project area.

The *Acacia loderi* shrublands was identified in the vicinity of the bulk water storage, TPS2 (Option 3, chainage 194,000 m) and along a small section of the pipeline alignment (see Figure 6-10 and Figure 6-11)

Vegetation that could be considered to comprise Sandhill Pine Woodland EEC occurs within the Slender Cypress Pine – Sugarwood – Western Rosewood community within the project area. The area of occurrence is predominantly around the Popiltah Lake area, with a further small area also just to the east of Toora Lake. The community is not listed under the EPBC Act.
Figure 6-10 Acacia loderi EEC in the vicinity of the bulk water storage
Figure 6-11 Acacia loderi EEC (shown in orange) in the vicinity of the TPS2 (Option 3)
Threatened Fauna

Seventy-one (71) fauna species were detected during the field survey of the project area, including 54 birds, six (6) mammals, seven (7) reptiles and four (4) frog species. The frog species are assessed in section 6.10. A complete fauna species list is provided in Appendix C of the Flora and Fauna Assessment provided in Appendix D of this REF.

Three (3) threatened fauna species were recorded during the project area survey these being:

- Mitchell Cockatoo’s *Lophochroa lea dBeateri* listed as vulnerable (TSC Act)
- Hooded Robin *Melanodryas cucullate cucullate* listed as vulnerable (TSC Act)
- Redthroat *Pyrrholaemus brunneus* listed as vulnerable (TSC Act)

Based on the results of previous studies undertaken in the vicinity of the proposal site and the habitat evaluation, the following additional species also have the potential to occur within the project area:

**Birds**

- Bush Stone-curlew *Burhinus grallarius* – Endangered TSC Act
- Chestnut Quail-thrush *Cinclosoma castanotum* – Vulnerable TSC Act
- Varied Sittella *Daphoenositta chrysoptera* – Vulnerable TSC Act
- Malleefowl *Leipoa ocellata* – Endangered TSC Act, Vulnerable EPBC Act
- Barking Owl *Ninox connivens* – Vulnerable TSC Act
- Gilbert’s Whistler *Pachycephala inornata* – Vulnerable TSC Act

**Mammals**

- Bolam’s Mouse *Pseudomys bolami* – Endangered TSC Act
- Southern Ningaui *Ningaui yvonneae* – Vulnerable TSC Act
- Stripe-face Dunnart *Sminthopsis macroura* – Vulnerable TSC Act

**Bats**

- Corben’s Long-eared Bat *Nyctophilus corbeni* – Vulnerable TSC Act, Vulnerable EPBC Act
- Inland Forest Bat *Vespadelus baverstocki* – Vulnerable TSC Act
- Little Pied Bat *Chalinolobus picatus* – Vulnerable TSC Act
- Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* – Vulnerable TSC Act

**Reptiles**

- Mallee Worm-lizard *Aprasia inaurita* – Endangered TSC Act
- Mallee Slender Blue-tongue Lizard *Cyclodomorphus melanops elongatus* – Endangered TSC Act
- Marble-faced Delma *Delma australis* – Endangered TSC Act
- Yellow-tailed Plain Slider *Lerista xanthura* – Vulnerable TSC Act
- Crowned Gecko *Lucasium stenodactylum* – Vulnerable TSC Act
- Ringed Brown Snake *Pseudeonaja modesta* – Endangered TSC Act
- Jewelled gecko *Strophurus elderi* – Vulnerable TSC Act
A number of additional threatened species are also considered likely to occur within the project area from time to time however, given the nature of the proposal and the characteristics of the species (e.g. wide ranging, highly mobile etc.) these species are considered unlikely to be at risk of impact. A full list of species considered likely to occur is presented in Appendix B of the flora and fauna assessment (provided in Appendix D of this REF).

**Fauna Habitat**

The project area does not contain any areas that have been declared as critical habitat under the TSC Act or EPBC Act.

Overall, five main habitat types were identified across the project area, which are listed below:

- Riparian Woodland
- Open Black Oak – Western Rosewood – Cypress Pine Woodlands
- Mallee Woodland with Chenopod understorey
- Mallee Woodland with Spinifex
- Chenopod Shrubland

The above habitats include important habitat features for terrestrial fauna. Habitat features recorded during the survey are discussed below.

**Hollow-bearing Trees**

A total of 69 hollow-bearing trees were recorded during the field surveys of the project area, supporting an estimated 189 hollows.

Generally, hollow-bearing trees were commonly recorded within Black Box and River Red Gum communities along watercourses and in open woodland areas in the Popiltah Lake area.

The Mallee communities present along Darling River in the vicinity of the under bore site near Wentworth also supported numerous hollow-bearing trees.

Overall, the greatest density of hollow-bearing trees was identified in the vicinity of the Great Darling Anabranch crossing on the Silver City Highway within the Black Box Woodland which occurs in this area. Given the close proximity to an ephemeral water course, these hollow-bearing trees have been assessed as likely to provide habitat for a range of bird and mammal species.

The locations of recorded hollow-bearing trees within the project area have been mapped and recorded as part of Appendix C.3 of the Flora and Fauna Assessment (see Appendix D).

**Rocky outcrops and scattered surface rock**

Rocky outcrops and scattered surface rock can provide sheltering and refuge opportunities for a number of reptile species.
Rocky outcrops were generally uncommon across the project area as landscapes consisted of flat sandy or clay plains and low sandy rises with little surface or outcropping rock.

However, rock outcrops were identified at four locations within the project area, including:

- The Great Darling Anabranch crossing on the Silver City Highway
- Within Mallee woodland with Spinifex north of Coombah
- North-east portion of Block 10

**Koala Habitat**

There is one record for the Koala in the vicinity of the project area. The sighting occurred along the Darling River in 2006, approximately 6.5 km north of Wentworth and 1.2 km north of the project area. There are no records for the Koala further north within the project area.

One species of primary feed tree (River Red Gum) and one species of secondary feed tree (Black Box) was observed within the project area during the assessment field survey. One of the trees listed in Schedule 2 of SEPP 44 (River Red Gum) is present within the project area; as such, potential Koala habitat was therefore considered to occur.

**Wildlife Corridors**

The chenopod shrublands across the project area are generally well connected although in varying states of disturbance

The River Murray, Darling River, Great Darling Anabranch and Pine Creek in particular and associated riparian vegetation act as a natural well connected corridor for terrestrial and aquatic fauna, linking the habitats within the project area to areas of adjacent habitat.

Woodland vegetation away from the riparian corridors is generally fragmented or thinned as a result of past clearing for urban development and agriculture, or from natural topographical variation between woodland and shrub communities.

Areas of greater connectivity within the project area occurs across the Black Oak – Western Rosewood woodland in the vicinity of TPS 2, the Black Box low woodland around Coombah and the Spinifex linear dune mallee north of Coombah.

**EPBC Matters of National Environmental Significance**

No Endangered or Critically Endangered Ecological communities listed under the EPBC Act are known to occur within the project area.

Based on a review of the EPBC Act protected matters search tool, two fauna species listed under the EPBC Act are known or are considered to have the potential to occur within the project area and if present are considered to be at risk of impact:

- Malleefowl *Leipoa ocellata* – Vulnerable EPBC Act
- Corben’s Long-eared Bat *Nyctophilus corbeni* – Vulnerable EPBC Act

Three migratory species were identified from the EPBC database search, these include:
Grey Wagtail *Motacilla cinerea*

Yellow Wagtail *Motacilla flava*

Satin Flycatcher *Myiagra cyanoleuca*

However, based on the field survey it has been determined that these species are unlikely to occur within the project area due to a lack of suitable habitat and, as such, are not considered at risk of impact from the project.

### 6.9.1 Construction Impacts

#### Threatened Fauna Species

Several threatened terrestrial fauna species were either recorded during the survey or identified in the Flora and Fauna Assessment (see Appendix D) as having the potential to occur.

The majority of threatened bird species identified are highly mobile and, given the relatively small impacts of the project when considered for any immediate area and the fact that habitats extend beyond the project site, impacts are only likely for these species if they are nesting at the time of construction. These species generally nest from winter through spring and there is potential for impacts to these species if they are nesting at the time of construction. Hollow-dependent species such as the Barking Owl nest from winter through to spring.

Assessment of significance were undertaken for the following species:

- Hooded Robin
- Major Mitchell’s Cockatoo
- Red throat
- Ground dwelling mammals
  - Stripe-faced Dunnart
  - Bolams Mouse
  - Southern Ningaui
- Ground dwelling reptiles
  - Crowned Gecko
  - Mallee Worm-Lizard
  - Mallee Slender Blue-tongue Lizard
  - Marble-faced Delma
  - Yellow-tailed Plain Slider
  - Ringed Brown Snake
  - Jewelled Gecko
  - Western Blue-tongued Lizard
- Microbats
  - Inland Forest Bat
  - Yellow-bellied Sheathtail-bat
  - Corben’s Long-eared Bat
  - Little Pied Bat

The assessments concluded that there is unlikely to be a significant impact the above species as:
The project would not disrupt the lifecycle of the population such that it would be placed at risk of extinction.

The project would not notably fragment or isolate habitat for this species.

The habitat to be removed by the project is not considered important to the long-term survival of the species within each locality it occurs in.

Hollow-dependant bat species may be in torpor during winter and breed from spring through summer. Preclearance surveys have been recommended for all woodland habitats to determine if these species are present within the project site. If nesting birds are identified, then works would not proceed in those areas until the young have fledged. Given that the species are highly mobile and that there are extensive woodland habitats adjacent to the project site, if these measures are implemented then impacts are considered unlikely.

Hollow bearing tree removal would be managed by an ecologist in accordance with hollow-bearing tree removal protocols as recommended by the flora and fauna assessment. This would ensure any bat or nesting species would be detected and managed prior to tree removal. Provided appropriate hollow-bearing tree removal protocols are followed, then impacts to hollow dependent threatened species are unlikely given their highly mobile nature and relatively small areas of habitat to be removed.

There are a number of ground-dwelling threatened species that are Mallee – Spinifex specialists including:

- Chestnut Quail-thrush *Cincllosoma castanotum*
- Malleefowl *Leipoa ocellata*
- Southern Ningaui *Ningaui yvonneae*
- Mallee Worm-lizard *Aprasia inaurita*
- Mallee Slender Blue-tongue Lizard *Cyclodomorphus melanops elongatus*
- Marble-faced Delma *Delma australis*
- Yellow-tailed Plain Slider *Lerista xanthura*
- Jewelled gecko *Strophurus elderi*

Approximately 10.09 ha of Spinifex Linear Dune Mallee would be cleared by the proposal over a distance of approximately 10 km. Based on aerial imagery, existing vegetation mapping and observations made during the survey, there is over 10,000 ha of contiguous linear dune vegetation adjacent to the study area. As such, the removal of 10 ha over a relatively large area is unlikely to impact the identified ground dwelling threatened species in terms of habitat availability. However, given that these species use spinifex as shelter and refuge there is the potential for harm to individuals during clearing works if they are present. Controlled removal of Spinifex is recommended to prevent harm to individuals. Spinifex would be removed in such a way that any animals present can escape and move to adjacent habitats. An ecologist would be present during clearing and grubbing to relocate any animals if required. With the implementation of these measures, impacts to Spinifex dependant fauna would be largely avoided.

Bolam’s Mouse and Stripe-face Dunnart are burrowing species that may occur within Spinifex communities but also occur in a broad range of other habitat types. The habitat preferences for the Crowned Gecko are largely unknown and the Ringed Brown Snake also has broad habitat preferences. Given the relatively small impacts of the proposal and
the large areas of suitable similar habitats adjacent to the study area, habitat loss is unlikely to significantly impact on these species.

Mitigation measures have been proposed to specifically minimise impact to these species. These species have been assessed in for the likelihood of any impact from the project (see Appendix B of the flora and fauna assessment). Based on this assessment, impacts were considered to be negligible. Further assessment of these species is not necessary.

Preclearance surveys would identify any animals present within the project site and would allow for them to be relocated into adjacent habitats. With the implementation of the mitigation measures in Section 6.9.3, significant impacts to threatened fauna as a result of the project are considered unlikely.

**Threatened Flora Species**

One threatened flora species, Purple Wood Wattle would be impacted by the project. Approximately 0.71 ha of habitat and plants would be removed. The exact numbers of individuals which would be removed is uncertain as this species is clonal and propagates from suckering. This characteristic is likely to be beneficial in that the species will likely recolonise the area following construction. Numerous young stems were observed to be propagating in the more highly disturbed area adjacent to the road.

The layout of the bulk water storage and TPS would be refined during detailed design to avoid removing Purple-wood wattle and *Acacia loderi* EEC within these sites. Impacts to these species will however occur as part of the pipeline construction and as such the assessments of significance have been undertake to assess the potential impacts on Purple-wood wattle and *Acacia loderi* along the remainder of the corridor.

An Assessment of Significance pursuant to the TSC Act was carried out for this species on the basis of the worst case removal of 0.71ha of habitat. Approximately 30ha of habitat occupied by this species is estimated to occur to the west of the highway. The assessment concluded that a significant impact was unlikely on the basis that:

- The project would not disrupt the lifecycle of the population such that it would be placed at risk of extinction.
- Only a small area of habitat would be cleared (0.71ha) and at least 30ha of connected occupied habitat would remain and continue to support the species.
- The project would not notably fragment or isolate habitat for this species.
- It is considered likely that the species will recolonise the disturbed area following completion of the works.
- The project would not notably contribute to any KTP relevant to this species.

The Yellow Swainson-pea was identified as having the potential to occur in the project area. However, given that this species spends most of its time within the soil seed bank, potential impacts would be avoided provided mitigation measures are implemented. Careful removal and replacement of topsoil would maintain the soil seedbank and the ability of this species to germinate under suitable circumstances and this has been recommended for areas of suitable habitat (mallee woodlands). As such impacts to the Yellow Swainson-pea are considered to be negligible.
EPBC Matters of National Environmental Significance

The ecology report prepared by NGH Environmental (2017), and provided in Appendix D considers whether the project is likely to have a significant impact on matters of national environmental significance (including nationally threatened species and ecological communities and migratory species). The assessment has concluded that for a number of reasons including:

- a lack of suitable habitat,
- the highly mobile nature of the species,
- the relatively small impacts of the project when considered for any immediate area, and
- that habitats extend beyond the project site,

that the project is unlikely to have a significant impact and that a referral under the EPBC Act is not required. With the implementation of the safeguards and mitigation measures detailed in Section 6.9.3, no significant impacts to EPBC listed entities are anticipated.

Loss of Vegetation

The project area provides a range of habitats for threatened flora and fauna species.

The project would have a direct impact on vegetation within the project area through removal for construction. A total of approximately 916 ha would be removed by the proposal. This is considered to be a worst case scenario. Generally, there was a band of highly disturbed and often exotic dominated vegetation that extended up to 8 m from the road edge. It is likely that the disturbance footprint associated with access and pipeline installation would occur within this highly disturbed and modified vegetation.

Table 6-16 Quantity of vegetation impacts

<table>
<thead>
<tr>
<th>Vegetation type</th>
<th>EEC</th>
<th>Site impact areas (ha)</th>
<th>Total Area impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>River Murray Intake and Darling River underbore</td>
<td>Pipeline</td>
</tr>
<tr>
<td>Australian Boxthorn Open Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>6.35</td>
</tr>
<tr>
<td>Acacia loderi Shrubslands</td>
<td>Yes</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td>Black Bluebush Low Open Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>152.56</td>
</tr>
<tr>
<td>Black Box Grassy Open Woodland</td>
<td>No</td>
<td>0.00</td>
<td>35.88</td>
</tr>
<tr>
<td>Black Box Lignum Woodland</td>
<td>No</td>
<td>0.23</td>
<td>0.00</td>
</tr>
<tr>
<td>Black Box Low Woodland</td>
<td>No</td>
<td>0.00</td>
<td>1.46</td>
</tr>
<tr>
<td>Black Box Open Woodland with</td>
<td>No</td>
<td>0.00</td>
<td>22.28</td>
</tr>
<tr>
<td>Vegetation type</td>
<td>EEC</td>
<td>River Murray Intake and Darling River underbore</td>
<td>TPS and Bulk Water Storage</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----</td>
<td>------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Chenopod Understorey</td>
<td>No</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Black Oak Chenopod Open Woodland</td>
<td>No</td>
<td>20.41</td>
<td>0.00</td>
</tr>
<tr>
<td>Black Oak Western Rosewood Blubush/saltbush Low Sparse Woodland</td>
<td>No</td>
<td>0.00</td>
<td>116.53</td>
</tr>
<tr>
<td>Bladder Saltbush Shrubland On Alluvial Plains</td>
<td>No</td>
<td>0.00</td>
<td>163.57</td>
</tr>
<tr>
<td>Chenopod Sandplain Mallee Woodland/shrubland</td>
<td>No</td>
<td>0.00</td>
<td>13.89</td>
</tr>
<tr>
<td>Copperburr Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>1.97</td>
</tr>
<tr>
<td>Exotic Dominated</td>
<td>No</td>
<td>0.03</td>
<td>35.10</td>
</tr>
<tr>
<td>Lignum Shrubland</td>
<td>No</td>
<td>0.02</td>
<td>0.00</td>
</tr>
<tr>
<td>Linear Dune Mallee</td>
<td>No</td>
<td>0.00</td>
<td>25.43</td>
</tr>
<tr>
<td>Low Bluebush Bladder Saltbush Open Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>18.62</td>
</tr>
<tr>
<td>Mixed Chenopod Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>52.47</td>
</tr>
<tr>
<td>Mulga Dead Finish</td>
<td>No</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Mulga on Stony Rises</td>
<td>No</td>
<td>0.00</td>
<td>2.44</td>
</tr>
<tr>
<td>Narrow-leaved Hopbush - Scrub Turpentine - Senna shrubland</td>
<td>No</td>
<td>0.00</td>
<td>16.45</td>
</tr>
<tr>
<td>Old Man Saltbush Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>1.23</td>
</tr>
<tr>
<td>Pearl Bluebush Low Open Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>8.47</td>
</tr>
<tr>
<td>Prickly Wattle Open Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>25.96</td>
</tr>
<tr>
<td>Purple-wood Wattle Shrubland</td>
<td>No</td>
<td>0.00</td>
<td>0.71</td>
</tr>
<tr>
<td>River Red Gum - Lignum Open Woodland</td>
<td>No</td>
<td>0.47</td>
<td>0.15</td>
</tr>
</tbody>
</table>
### Vegetation Type Impact Areas

<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>EEC</th>
<th>River Murray Intake and Darling River underbore</th>
<th>Pipeline</th>
<th>TPS and Bulk Water Storage</th>
<th>Total Area impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Red Gum Open Woodland</td>
<td>No</td>
<td>0.00</td>
<td>0.58</td>
<td>0.00</td>
<td>0.69</td>
</tr>
<tr>
<td>Slender Cypress Pine - Sugarwood</td>
<td>Yes</td>
<td>0.00</td>
<td>16.00</td>
<td>0.00</td>
<td>16</td>
</tr>
<tr>
<td>Sugarwood Open Woodland</td>
<td>No</td>
<td>0.00</td>
<td>6.73</td>
<td>0.00</td>
<td>6.73</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>0.75</td>
<td>680.71</td>
<td>234.01</td>
<td>916.05</td>
</tr>
</tbody>
</table>

### Fauna Habitats

A range of birds, bats, mammals and reptiles are expected to utilise the habitats present within the project area. Impacts to these species are considered to be manageable with the implementation of specific safeguards provided below in Section 6.9.3.

Nesting bird species that are known or likely to occur within the project area may utilise the woodland habitats. These species generally nest from winter through spring and there is potential for impacts to these species if they are nesting at the time of construction. Given that the species are highly mobile and that there are extensive woodland habitats adjacent to the project site, if these measures are implemented then significant impacts are considered unlikely.

There are a number of ground-dwelling threatened species that are Mallee – Spinifex specialists. Approximately 10.09 ha of Spinifex Linear Dune Mallee would be cleared by the proposal over a distance of approximately 10 km. Based on aerial imagery, existing vegetation mapping and observations made during the survey, there is over 10,000 ha of contiguous linear dune vegetation adjacent to the project area. As such, the removal of 10 ha over a relatively large area is unlikely to impact these species in terms of habitat availability. However, given that these species use spinifex as shelter and refuge there is the potential for harm to individuals during clearing works. With the implementation of mitigation measures included in Section 6.9.3, impacts to Spinifex dependent fauna would be minimised.

### Koala Habitat

The ‘Koala habitat assessment tool’ was used to determining if the project would impact on habitat critical to the survival of the Koala as part of the Flora and Fauna assessment. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala.

The assessment resulted in a score of 4 and as such habitat within the project area was not considered to be critical to the survival of the Koala, and an assessment of significant impact according to the EPBC Act significant impact criteria is not required.
EPBC Matters of National Environmental Significance

Potential impacts to the Malleefowl *Leipoa ocellata* and Corben’s Long-eared Bat, *Nyctophilus corbeni* which are listed threatened species under the EPBC Act, are considered manageable with the implementation of recommended mitigation measures included in Section 6.9.3. With the implementation of these measures, no impacts to EPBC listed entities are anticipated.

As it is considered unlikely that a significant impact would occur, a referral under the EPBC Act is not considered to be required.

Endangered Ecological Communities

The project would impact approximately 6.36 ha of Sandhill Pine Woodland vegetation community which is listed as an EEC under the NSW TSC Act. This community is present as four separate local occurrences within the project area (refer to Appendix 1.2 of the Flora and Fauna Assessment). The project would impact on worst case 0.77% of the local occurrence of this community.

There are approximately 36.3 ha of *Acacia loderi* shrubland EEC that occur within the project area. This community occurred in two separate locations which represents two separate local occurrences of the community. Approximately 6.3 ha occurs in the vicinity of the Bulk Water Storage Site and roadside and a further 30 ha occurs surrounding the TPS2. Surrounding the Bulk Water storage site, 0.3 ha would be impacted along the roadside within the pipeline alignment. The design of the Bulk Water Storage Site has avoided the patches of *Acacia loderi* shrubland. The project would result in an impact of 4.76% of the local occurrence of this community (see Figure 6-10 and Figure 6-11).

Surrounding TPS2 (option 3, Chainage 193000), 26.55 ha of *Acacia loderi* Shrubland EEC occurs. Following the positive identification of the community at this location, the proposed TPS2 was moved south. Whilst this location was not surveyed, an assessment of vegetation at the site was made using aerial photography and knowledge of the adjacent vegetation communities. Based on this desktop assessment, it was estimated up to 4 ha of *Acacia loderi* shrubland could occur in this area and be impacted by the proposal. Based on this assumption, 13% of the local occurrence of the community could be impacted. This is a worst case scenario and patches of *Acacia loderi* shrubland could be significantly less, interspersed between Black Oak (*Casuarina pauper*) and Rosewood.

Impacts to each local occurrence are documented in Table 6-17 below.

**Table 6-17 Local occurrence of *Acacia loderi* Shrubland EEC**

<table>
<thead>
<tr>
<th>Patch No.</th>
<th>Total extent (ha)</th>
<th>Area to be impacted (ha)</th>
<th>Percentage of extent to be impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.3</td>
<td>0.3</td>
<td>4.76%</td>
</tr>
<tr>
<td>2</td>
<td>30.55</td>
<td>4.0</td>
<td>13.09%</td>
</tr>
</tbody>
</table>

An Assessment of Significance was undertaken as part of the Flora and Fauna assessment for the Sandhill Pine Woodland EEC and *Acacia loderi* Shrublands EEC which are listed under the TSC Act, as these EEC’s would be impacted by the proposal.
The assessments concluded that a significant impact on the two EEC’s is unlikely to occur as a result of the project.

Key Threatening Processes (KTPs)

Given the relatively small scope of works and the mitigation measures that would be implemented (see Section 6.9.3 below); the Flora and Fauna assessment concluded that the project is not considered to contribute substantially to any KTP listed under the TSC Act or EPBC Act.

A range of mitigation and management measures have been recommended in the Flora and Fauna Assessment to prevent the unnecessary loss of vegetation and habitat, and to minimise impacts of the project.

In general, they include the establishment of exclusion zones, staged habitat removal for hollow-bearing trees, rehabilitation, sedimentation and pollution control, and the prevention of weed and disease establishment and spread.

Specific mitigation measures have been provided below in Section 6.9.3 for threatened species and endangered ecological communities identified with the project area to mitigate against KTPs; these safeguards are important in mitigating against significant impacts to these entities.

Hollow-bearing Trees

A total of 17 of the hollow-bearing trees recorded during the survey would be removed by the project. The hollow-bearing tree surveys were opportunistic and there would be additional hollow-bearing trees that would be impacted by the project that were not identified during the survey. All hollow-bearing trees within the project site should be accurately mapped and identified prior to construction to facilitate the implementation of other measures to protect threatened species.

Generally, vegetation within which hollow-bearing trees were recorded, extended beyond the project area and it is likely that this vegetation supports hollow-bearing trees at a similar density to those recorded within the project area. As such, no significant impact resulting from the removal of the hollow bearing trees for the proposal is anticipated.

Wildlife Connectivity

The locations of the proposed infrastructure are generally all within areas that have been subject to past clearing and fragmentation. This includes the River Murray Intake located within an existing recreation reserve, dosing plant located within an existing disturbed and urbanised area, the transfer pumping stations (TPS1 and TPS3) and the pipeline located adjacent to a major highway.

The exception is TPS2 (Option 1), which occurs within an area of mostly continuous woodland. Clearing in this area would result some fragmentation. However, connectivity would be maintained through the areas surrounding the proposal site.

Overall, given the relatively small areas to be impacted by the works and the existing environment they occur in, the project is unlikely to cause further isolation or fragmentation of habitat.
Weeds

Five priority weed species listed for the Unincorporated (Far West Region) and Wentworth LGAs, were detected within the study area:

- African Boxthorn *Lycium ferocissimum*
- Bridal Creeper *Asparagus asparagoides*
- *Cylindropuntia* sp.
- Mesquite *Prosopis velutina*
- Mexican Poppy *Argemone ochroleuca*.

Risk of spread may occur during vegetation removal and movement of machinery during both construction and operation. Appropriate mitigation measures have been recommended to control existing infestations and risk of spread into adjacent areas (see Section 6.9.3). Each species requires particular treatment to be successfully managed and advice should be sought before removal. All priority weeds would be treated according to both the requirements of the *Biosecurity Act 2015* and the relevant local control authority. With these measures in place the potential impacts associated with weed introduction and spread are considered manageable.

6.9.2 Operational Impacts

Release of water from the pipeline for maintenance purposes at controlled discharge valves along the pipe has the potential to cause scouring and sedimentation if water is released onto surrounding land. Rock armouring of release points would be required to prevent this; and accordingly has been included in Section 6.9.3 as a mitigation measure.

6.9.3 Mitigation Measures

- All areas of known threatened flora or EEC are to be mapped and included in the CEMP. The contractor would consider opportunities to avoid impacts on these areas where practicable.
- A clearing and grubbing protocol would be included in the CEMP. This would include best practice methods for the removal of woody and non-woody vegetation. Woody vegetation removed for the works <600mm in diameter is to be mulched/chipped and used as ground cover. Larger timber should be placed in the general area as scattered course woody debris.
- All workers would be made aware of known and potential threatened flora and fauna during works and understand the procedures if threatened flora and fauna are detected.
- Where Purple Wood Wattle *Acacia carneorum* and *Acacia loderi* shrubland EEC occurs along the pipeline route, the footprint of works would be minimised to a 10 m corridor. Vehicles, equipment and machinery movements would be minimised and no equipment, vehicle or material storage would occur in this area.
- Topsoil removed would be stored in stockpiles or windrows less than 1m in height, particularly within the area of *Acacia loderi*, Purple-wood Wattle Shrubland and Spinifex Linear Dune Mallee woodland. Topsoil would be spread over the adjacent disturbed areas as soon as possible.
- The current hydrological flows of the unnamed creeks in the Bulk Water Storage Site at Chainage 249,000 would be maintained to avoid impacts to the *Acacia loderi* EEC and Purple Wood Wattle surrounding the Bulk Water Storage Site.

- Surveys to mark the extent of *Acacia loderi* shrubland EEC within the Transfer Pump Station 2 (option 3) should be undertaken before works commence. Impacts to *Acacia loderi* shrubland EEC should be minimized and avoided where possible. Opportunities to move the construction footprint further south would reduce the impacts to the *Acacia loderi* Shrubland EEC.

- Pre-clearance surveys of woodland areas by an ecologist for nesting threatened birds would occur prior to any clearing works during winter and spring.

- Nesting threatened birds identified within the works area, works would be managed in accordance with the onsite ecologist’s advice. Avoidance of impact would be a priority.

- Pre-clearance surveys by an ecologist would occur in all works areas prior clearing and topsoil stripping to relocate any ground dwelling fauna. Burrows that may be occupied by native fauna would be identified.

- Any burrows identified during pre-clearance surveys would be carefully excavated by an ecologist to recover fauna occupying the burrow.

- Within the Spinifex Linear Dune Mallee community, Spinifex would be relocated from the works area so as to protect any fauna within the spinifex. Spinifex relocation would be planned and supervised by an ecologist.

- Trenches and pits would be filled/closed as soon as possible after creation. If they are required to be left open, measures would be undertaken to ensure fauna would not be trapped in the pits overnight. This may be achieved by placing escape ramps into pits or by covering the pit if practical. The trench/pit would be inspected each morning prior to the commencement of works for trapped fauna.

- Prior to the commencement of clearing and topsoil stripping the limits of impact would be clearly marked using temporary flagging tape, or pegs.

- Trees to be retained would be protected by a buffer zone during works in the immediate area, in line with AS 2009 4970.

- Trees must be removed causing minimal damage to surrounding vegetation. This would ensure groundcover disturbance would be kept to a minimum.

- Prior to construction, a hollow-bearing tree survey would occur along the impact area.

- Removal of hollow-bearing trees would be managed by an ecologist and would follow a pre-clearing process and staged habitat removal approach as described in the *Hollow-bearing Tree Removal Protocol* included as Appendix E of the Flora and Fauna Assessment.

- Declared noxious weeds would be managed according to the requirements stipulated by the local control authority and recommendations made by the Noxious and Environmental Weed HandBook (DPI, 2014), which contains details as to the management of specific noxious weeds.
• Pre-construction and regular targeted control of noxious and environmental weeds would take place to manage noxious weeds, woody weeds and exotic perennial grasses within the proposal site.

• Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be cleaned prior to entering the work site if the machinery is used off the hard stand or road areas and prior to leaving the site if operating in areas containing noxious weeds.

• All plant material containing seed heads, weeds that contain toxins, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.

• Weed-free fill would be used for on-site earthworks.

• All herbicides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application should be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.

• Permanent access points constructed along the pipeline would be used for operational maintenance activities.

• Any fallen timber, dead wood and bush rock encountered in the impact area would be relocated to a suitable place nearby (a suitable place would be deemed as an area with similar characteristics as to where the log/dead wood/rock was originally located). These items would not be placed on top of existing habitat features.

• A site stabilisation and weed management plan would be prepared for the works. The plan would identify native flora species endemic to the area that could be used for site stability and habitat rehabilitation.

• Revegetation and any landscaping is to be timed to take advantage of natural rainfall and not be dependent on hand water where practicable.

6.10 Aquatic Flora and Fauna

Threatened Aquatic Fauna

Two threatened fish and one threatened crustacean species listed under the Fisheries Management Act 1991 (FM Act) were identified the flora and fauna assessment as having the potential to occur within the project area, including:

• Murray Cod - Known to occur at the proposed intake locations.

• Silver perch - Mapped distribution identifies it as occurring within the Murray and Darling River throughout the project area.

• Murray Crayfish - Mapped distribution identifies it as potentially occurring within the River Murray at intake in Wentworth.

Two further species that are part of endangered populations listed under the FM Act were also identified as overlapping with the project area.

• Murray-Darling Basin population of Eel-tailed Catfish - Mapped distribution identifies it as occurring within the River Murray at the intake locations.
Olive Perchlet - Mapped distribution identifies it as potentially occurring within the Darling River Anabranch along the pipeline route.

As targeted surveys were not undertaken for these fish species during the field survey, they are assumed to occur within their mapped distributions within the project area.

Two threatened amphibian species were identified as having the potential to occur within the project area:

- Southern Bell Frog (*Litoria raniformis*)
- Painted Burrowing Frog (*Neobatrachus pictus*)

There is one record for the Painted Burrowing Frog within the Silver City Road Reserve from 2009. It was therefore (based on the desktop assessment) considered highly likely that this species could occur within the project area. As such targeted amphibian surveys were undertaken at several locations along the proposed pipeline including:

- Greater Darling Anabranch
- Lake Popiltah
- 20km north of Lake Popiltah
- 42km south of Broken Hill near Pine Creek.
- 33 km south of Broken Hill near Pine Creek.

The surveys were conducted over three consecutive nights to detect the potential presence of the Painted Burrowing Frog (*Neobatrachus pictus*) which was identified through the desktop assessment as being previously recorded within the project area. These surveys occurred immediately after a substantial rainfall event of 27 mm (as recorded by survey personnel in the vicinity of Lake Popiltah) on 21 September 2016.

The day following the rainfall event, suitable ephemeral pools that had formed were mapped using a GPS enabled tablet running GIS Pro. For the following three consecutive nights, at each suitable ephemeral pond, the following methodology was employed:

- A 10 - 15 minute listening period to detect calling frogs incorporating call playback.
- A nocturnal search using spotlights along the ephemeral ponds by two ecologists.

At select pools with high frog activity dip netting was conducted to catch and record the physical characteristics of the frog species present within the pond. Bioacoustic recording was also undertaken in the vicinity of a known record over two nights. Recordings were programmed for two hours at dawn and dusk. Results were analysed using Raven Lite sound analysis software (Cornell Lab of Ornithology).

The survey approach is consistent with the recovery plan for the species (Molsher 2000) which states that the species “is usually encountered when breeding, although individuals are often active on moist evenings and have been observed on roads and around swamps. Breeding only occurs after heavy rain usually > 25mm in 24 hours) and probably at all times of the year. Breeding has been observed in late summer, early autumn, throughout winter and in early spring and usually occurs in shallow ephemeral pools.”

The extensive targeted survey did not detect this species within the project area, although numerous individuals of the Common Spadefoot Frog were detected in a number of
locations through call, observing frogs in the water and capturing individuals. Although this species was not recorded in the surveys, it has been recorded in the project area and is assumed to be present.

Numerous records have been recorded for the Southern Bell Frog along the River Murray and it is possible that this species could occur at the River Murray Intake site. No targeted surveys were conducted for this species, and for the purposes of the assessment it is assumed to occur at the intake site.

**Aquatic Endangered Ecological Communities**

Two aquatic EECs listed under the TSC Act occur within the project area:

- Lowland Darling River Aquatic Ecological Community
- Lower River Murray Aquatic Ecological Community

The lower River Murray endangered ecological community includes all native fish and aquatic invertebrates within all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the River Murray downstream of Hume Weir. As such the proposed River Murray Intake occurs within this community.

The lowland Darling River EEC community includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranchs, the anabranches, and the floodplains of the Darling River within the State of New South Wales, and including Menindee Lakes and the Barwon River. The proposed pipeline would cross the Darling River and the Great Darling Anabranch and its associated floodplains; as such, this EEC has the potential to occur within the project area.

**Aquatic Habitat**

**River Murray Intake, Tuckers Creek and Darling River Underbore**

The River Murray Intake site and Darling River underbores are located approximately 1 km upstream of the confluence of the Darling and River Murrays. In this location, the town of Wentworth lies on the bank of the Darling River and both rivers are heavily utilised for recreation.

A narrow band (approximately 20m wide) of River Red Gum - Lignum very tall open forest occupies the foreshore and upper bank at the pumping station intake area. This area is subject to heavy recreational use such as recreational boating and water-skiing and, as such, much of the fringing riparian vegetation is disturbed. Along the water's edge, a patchy narrow band (approximately 1-2 m wide) of Common Reed (*Phragmites australis*) and *Azolla pinnata* occurs.

The vegetation at the underbore sites for the Tuckers Creek crossing in Wentworth comprises a thin band of River Red Gum Forest on the norther and western banks. The riverbanks consist of mature River Red Gums and Phragmites and scattered shrubs of River Cooba, Lignum and Western Boobialla. Some fallen woody debris is present along the banks and within the stream. Approximately ten metres back from the banks the vegetation transitions to Black Box Woodland. On the north side the vegetation is structurally diverse with abundant Black Box (*Eucalyptus largiflorens*) and shrubs of Lignum (*Duma florulenta*), Saltbushes (*Atriplex semibaccata*, *enchytaena tomentosa* and
rhaghodia spinescens). On the southern side the vegetation has been heavily degraded through previous clearing, cropping and irrigation. Some scattered Black Box remains and a sparse understory of chenopod species.

The underbore sites for the Darling River crossing in Wentworth consists of a thin strip of River Red Gum Forest on the Northern and Southern banks. Mature River Red Gums (Eucalyptus camaldulensis) and Common Reed (Phragmites australis) are present on the river banks. The riverbanks are highly disturbed with little understory vegetation but some shrubs of River Cooba (Acacia salicina) and saltbushes (Rhaghodia spinescens, Enchylaena tomentosa, Atriplex lindeyi) are present. Ten metres back from these river banks, vegetation is highly disturbed from grazing and farming activities and very little ground cover remains.

Within the study area both the River Murray and Darling River had low bank heights and gradients and were observed to be slow flowing and turbid. At the Intake site the River Murray is approximately 160m wide and the Darling River, 80m. There was no evidence of active erosion of the clay-loam substrate. The waterways within the study area comprise slow moving, deep runs with no pools or ripples evident. Both waterways are permanent with an average flow rate of 14,463 ML/day (considering all daily flows over the past five years) downstream of the confluence of these waterways.

No snags or other structures were observable above the surface.

Both the River Murray at the Intake site and the Darling River at the underbore site are Class 1 Waterways – Major Fish Habitat. Both waterways are also mapped as Key Fish Habitat (KFH) on the NSW DPI KFH mapping. As such, the waterways are expected to provide habitat for a range of aquatic species including fish, crustaceans and macro and micro-invertebrates. However, no important habitat features such as refuge areas (e.g. adjacent wetlands, upstream pools), spawning areas (e.g. gravel beds, snags, reed beds) were observed. There were no natural or artificial barriers to fish passage upstream and downstream (e.g. waterfalls, cascades, weirs, dams, floodgates, road crossings) within or in the vicinity of the study area.

**Pipeline route**

The only permanent waterways along the pipeline route are Tuckers Creek and the Darling River (both of which will be under bored). Several ephemeral waterways occur (See Figure 6-6), with the most major being the Great Darling Anabranch (approximately 65 km north of Wentworth) and Pine Creek (approximately 45 km south of Broken Hill). The eastern bank of the Great Darling Anabranch is heavily utilised as a camping area and surrounding areas are generally utilised for sheep or cattle grazing.

Vegetation along the banks of the Great Darling Anabranch is comprised of a modified Black Box open woodland wetland with chenopod understorey community while vegetation within the channel almost entirely comprises exotic terrestrial species. Permanent fringing or instream aquatic vegetation is absent, vegetation and structures that would form snags or other important habitat features is absent and no natural or artificial barriers to fish passage are present in the vicinity, upstream and downstream of the site.

The Great Darling Anabranch within the project area is classed as a Class 1 Waterway – Major Fish Habitat (in accordance with DPI Fisheries stream order and classification
guidelines), as it is a major named waterway and provides habitat for threatened species. It connects a number of large ephemeral lakes to the north of the project area (and ultimately the Darling River), to the River Murray to the south west of Wentworth. When flowing, it is likely to provide habitat and passage for a range of fish species. It is mapped as key fish habitat on the DPI Fisheries key fish habitat mapping.

Vegetation along the banks of Pine Creek comprises River Red Gum open woodland wetland, with the sandy creek bed largely unvegetated. Permanent fringing or instream aquatic vegetation is absent. Within the project area, Pine Creek is a Class 3 – Minimal Fish Habitat waterway. It is not mapped as key fish habitat on the DPI Fisheries key fish habitat mapping.

Several other minor ephemeral waterways occur within the project area:

- Two Mile Break
- Four Mile Creek (two separate crossings)
- Tingha Creek
- Coombah Creek
- Kelly’s Creek

These waterways have road bridges but are generally dry, and would only flow after heavy or prolonged rainfall events. Generally, the vegetation within these waterways is consistent with the surrounding vegetation types. They are shallow, low banked waterways that are mostly well vegetated and stable. Surrounding land use in the vicinity of the ephemeral waterways along the pipeline route is generally sheep or cattle grazing land.

**Ephemeral Pools**

Eighteen (18) ephemeral pools which could potentially provide breeding habitat for amphibian species were identified during the field survey of the project area, after a rainfall event. Despite targeted surveys for the Painted Burrowing Frog (*Neobatrachus pictus*) it was not detected in the field.

These pools had generally formed within excavated table-drains or diversions from culverts and in naturally low lying areas. The locations of the ephemeral pools have been mapped and their locations are provided in the Flora and Fauna Assessment (see Appendix D).

Fauna surveys were undertaken at each of the pool sites to assess for the presence of amphibians. The Common Spadefoot Frog (*Neobatrachus sudelli*) was heard or observed in 6 of the 18 ponds. This amphibian species is not listed as threatened under the TSC Act or EPBC Act. No threatened amphibian species were heard or observed at any of the pond sites.

**6.10.1 Construction Impacts**

The River Murray, Darling River and Great Darling Anabranch provide habitat for a variety of threatened fish and other aquatic species which are likely to occur within the project area.
A range of aquatic impacts are likely to, or may occur as a result of the project including clearing of riparian habitats, sedimentation and pollution, water extraction and entrainment of fish.

**Threatened Aquatic Fauna**

There is potential for the Southern Bell Frog (*Litoria raniformis*) to occur within fringing riparian vegetation at the River Murray Intake site. The quantity of habitat to be removed is considered negligible in the context of adjacent similar habitat.

An assessment of significance was undertaken for the Southern Bell Frog and the Painted Burrowing Frog. The assessment concluded that there is unlikely to be a significant impact on these species as:

- The project would not disrupt the lifecycle of the population such that it would be placed at risk of extinction.
- The project would not notably fragment or isolate habitat for this species.
- The habitat to be removed by the project is not considered important to the long-term survival of the community within each locality it occurs in.

Recommendations for preclearance surveys are included in Section 6.10.3 of this report. With the implementation of this safeguard, impacts to the Southern Bell frog and Painted Burrowing Frog are unlikely.

**Endangered Ecological Communities**

Darling River EEC which is listed under the TSC Act is located in the project area. Approximately 0.83 ha of floodplain woodland that is part of this community would be impacted by the project. No impacts to the aquatic component of this community are considered likely because the Darling River would be underbored.

An assessment of significance was undertaken for the Darling River EEC. The assessment concluded that a significant impact on the EEC is unlikely as a result of the project.

**Obstruction of fish passage**

The project would not result in the obstruction of fish passage within the River Murray as works would only be conducted in close proximity to the bank leaving the vast majority of the water way unaffected, and works would not occur within ephemeral waterways prior to or during predicted flow events.

However, the final formation of trenches across ephemeral waterways would be designed to match the existing channel morphology and would not present an obstruction to the passage of fish during flow events.

**Aquatic Habitat**

**Clearing of riparian habitats**

The clearing of riparian habitats that provide habitat for aquatic species will be minimal. Some clearing of fringing common reed may occur at the River Murray Intake site but this is likely to be less than 12m². The clearing of riparian habitats that provide habitat for aquatic species will therefore be minimal.
Direct impacts would occur to vegetation on the floodplain of the Darling River and the Great Darling Anabranch during construction. Small areas of disturbed Black Box woodland would be removed (0.23 ha) for the eastern underbore pad and pipeline from the River Murray Intake. Approximately 0.6 ha of disturbed Black Box woodland on the floodplain of the Great Darling Anabranch would be impacted.

**Sedimentation and pollution**

Works on the banks of the River Murray and the installation of instream structures has the potential to cause sedimentation and pollution of the waterway. Excavations and vegetation removal and instream works would be required that have a high potential to raise turbidity levels and create sedimentation of downstream aquatic habitats.

There is also potential for the mobilisation of sediments and pollutants within ephemeral waterways if works are conducted during or immediately prior to flow events.

The secondary impacts from construction on the banks immediately adjacent to the river introduces risk of aquatic impact, primarily from runoff during storm events and risk of spill of potential contaminants from the construction site.

There is also potential for the mobilisation of sediments and pollutants within ephemeral waterways if works are conducted during or immediately prior to flow events.

These risks are however, considered manageable. Measures are recommended in Section 6.10.3 of this report to minimise the potential for sedimentation or pollution of waterways.

**Pests and pathogens**

There is the potential for pathogens to be introduced or spread during the proposed construction works through the importation and use of contaminated equipment or machinery. As a precautionary approach, the proposed works would implement basic hygiene protocols to prevent the introduction or spread of pathogens as recommended in Section 6.10.3. These measures would adequately manage the potential for these impacts.

6.10.2 Operational Impacts

**Entrainment of fish**

During operation, there is the potential for impacts to aquatic species due to the risk of entrainment and impingement of aquatic species at the intake within the River Murray.

The extraction of large volumes of water creates negative pressure and flows that can pull debris and other aquatic objects such as fish, juveniles, eggs and tadpoles towards the source of extraction. Without proper protection of the extraction infrastructure, there is the potential for fish, including threatened species, to be entrained or trapped within the intake leading to injury and/or death.

This REF has been prepared on the basis that the intake screen has an aperture of 3 mm and an approach velocity to the screen of less than 0.1 m/sec to minimise the risk entrainment and impingement of debris and aquatic fauna. This approach has been discussed and agreed with DPI Fisheries.
**Aquatic Habitat**

**Aquatic Endangered Ecological Communities**

The proposal would involve the installation of infrastructure and water extraction within the Lower River Murray EEC. The community includes native fish and aquatic invertebrates within the River Murray. The impacts to this community would be managed by implementing the recommendations in Section 6.10.3, and this would ensure that there are no significant long-term impacts.

The Darling River EEC includes all native fish and aquatic invertebrates within all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River.

The project would not impact on the aquatic environment as the pipeline would be thrust-bored under the Darling River at Wentworth, and works would not be undertaken during periods of flow within the channel of the Great Darling Anabranch River.

Given that floodplain vegetation that is part of this community would be impacted, an Assessment of significance was undertaken for this community as part of the Flora and Fauna assessment. This assessment concluded that a significant impact is unlikely due to the project.

**Matters of National Environmental Significance**

Three wetlands of international importance (Banrock Station, Riverland, The Coorong) are located downstream of the River Murray in South Australia. No impacts to these wetlands are predicted due to the operation of the project.

**Water extraction**

The Broken Hill region requires access to approximately 10 GL of water annually for water supply purposes. This water is predominately supplied from the Darling River and Menindee Lakes scheme. Anticipated extraction rates from the new River Murray intake are detailed in Table 5-4. The extraction of 34.7 ML/day represents approximately 0.3% of existing River Murray cap to meet human water use needs. The abstraction of this volume of water from the River Murray is unlikely to have any notable effect on the volume of water available to aquatic species and communities.

6.10.3 Mitigation Measures

**Pre-Construction**

- The River Murray Intake would be designed with aperture screens of 3mm and to ensure approach velocities of no more than 0.1m/s at the intake screens.

- The Contractor is to finalise the design for the intake in consultation with DPI Fisheries.

**Construction**

- In order to minimise sedimentation, fill or excavated material must not be stockpiled in flood prone areas. Particular care should be taken in siting stockpiles and dumps.
Sites should be situated be secure from a 1 in 10 year flood level and have effective sediment control works to contain any runoff.

- Soil and Water Management Plans would be prepared and the controls put in place prior to construction to minimise potential water quality impacts during construction. The design of the controls where works are occurring on the river bank immediately adjacent to the river would be sensitive to flow impacts. The use of in stream erosion measures would be considered to minimise potential downstream impacts, particularly during instream works and works on the river banks.
- Any aquatic fauna contained within the cofferdam are to be translocated prior to or during dewatering.
- All debris created by the works would be fully contained and disposed of appropriately.
- Preclearance surveys of riparian habitat at the proposed intake would occur prior to the removal of riparian vegetation.
- Any amphibian species detected within the works area would be relocated to nearby suitable habitat.
- Ephemeral waterways work would be programmed to avoid rainfall events >20 mm.
- Works would not occur within ephemeral waterways when inundated.
- Follow appropriate hygiene protocols for the control of disease in frogs (Outlined in NPWS 2008), particularly with regards to vehicles entering and exiting aquatic habitats within the proposal area.
- Removal of instream habitat structures such as boulders, vegetation and large woody debris (if encountered) should be avoided where possible. Such features should be relocated within 100 m of where they were found. Relocation of large woody debris would be undertaken in consultation with DPI Fisheries.
- The construction and access footprint would be minimised (particularly on the river banks and bed) and demarcated on the ground. Areas outside of the construction access footprint would be identified as no-go areas and this would be communicated to all staff during site induction.
- Observed fish or crustacean deaths as a result of the work would be managed in accordance with the biodiversity management plan (or similar) for the works.

**Operation**

- Rock armouring at discharge valves along the pipeline is to be installed and maintained (routinely inspected) to prevent erosion during controlled releases of water for maintenance.

**6.11 Aboriginal Archaeology**

An Aboriginal Cultural Heritage Assessment (ACHA) is being undertaken for the proposal by Niche Environment and Heritage (Niche, 2017) to assess the potential for the project to harm Aboriginal objects, values and places, in accordance with current best practice and informed by the Aboriginal community. Given the extent of the project, and in order to facilitate a timely start to construction works, it was decided to submit AHIP applications to...
manage and mitigate harm to Aboriginal objects for the construction of the project in the following four stages:

- **Stage 1** - Broken Hill to Pine Creek – draft ACHA complete and AHIP application to be submitted to OEH in early November 2017,
- **Stage 2A** - Wentworth to Anabranch – draft ACHA currently being prepared and AHIP application to be submitted to OEH in mid November 2017,
- **Stage 2B** - Anabranch to Coombah – draft ACHA being prepared and AHIP application to be submitted to OEH in early 2018,
- **Stage 2C** - Coombah to Pine Creek – draft ACHA being prepared and AHIP application to be submitted to OEH in early 2018,

The ACHAs are being prepared in accordance with the following regulations and guidelines:

- *Aboriginal cultural heritage consultation requirements for proponents 2010 (ACHCRs)* (NSW Department of Environment, Climate Change and Water (DECCW), 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c);
- *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (NSW Office of Environment and Heritage (OEH), 2011);
- *Applying for an Aboriginal Heritage Impact Permit: Guide for applicants* (OEH 2011)
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013);

An extensive program of test excavations has been undertaken to inform each of the ACHAs. At the time of drafting this REF, test pitting had been completed for all stages, and the archaeological report for Stage 1 had been complete. The following section on Aboriginal archaeology is based on the information available at the time of drafting for Stage 1.

### 6.11.1 AHIMS sites and Heritage Listings

An AHIMS search was conducted for the project area and its surroundings between 17 August 2016 and 22 October 2016. Forty-six Aboriginal sites were registered in AHIMS within a 1 km radius of the project area. The sites were concentrated around Pine Creek, Lake Coombah, Lake Popiltah, the Darling River and the Darling Anabranch River. Despite the number of sites in this area, only a small percentage of the project area has previously been surveyed. Nine Aboriginal sites were identified within 40 m.

The distribution of recorded Aboriginal sites indicates an abundance of archaeological evidence within sand plains, lake beds, swamps, floodplains, undulating sand plains, ranges and hills and stony down land systems with alluvial plains and rolling downs and lowlands containing the most frequent occurrences of sites. Artefacts and culturally modified trees were the most commonly recorded site features returned by the AHIMS
search, followed by stone quarries, shell middens and PADs. Culturally modified trees were only recorded in the alluvial and floodplain land systems while stone quarries were only identified in the range and rolling down and lowlands land systems. A number of ceremonial site features including stone arrangements, culturally modified trees, a burial with culturally modified trees, a burial with a hearth and artefacts and a stone arrangement around a watering hole were also present in the search area but were not located within the project area.

Multiple sites recorded in the search area contained over 100 artefacts and there are a significant number of stone quarries, hearths, middens and culturally significant sites relating to ceremony.

Given the geographic extent of this search, the number of sites is relatively small and may reflect limited archaeological survey within 30 km of the project area as well as lower potential in dunefield land systems. The relatively few sites in the playa and basin land system is reflective of the search area rather than a lack of potential for sites in the playa and basins land system.

The assessment also included a review of previous local and regional Aboriginal archaeological studies within the project area. A summary of these studies is provided in Appendix E.

**Synthesis and Predicative Model**

The pipeline alignment intersects with Dune and sandplain landforms in the Woorinen and Lowan Sand Formation landforms and landscapes, particularly in proximity to Pine Creek, Lake Coombah, Coombah Creek, Lake Popiltah, the Darling River Anabranch, the Darling River floodplain and the Darling River and River Murray Junctions.

The density and likelihood of the project area intersecting Aboriginal sites contained within these formations and landforms is increased with proximity to temporary or permanent water sources. Chronological evidence of Aboriginal occupation may be obtained from the project area through, but not limited to, radiocarbon dates and Optical Stimulated Luminance (OSL) or Thermoluminesence (TL) dating of organic materials such as charcoal and heat retainers from hearths, shell, fossils and from quartz grains in sandy deposits.

Stone artefacts and hearths would comprise the majority of Aboriginal sites within the project area with shell middens occurring more frequently within 200 m of semi to permanent water sources such as lakes, the Darling River Anabranch and the Darling River. Culturally modified trees may occur in the floodplains.

Burials would occur anywhere in the project area but would be more common in lake and alluvial environments and in association with lunette, lakeshore, channel margins, islands, source-bordering dunes, sandhills, low-red sand dunes and river banks.

**Archaeological Sensitivity Mapping**

An archaeological sensitivity map has been developed for the project to map, visualise and predict potential surface and subsurface archaeological deposits. The archaeological sensitivity maps are provided in Appendix M.

Landform mapping has been based on Geoscience Australia’s 30 m digital elevation model available through the Elevation Information System (www.ga.gov.au/elvis).
Additional landform mapping has been undertaken using the 5 m digital elevation model for the southern portion of the project area, geological mapsheets and the NSW Western NSW landsystem datasets.

Preliminary archaeological sensitivity mapping was developed based on the results of the survey. The preliminary model suggested that the interface between ecological zones and/or the interface between sandplains, alluvial plains and lower slopes and landforms within 600 m of low-lying areas or areas where stone sources are nearby may have elevated potential for surface and subsurface Aboriginal objects and archaeological deposits to be present. Testing of specific sites in the Barrier Ranges and Nine Mile land system across the wider region, specifically the lower slopes and drainage lines where sheetwash and downslope erosion have formed depositional environments, have provided dates of Aboriginal occupation up to 6,000 years, however the depth, integrity and extent of depositional environments in the project area was unknown. The archaeological test excavation undertaken was designed as an evidence-based approach to address an identified information gap regarding the subsurface extent, depth and significance of soils and archaeological deposits between Broken Hill and Pine Creek within the Project Area.

The combined results of the surveys and test excavations indicate that almost all Aboriginal objects across the project area were located at the surface or within the top 150 mm of reworked topsoil. On the basis of this information, the definition of surface archaeological potential has been revised to 150 mm and the definition of subsurface archaeological potential has been revised to >150 mm in depth.

Nineteen test pits were excavated across colluvial depositional plains, colluvial lower slopes and colluvial slopes near minor drainage lines across the low, low-moderate and moderate sensitivity layers. These deposits were anticipated to generally be shallow and have infrequent occurrences of Aboriginal objects but it was predicted that if deeper soil profiles were present, there may be occasional pockets of intact Aboriginal objects.

The test excavation program was able to confirm that the colluvial landscapes between Broken Hill and Pine Creek had shallow A horizon soils that rarely exceeded 300 mm in depth. On some occasions, B Horizon soils were reached at 500 mm. No deep soil profiles were identified within the colluvial landscapes tested. No Aboriginal objects were located below 5 cm in depth within the colluvial depositional plains, colluvial lower slopes and erosional rises. The soils were found to be often windblown, disturbed and reworked, supporting the interpretation that most surface finds were lag deposits and the integrity of any subsurface Aboriginal objects present in these landscape is likely to be poor and have limited research potential.

The archaeological model has therefore been updated to reflect the low risk of impacting subsurface Aboriginal objects in these landforms.

Seven test pits were excavated within alluvial plains or alluvial over-bank deposits across the moderate-high and high sensitivity layers. Of the test pits placed in alluvial deposits, four contained Aboriginal objects. The Aboriginal objects, including an intact hearth, were identified in those test pits closer to Pine Creek, a well-defined watercourse. No Aboriginal objects were identified in the two test pits from the alluvial deposits of the upper reaches of the drainage line tested in Excavation Transect 1.1. A planned transect within the alluvial deposits of Kelly Creek was abandoned as it was anticipated that the soil deposits would
be too deep to excavate safely within the constraints of the Code of Practice for Archaeological Investigation in NSW.

While the sample size was small, particularly with respect to alluvial deposits, the results supported that well-defined drainage lines in alluvial deposits had potential to preserve Aboriginal objects. The intact hearth in particular at Pine Creek has excellent potential to provide dates of Aboriginal occupation in the local area. The number of Aboriginal objects recovered from the test pits suggests low densities of discarded material or shallow, reworked deposits but such a result could well be a factor of sampling bias.

The archaeological model has therefore been updated to reflect the moderate, rather than high, risk of impacting subsurface Aboriginal objects in alluvial deposits associated with minor to well defined drainage lines such as Acacia Creek and Kelly Creek. The archaeological model has been adjusted to better reflect the high risk of impacting subsurface Aboriginal objects in alluvial deposits associated with major drainage lines such as Pine Creek.

6.11.2 Field Surveys

The project area was surveyed in accordance with requirements the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010. The survey was conducted over 10 days between the 24th October and 4th November 2016.

Approximately 269 km of the 270 km of the proposed pipeline impact footprint was subject to 100% pedestrian survey. A small portion of the project area <1%) of the project area was not surveyed due to access restrictions, high levels of disturbance or at the request of the Barkindji Native Title Group Aboriginal Corporation.

The results of the Aboriginal cultural heritage survey identified 240 new Aboriginal sites. Six previously recorded sites were found to be larger than previously recorded and extend into the project area (2-Canegrass, BH2-1, Pine Creek 1 and Wentworth Hospital 1, Wentworth Hospital 2 and Wentworth Hospital 3). Twelve previously recorded sites within 60 m of the project area were not subject to survey.

132 Aboriginal sites were located within 60 m of the proposed pipeline route. One site was located within the River Murray intake pump station impact footprint. Eight sites were located within the impact footprint of TPS3. No sites were identified within the impact footprint of TPS1 or TPS2.

Of the 259 Aboriginal sites identified during surveys and past assessments, 107 of the sites were stone artefact sites, 20 were hearth sites, five were stone artefact and hearth sites and four sites contained stone artefacts, hearth, non-human bone, PAD and shell. The remaining sites comprised one example each of stone artefacts with PAD; stone artefacts with shell; culturally modified tree; shell; and hearth with shell. A summary of Aboriginal sites by feature per impact area is presented in Appendix E.

AHIMS sites cards, including location information, photos and site descriptions for each of the recorded sites as well as the table of findings (including all Aboriginal sites within 60 m of the Project area) as prescribed by the Code of Practice for Archaeological Investigation in NSW, are provided in Appendix E.

The survey of proposed water pipeline and additional infrastructure provide new data for alluvial plain, ranges, rolling down and lowland and sandplain land systems. The Fowlers, Conservation, Darling, Barrier, Nine Mile, Oakvale and Kars land systems had the greatest
number and density of artefacts recorded, reflective of the availability of raw material sources for stone manufacture and the availability of temporary water in these land systems. Visibility of hearths was more common in the alluvial plains and sandplains than in the ranges and rolling down and lowlands. Survey units on the Woorinen geological formation had very low visibility. This is reflected in the low number of sites identified in those areas.

Most sites, artefacts and hearths were located within 600 m of water. Where sites were located further away, they tended to be associated with stone sources.

**Hearth Sites**

A total of 65 sites were recorded with burnt stone, burnt clay and burnt termite mound heat retainer hearths. The majority of hearth sites comprised disturbed and dispersed heat retainers and did not retain dating potential. A small percentage of hearth sites were partially exposed or partially buried and warranted further investigation. Of the newly recorded sites, LTWP HTH 114 contained ten concentrations of heat retainers, though the bulk of these appeared to be disturbed and reworked due to grading within the road reserve. Two of the hearths however retained visible charcoal and mounded structure and were excellent candidates for dating. LTWP AFT HTH 213 consisted of four hearth, one partially buried and dispersed hearth, one dispersed hearth and two with dispersed termite heat retainers across the entire site. LTWP AFT HTH 223 consists of three partially buried hearths, tow have visible charcoal with possible dating potential. LTWP AFT HTH 22, LTWP HTH 95, LTWP HTH 107, LTWP 102, LTWP HTH 201 and LTWP HTH 219 had two hearths recorded within each site. The other 52 sites had only one hearth recorded during the survey. Hearths were more frequent in the alluvial plains in the southern portion of the project area and may be indicative of both better preservation conditions and areas of repeated occupation, where Aboriginal people focused on exploiting riverine and lake environments.

**Shell**

Six sites were identified to have freshwater mussel shell fragments or middens. These were Wentworth Hospital 1, Wentworth Hospital 2, Wentworth Hospital 3, LTWP AFT HTH SHL 103, LTWP HTH SHL 118 and LTWP SHL 105. The shell middens and shell fragments were situated in close proximity to the permanent water source of the Darling and Darling Anabranch River systems. LTWP SHL 105 and LTWP HTH SHL 118 had minimal amount of fragmented freshwater mussel shell and were interpreted to be reworked and disturbed deposits.

**Culturally Modified Trees**

Two locations, LTWP ST 155 and LTWP ST 212 had scarred trees.

LTWP ST 155 contains a culturally modified box tree. The scar is an oval shape, 95 cm x 40 cm. It may have been used as a coolamon. The site is located on within a flat floodplain, in an isolated clump of trees. LTWP ST 212 contains a culturally modified box tree located on the margins of a heavily modified flood out area of Lake Popiltah. The scar is a slab shape, measuring 157 cm x 60 cm. The scar has a regrowth depth of 20 cm, and there are steel axe marks remaining.
Sites with multiple features

A number of sites included multiple features such as, artefact scatters, middens and ground hearths. Such features were identified at LTWP AFT HTH 22, LTWP AFT HTH 20, Wentworth Hospital 1, Wentworth Hospital 2, Wentworth Hospital 3, LTWP AFT HTH SHL 103, LTWP AFT HTH 1, LTWP AFT HTH 98, LTWP AFT HTH 117, LTWP HTH SHL 118, LTWP AFT HTH 172, LTWP AFT HTH 173, LTWP AFT HTH 175 and LTWP AFT HTH 233. Sites with multiple features generally contain a greater diversity of evidence of Aboriginal occupation and are considered to have increased scientific value.

Stone Artefact Sites

A total of 1589 stone artefacts were recorded across 227 sites. LTWP AFT HTH 22 contained the highest number of stone artefacts (163), followed by LTWP AFT HTH 175 (147+) and LTWP AFT 1 (100+). There were 50 to 60 artefacts per site at LTWP AFT 3, LTWP AFT 2, LTWP AFT 5 and LTWP AFT 55. LTWP AFT 27, LTWP AFT HTH 20, LTWP AFT 41, LTWP AFT 72, LTWP AFT 75, LTWP AFT 144, LTWP AFT HTH 213 and Cangrass / Stephen Creek 2 contained between 43 and 20 stone artefacts. All other site had less than 20 artefacts or none at all.

Archaeological Potential and Potential Archaeological Deposit

It is currently unknown whether Aboriginal objects are preserved in buried deposits across the project area or the value of any objects contained within those deposits. The archaeological model suggests that the interface between ecological zones and /or the interface between sandplains, alluvial plains and lower slopes and landforms within 600 m of low-lying areas or areas where stone sources are nearby may have elevated potential for surface and subsurface Aboriginal objects and archaeological deposits to be present.

The project area has a complex mixture of aggrading and eroding soil which result in both the burial and removal past ground surfaces as a result of shifting climate and landscape formation over the last 100,000 years. Some sites will be more visible in the sandplains and floodplains due to continued erosion but many others may be buried by soil shifted through changing wind and water regimes. Archaeological detectability across the project area was generally low due to a wind blown drape of soil and surface disturbance.

A small portion of the sites were recorded on the hill crests and mid upper slopes within the Barrier Ranges and Nine Mile land systems on skeletal soils with visible outcrops. These sites have limited subsurface archaeological potential due to the shallow nature of the soils while their surface extents often extend across and beyond the road reserve within the same landforms and may be indicative of local, expedient use of quartz outcrops.

The remainder of the sites were located in areas where visibility of the underlying soil deposits was low (low archaeological exposure). There is currently an information gap regarding the subsurface extent, depth and significance of these deposits, if any. It is widely recognised that there can be no visible surface indicators of subsurface archaeological deposits of significance.

The project area has been subject to significant levels of disturbance since European use of the landscape began in the 19th century. Major changes have included the construction and maintenance of the Silver City Highway, realignment of the Silver City Highway, installation of services, grazing and vegetation clearance. Construction of dams, fences
and roads and other rural infrastructure, and in particular over stocking of pastoral holdings in the late 1800s, causing severe erosion. Where this has occurred, archaeological integrity of the topsoil would have been destroyed, generally to a minimum of 400 mm and often to depths of 700 mm. While Aboriginal objects may still be present, they will generally not be stratified or in their original context, reducing their scientific value.

The condition of most of the visible sites was poor as many were no longer within their original context due to the level of disturbance and erosion across the road. Nevertheless, some sites still had structure with intact or partially exposed hearths or shell that can provide a dating sample of Aboriginal occupation in the local region and identifiable knapping floors which provide detailed information about the technological organisation of Aboriginal people in the past. The survival of these relatively intact traces indicate that the project area has the potential to retain pockets of intact archaeology even in the top 400 mm of soil.

6.11.3 Surface Archaeological Potential

Almost all Aboriginal objects across the Stage 1 (Broken Hill to Pine Creek) area were located at the surface or within the top 150 mm of reworked topsoil. On the basis of this information, the definition of surface archaeological potential has been revised to refer to the surface and soils to a depth of 150 mm. The following updates have been applied to the archaeological model since Niche 2017:

- Moderate surface archaeological risk is predicted in the bulk storage option area based on a desktop assessment of distance from water, land system units, landform units, geological units and vegetation units
- Low surface archaeological risk has been predicted for the Slag Street Alternate Pipeline Route based on a desktop assessment distance from water, land system units, landform units, geological units, vegetation units and aerial disturbance.
- No surface archaeological risk is predicted at the Mica St water treatment area based on a desktop assessment of a historical assessment of Block 10, distance from water, land system units, landform units, geological units and vegetation units

6.11.4 Statements of Significance for the Project area

Grading values and significance for each site or zone have been applied to provide a measure of the values/significance for Aboriginal objects identified within the project area, and to provide an overall assessment of the significance of each of the zones used that define the project area. Grading had three categories: Low, Moderate and High

Preliminary statements of significance are presented below for the alignment project area.

Social Value

The project area has social value to the Aboriginal community because it contains archaeological sites, traditional resources and waterways that establish a link between the past and present Aboriginal use and custodianship of the land.

The project area intersects the waterways and lakes of the River Murray, Darling River, Darling River Anabranch, Coombah Creek, Pine Creek and Stephens Creek. These waterways have social and spiritual value due to their association with the mythology of the Nachie (Rainbow Serpant), Eagle and Crow and pathways of ancestral beings.
During consultation with the RAPs, the presence of cultural plants within the project area was a topic of interest. Plants of traditional or historical value to the Aboriginal community “highlight one part of the natural environment that demonstrates the Aboriginal cultural affiliation with the landscape” (Purcell 2002: 200). The project area contains numerous examples of plants and animals of traditional value. A small plant community of a culturally important plant species is present in the project area.

Though no burials have been identified in the project area to date, the project area contains a number of landforms and landscapes which are regionally associated with burials. This potential is captured in the high and very high archaeological sensitivity layers.

The RAPs have indicated a cultural and spiritual responsibility to participating in the management of Country, cultural knowledge, Aboriginal heritage values and Aboriginal heritage evidence for the health and social wellbeing of current and future generations. The continued experience and interaction and involvement in decision making processes of the Aboriginal community with the project area through the project forms part of the social value of the project area for the Aboriginal community. The RAPs have strongly indicated that maintaining healthy waterways and the management of ancestral remains is a priority for the Aboriginal community and of immense cultural importance. Rehabilitation of the landscape after the construction of the pipeline was also a recurrent theme.

With the exception of the waterways and their associated landscape, the RAPs have not identified any focal associations (strong or special associations to a particular area) to the project area that are distinct or of higher value than the surrounding pastoral property and landscape in the region.

**Historic Value**

The assessment has not identified any other historic values within the project area. The historic values of the project area are considered common and generic to the local region. Larger, more comprehensive suites of evidence that preserve a greater record of the shared pastoral histories of the region and form a notable part of Harry Nanya’s life are found at Lake Victoria and Popilta Station.

The Silver City Highway is frequently used today to connect families between Wentworth and Broken Hill. These values are common to all roadways and are not exceptional to the project area.

**Scientific (Archaeological) Value**

Of the 255 Aboriginal sites identified during surveys and past assessments, 194 of the sites were stone artefact sites, 34 were hearth sites, 16 were stone artefact and hearth sites, five sites contained stone artefacts, hearth, non-human bone, PAD and shell, and two sites were culturally modified trees. The remaining sites comprised one example each of stone artefacts with PAD, stone artefacts with shell, shell and hearth with shell. Over a 1000 stone artefacts and 50 hearth areas are located in or very close to the project area. The project area contains evidence of early to late stages of stone tool manufacture, utilised stone tools and evidence of seed grinding and evidence of the exploitation of bird, terrestrial and aquatic species such as emu, kangaroo and freshwater mussel. The project area has research potential as it is likely to contain evidence of the entire stone tool manufacture sequence, from stone procurement from local sources through to...
manufacture, use and discard. Such sequences can be used to demonstrate the interconnectedness of sites within the landscape and therefore the activities and movement of people or objects through the landscape. The project area has the potential to contain deeply stratified intact subsurface archaeological deposits, below and between disturbance from modern land use, that may be able to build on the chronology of Aboriginal land use across the wider region. The project also contains hearths and shell which may build on the chronological understanding of the local region. These deposits may demonstrate Aboriginal land use from more recent times to the Pleistocene and therefore have the potential to capture human response and adaptation to changing climate regimes in the region. The project area is therefore considered to have moderate scientific value at a local to regional level.

**Sensitive Areas and Knowledge Gaps**

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* states that information gaps are not uncommon and should be acknowledged. Places of potential value that are not fully identified or defined should be included as sensitive areas to target further investigation.

It is currently unknown whether Aboriginal objects are preserved in buried deposits across the project area and the value of these objects, with the exception of the Broken Hill to Pine Creek section where none were identified. These potential values are captured in the archaeological sensitivity map for the project. In areas of moderate or higher risk, there is the potential for further Aboriginal objects of varying significance to present on the surface or subsurface.

**6.11.5 Construction Impacts**

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) requires that both direct and indirect harm to Aboriginal objects and Aboriginal places be considered. Generally direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as an indirect consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area as a result of an activity.

The construction of the project would result in direct harm to Aboriginal sites and objects through the removal of vegetation, topsoil, machinery and vehicle movement and excavation. The exact number of Aboriginal objects to be impacted by the works is unknown at this stage and is currently being confirmed through a program of sub-surface testing. It is therefore necessary to rely on the predictive model of Aboriginal site distribution developed by Niche (2017) which has been based landscape characteristics, existing archaeological information and on the extensive survey and archaeological test excavations undertaken to date.

Based on the assessment of impacts undertaken to date, the project would result in direct harm to a high number of low value archaeological sites and a small number of sites which are considered of moderate significance on a local level. No Aboriginal sites of very high significance have been identified during the investigations to date.
The assessment of subsurface impacts is ongoing and being determined based on an extensive program of test excavations. Based on the works completed for Stage 1 which is the Broken Hill to Pine Creek section of the pipeline and associated infrastructure, the following summary is made. The project would have a:

- low risk of impacting subsurface Aboriginal objects in the colluvial landscapes between Broken Hill and Pine Creek,
- moderate risk of impacting subsurface Aboriginal objects in alluvial deposits associated with minor to well defined drainage lines such as Acacia Creek and Kelly Creek
- high risk of impacting subsurface Aboriginal objects in alluvial deposits associated with major drainage lines such as Pine Creek.

The subsurface potential in Stages 2A, 2B and 2C of the project site is unavailable at this stage, however those areas originally determined to be of moderate and high subsurface risk have generally reduced across the project based on the results of the test excavation. There are however known Aboriginal sites of moderate or higher significance and areas of high subsurface risk which would require management and mitigation measures.

The project would result in impacts to known Aboriginal sites and areas of low, moderate and high surface risk and areas of low, moderate and high subsurface risk. Further analysis is being completed to fully understand the significance and impact of the project on these areas. A management plan is being developed in consultation with the RAP to address these areas. No impacts to sites of very high significance (such as human burials) are likely to occur as a result of the works. Should very highly significant Aboriginal sites (such as burials) be discovered during the current investigation or during construction, the pipeline or infrastructure would be designed to avoid impact if possible.

The ACHA for the assessment completed to date indicates that similar archaeological sites, of similar value would be present in commensurate environmental contexts immediately adjacent to the project area, and throughout the local area and region. Although some areas of high and moderate archaeological sensitivity would be impacted by the project, such areas would also occur adjacent in the local area, and throughout the region. Management and mitigation measures have been developed in consultation with the local Aboriginal community to mitigate the cumulative impact on the archaeological resource of the area.

The project would have a significant impact on some Aboriginal sites within the project area where impacts are unavoidable. The Aboriginal community considers all Aboriginal sites to be significant. The project is unlikely to have a significant impact on Aboriginal cultural heritage and archaeological resource within the broader region because similar Aboriginal sites are likely to be present throughout this region.

Given the impact to Aboriginal objects as a result of the project, an AHIP under Section 90 of the NPW Act to harm (move or destroy) Aboriginal objects would be required prior to construction works commencing. Due to the extent of the project area, the construction of the proposal would be subject to four separate AHIPs.

6.11.6 Operational Impacts

Post-construction, no impacts are predicted in relation to Aboriginal heritage.
6.11.7 Mitigation Measures

Four general management strategies were considered and have been pursued with regard to both direct impacts (e.g. surface disturbance) and indirect impacts to Aboriginal sites (e.g. increased erosion, unintentional increase in traffic). Avoidance of known sites/high risk areas during pipeline development (to be ongoing during further detailed design).

Mitigation strategies for unavoidable impacts include:

- salvage excavation and landscape characterisation of a sample of areas within the moderate to very high subsurface archaeological sensitivity;
- salvage surface collection in surface high risk layers;
- unmitigated harm in low and low-moderate risk layers.

The project is not a low impact activity as defined by the NPW Regulation. The aboriginal cultural heritage assessment, and advice provided by OEH, has determined that Aboriginal cultural heritage would be impacted as part of the proposed activity. An AHIP authorising the harm would be required prior to any activity commencing.

Direct Harm

An AHIP would be required to impact areas of moderate to very high archaeological sensitivity and known Aboriginal heritage sites.

An AHIP authorising the harm would be required prior to any activity commencing that would impact on Aboriginal cultural heritage. WaterNSW and its contractors would comply with the conditions of the AHIPs.

It is recommended that in order to mitigate direct harm, any such AHIP be conditioned to:

- Salvage a representative sample of Aboriginal objects from sites of moderate or higher significance
- Collect dating samples from viable hearths
- Collect a representative sample of dates from Aboriginal sites within the moderate to very high archaeological sensitivity areas
- Reduce knowledge gaps and improve regional understanding of the subsurface archaeological resource by undertaking subsurface archaeological salvage in a representative sample of sites of moderate significance in moderate to very high subsurface archaeological sensitive landforms and landscapes.
- Include a protocol for the management of unexpected finds, including but not limited to stone artefact sites, hearths, culturally modified trees, shell, burials
  - A protocol for the discovery and management of human remains, including stop work provisions and notification protocols.
- Include a protocol for managing gender-specific cultural values
- Include an adaptive management framework to manage the discovery of any Aboriginal sites and values of high regional significance (such as Pleistocene aged sites)

Indirect Harm Outside the Impact Footprint
In order to minimise and mitigate direct and indirect harm to known Aboriginal sites and areas of moderate or higher archaeological sensitivity immediately outside the impact footprint, it is recommended that:

- Vehicle and people movements be constrained to defined disturbance footprints (to minimize the risk of disturbance outside of the footprints);
- Implementation and maintenance of controls for sediment, erosion and waterflow through instruments such as an Environmental Sediment Control Plan;
- Avoidance of known sites and areas of archaeological sensitivity (via, temporary fencing, no-go areas, signage etc);
- A database of Aboriginal heritage sites and values be maintained for the duration of the works;
- Protocols for heritage awareness training to be incorporated into the work site inductions for both employees, sub-contractors and site visitors who may be conducting works within the Project area. Managers of the infrastructure should be trained in procedures to recognise and avoid disturbance to cultural heritage places and items.
- Communication of Aboriginal heritage sites and values identified as a result of this project should be communicated to other stakeholders who utilise the road corridor (for example local council, RMS, utilities holders).

### 6.12 Historic Heritage

A Preliminary Historical Heritage Assessment was prepared by Niche Environment and Heritage (2017) for the purpose of identifying historical heritage items within, or in close proximity to the project. The assessment has been prepared in accordance with the ‘Statements of Heritage Impact’ guidelines published by the NSW Heritage Office and Department of Urban Affairs & Planning (1996, revised 2002), originally published as part of the NSW Heritage Manual. The assessment is provided in Appendix H and summarised as follows.

Broken Hill was founded in 1883 when a rich mineral deposit (silver, lead and zinc) was discovered. The City of Broken Hill is recognised as being of outstanding heritage value to the nation due to its significant role in the development of Australia as a modern and prosperous country and is thus listed on the Commonwealth’s register of National Heritage Places (Place ID: 105861). The listing recognises the significance of over 130 years of continuous mining operations, its contribution to technical developments in the field of mining, its pioneering role in the development of occupational health and safety standards, and its early practice of regenerating the environment in and around mining operations.

A summary of available historical heritage literature including previous heritage studies and archaeological assessments relevant to each of the works areas is provided Appendix H.

The proposed works have the potential to impact;

1. The Wentworth Water Tower (item no. I94) and
2. Mica Street Filtration Plant Reservoir (Item no. I120)
The Wentworth Water Tower (Lot 7011 DP1125398) is an item of local heritage significance listed on the Wentworth Local Environmental Plan (LEP) 2011. The pipeline for the River Murray Intake pump station extends into the heritage curtilage of this item and the pump station itself is sited immediately adjacent (Figure 6-12). The proposal would also have the potential to impact Mica Street Filtration Plant Reservoir, an item of local heritage significance listed under Broken Hill LEP 2013, located at 199 Kaolin Street, Broken Hill (Lot 2129, DP 757298).

The site of the proposed intake includes an abandoned wet well which was constructed in 1935. The well has been heavily modified by later additions to the Pumping Station, is in very poor condition and is unlikely to be of local or State heritage significance. The well is not contained within the heritage curtilage of the Wentworth Water Tower (see Figure 6-12) and based on the field assessment and preliminary significance assessment, it was determined not to be classified as a ‘heritage item’ under the Heritage Act, 1977. Its removal and replacement with a new tank would therefore have no impact on the heritage significance of the Wentworth Water Tower and no further heritage assessment is required.

Figure 6-12 Location of River Murray Intake Pump Station and pipeline (shown in blue) within the Heritage Curtilage of Wentworth Water Tower (shown in red)

Source: Niche 2017

Wentworth Water Tower

The proposed pipeline extends into the heritage curtilage of the Wentworth Water Tower, which is located to the rear of the Wentworth District Hospital in a public reserve off the
Silver City Highway. The proposed River Murray Intake Pump Station is situated just outside this heritage curtilage. The water tower is an ornate structure with nine cylindrical iron columns, supporting a water tank with a galvanised iron polygonal roof with decorative wrought iron finial. The tower appears to be in relatively good condition, with some corrosion noted. The tower occupies quite a prominent and impressive feature in the Wentworth skyline and can be observed from many directions, including the approach from Mildura along the Silver City Highway and from the other side of the Darling River, at some distance from the tower itself. The area surrounding the tower is relatively flat with some vegetation, including trees and shrubs and is accessible via roads and paths.

The existing pumping station and site of the proposed new River Murray intake pump station is located to the south of the water tower on the banks of the River Murray. The existing pumping station is screened within the project area by trees and other vegetation, which effectively obscure any views between it and the water tower.

Remains of a collapsed former structure are located approximately 30 m east of the tower. The structural debris consists of bricks, mortar, cement, corrugated iron, asbestos and tiles. The presence of tiling suggests that the structure may have been associated with the provision of amenities within the public reserve, such as a former toilet block. There is no structure shown in this location on historical aerial photographs of the area dating to 1965, so the structure was presumably constructed at some point after this time. Given their age and likely association, the structural remains would not be of local or State heritage significance and are not considered ‘relics’ under the Heritage Act 1977.

The land use history of the project area does not indicate the potential for any other former structures or intact archaeological deposits, with a large portion of the area having been previously disturbed during the 1970s for the construction of the existing pumping station and underground water pipeline in Wentworth during the mid-1970s. Except for the structural remains documented above, no potential archaeological features were observed during the site inspection. The project area, within the heritage curtilage of the Wentworth Water Tower is therefore considered to have no archaeological potential.

Mica Street Filtration Plant and Reservoir

The proposed pipeline route terminates at the curtilage of the current Mica Street WTP. The plant is located off Kaolin Street on a hill within the centre of Broken Hill (refer to Figure 6-13). It is a focal point for the town as the highest point in Broken Hill. The JP Keenan Lookout, which is open to public, is located to the east of the filtration plant and to the south of the newer water treatment plant and offers a view south of the town towards the slag heap. The current WTP consists of a complex of buildings, but the main heritage item is the No. 1 reservoir, which is a roofed mass concrete tank and the Filtration Plant which consists of a sedimentation tank and filtration plant with an attached lab and administration building. Two more recent storage tanks are located in the complex, one to the east and one to the west of the filtration plant.

Two storage areas would be temporary established during the works, one is a cleared dirt area located to the north of the new WTP. It is located at a distance from the heritage listed item and there is no view from this location towards the Filtration Plant or the Reservoir, and the other storage area is located over part of the JP Keenan Lookout and to the east and south east of it.
Works also would be carried out at an area located to the south of the newer WTP, which is a disturbed area located on the lower slope from the WTP, the works in this area would be the installation of new pipes and fixtures to facilitate the connection of the new Wentworth-Broken Hill pipeline with the existing Mica Street WTP infrastructure.

The site of the proposed terminal balance tank is located on a south west facing slope away from Reservoir no.1.

Figure 6-13 Location of the new balance tank within the Heritage Curtilage of Mica Street Filtration Plant and Reservoir

Source: Niche HIA, June 2017

Commonwealth, National, State and Local Heritage Lists

Table 6-18 below presents the results of Commonwealth, National, State and local heritage lists and register searches undertaken on 26 September 2016. Only historical heritage items located within, or in close proximity to, the pipeline alignment (i.e. within 500 m) are included.
6.12.1 Assessment of Significance

The NSW Heritage Manual guideline, ‘Assessing Heritage Significance’ (NSW Heritage Office 2001) provides the framework for the following significance assessments and Statements of Significance. These guidelines incorporate the seven aspects of cultural heritage value identified in the *Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013* (Burra Charter) into a framework currently accepted by the NSW Heritage Council. The significance assessment for the Wentworth Water Tower and Mica Street Filtration Plant and Reservoir are presented in Table 6-19 below.
### Table 6-18 Commonwealth, National, State and local heritage listed items and places

<table>
<thead>
<tr>
<th>Heritage Place</th>
<th>Register</th>
<th>ID</th>
<th>Location</th>
<th>LGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Broken Hill</td>
<td>National Heritage List</td>
<td>105861</td>
<td>Approximately 16770 ha, Silver City Highway and Barrier Highway, Broken Hill, comprising the whole of the Broken Hill City Council LGA</td>
<td>Broken Hill</td>
</tr>
<tr>
<td>St Ignatius School</td>
<td>State Heritage Register</td>
<td>01507-5051260</td>
<td>30 Caddell Street, Wentworth</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Mica Street Filtration Plant and Reservoir</td>
<td>s.170 register, State Heritage Inventory</td>
<td>Mica Street, Lot 7467 / DP1182254</td>
<td>Broken Hill</td>
<td></td>
</tr>
<tr>
<td>Old Broken Hill City Abattoir</td>
<td>Broken Hill LEP 2013</td>
<td>I100</td>
<td>41 Kanandah Road ; Lot 7121 / DP1021655</td>
<td>Broken Hill</td>
</tr>
<tr>
<td>Windamingle Homestead</td>
<td>Wentworth LEP (WLEP) 2011</td>
<td>I6</td>
<td>Silver City Highway; Lot 5304 / DP768219</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Bunnerungie Homestead</td>
<td>WLEP 2011</td>
<td>I2</td>
<td>Silver City Highway; Lot 3248 / DP765453</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Bunnerungie Bridge</td>
<td>WLEP 2011</td>
<td>I3</td>
<td>Silver City Highway; Lot 3248 / DP765453</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Bunnerungie Cemetery</td>
<td>WLEP 2011</td>
<td>I4</td>
<td>Silver City Highway; Lots 1913-1914 / DP763770</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Irrigation Pipe</td>
<td>WLEP 2011</td>
<td>I5</td>
<td>Silver City Highway; Lot 1914 / DP763770</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Dwelling</td>
<td>WLEP 2011</td>
<td>I79</td>
<td>5 Perry Street; Lot 6, Section 42 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Old Wentworth Gaol</td>
<td>WLEP 2011</td>
<td>I50</td>
<td>Beverley Street; Lot 90 / DP756994</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Dwelling</td>
<td>WLEP 2011</td>
<td>I58</td>
<td>35 Cadell Street; Lot 4, Section 9 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Dwelling</td>
<td>WLEP 2011</td>
<td>I59</td>
<td>40 Cadell Street; Lot 1, Section 1 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>“Crangs”</td>
<td>WLEP 2011</td>
<td>I57</td>
<td>34 Cadell Street; Lot 4, Section 1 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>“The Nunnery”</td>
<td>WLEP 2011</td>
<td>I55</td>
<td>28 Cadell Street; Lot 7, Section 1 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>St Ignatius School</td>
<td>WLEP 2011</td>
<td>I56</td>
<td>30 Cadell Street, Lot 6, Section 1 / DP759074</td>
<td>Wentworth</td>
</tr>
<tr>
<td>Wentworth Water Tower</td>
<td>WLEP 2011</td>
<td>I94</td>
<td>Wentworth District Hospital, Silver City Highway (rear); Lot 7011 / DP1125398</td>
<td>Wentworth</td>
</tr>
</tbody>
</table>
Table 6-19 Assessment of Significance

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Wentworth Water Tower</th>
<th>Mica Street Filtration Plant and Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) An item is important in the course, or pattern, or NSW's cultural or natural history (or the cultural or natural history of the local area)</td>
<td>The Wentworth Water Tower was constructed in c.1888 with the commencement of the town’s water supply. It is representative of the provision of utilities services in the early years of the town's local government and for this reason has local heritage significance under this criterion. The project area is confined to land surrounding the water tower itself and is included within its curtilage. It provides an important setting for the tower and contributes to its local heritage significance under this criterion. The Wentworth Water Tower is considered to have local heritage significance under this criterion.</td>
<td>The Mica Street WTP and Reservoir are significant for their role in providing Broken Hill with water since 1892. A supply of clean water has shaped the growth and development of the town and its mining industry. The construction of the reservoir was a major public work of its time and evidence of an earlier technological period. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
<tr>
<td>b) An item has strong or special associations with the life or works of a person, or group of persons, of importance in the cultural or natural history of NSW (or the cultural and natural history of the local area)</td>
<td>The Wentworth Water Tower (including the project area) has no strong and/or special associations with the life and works of a person or persons of importance in the history of NSW or the local Wentworth area and is not considered to have heritage significance under this criterion.</td>
<td>The Mica Street WTP and Reservoir has an association with the Broken Hill Water Board which has had a role in the provision, management and supply of drinking water to Broken Hill since 1892. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
<tr>
<td>c) An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievements in NSW (or the local area)</td>
<td>The Wentworth Water Tower is a tall, impressive and ornate structure, and forms a prominent and important visible feature in the Wentworth skyline and surrounds. The project area is confined to the largely open land surrounding the water tower and by virtue of it being relatively open and clear, contributes to upholding the visual setting and aesthetic characteristics of the tower.</td>
<td>The Mica Street WTP and Reservoir has operated consistently since 1892, which demonstrates a high degree of technical achievement in harnessing a scarce natural resource in an arid environment. The Reservoir is of aesthetic significance because of the use of mass concrete and its location on the highest point within the local area. It is considered to</td>
</tr>
<tr>
<td>Criterion</td>
<td>Wentworth Water Tower</td>
<td>Mica Street Filtration Plant and Reservoir</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>(d) An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.</td>
<td>The Wentworth Water Tower (including the project area) is considered to have local heritage significance under this criterion.</td>
<td>be a landmark in the town of Broken Hill. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
<tr>
<td>e) An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area)</td>
<td>Given it is a highly visible feature in the Wentworth skyline and located within a public reserve, the Wentworth Water Tower and surrounding land, including the project area, are likely to have an association with the Wentworth community as a local landmark. The Wentworth Water Tower (including the project area) is considered to have local heritage significance under this criterion.</td>
<td>Given they are visible in the Broken Hill skyline and located within the elevated Mica Street hill which has long been associated with the provision of water services in Broken Hill, the Mica Street Reservoirs are likely to have an association with the Broken Hill community as a local landmark. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
<tr>
<td>(f) An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area); and</td>
<td>Neither the Wentworth Water Tower nor the project area are considered to have potential to yield information that will contribute to an understanding of the history of NSW or the local Wentworth area unavailable from other resources and are not considered to have heritage significance under this criterion.</td>
<td>The Mica Street WTP has the potential to demonstrate the development of water supply in Broken Hill, as it has been in continuous use since 1892 and has numerous changes to the compound in this time. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
<tr>
<td>(g) An item is important in</td>
<td>The Wentworth Water Tower is a unique and early example of an ornate water tower constructed during the nineteenth century and considered to be rare in the local area. For this reason, the Wentworth Water is considered to have local heritage significance under this criterion.</td>
<td>The Mica Street WTP and Reservoir provide a unique example of the long, continuing and important role of water in Broken Hill and are considered rare in the local area. The Reservoir constitutes and early example of mass concrete use in Broken Hill. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
</tbody>
</table>
### Criterion: demonstrating the principal characteristics of a class of NSW's: Cultural or natural places; or Cultural or natural environments; (or a class of the local areas) Cultural or natural places; or Cultural or natural environments.

<table>
<thead>
<tr>
<th><strong>Wentworth Water Tower</strong></th>
<th><strong>Mica Street Filtration Plant and Reservoir</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The form and characteristics of a late nineteenth century water tower constructed as part of the original water supply system in the Wentworth area. The Wentworth Water is considered to have local heritage significance under this criterion.</td>
<td>Representative of the impact of a reliable water supply in an arid environment and the impact that has on the development of regional communities. The Mica Street WTP and Reservoir are considered to have local heritage significance under this criterion.</td>
</tr>
</tbody>
</table>

### Statement of Significance

The Wentworth Water Tower was constructed in c.1888 as part of the town of Wentworth’s water supply. It is a surviving representation of the provision of utilities services in the early years of the town’s local government and is therefore significant for its historical heritage values. The tower is a tall, impressive and ornate structure, which occupies a prominent and important visible feature in the Wentworth skyline and surrounds. Given it is a highly visible feature in the skyline and located within a public reserve, the Wentworth Water Tower is likely to have an association with the Wentworth community for its local landmark qualities.

The project area, which forms part of the water tower’s curtilage, contributes to its aesthetic heritage values by preserving its open and unobscured visual setting and aesthetic characteristics. The Wentworth Water Tower is a unique and rare example of its kind and is considered to be representative of its type in the local area. The Wentworth Water Tower is considered to be of local heritage significance.

The Mica Street WTP and Reservoir constitute part of the earliest water supply infrastructure projects within Broken Hill associated with the Broken Hill Water Board. It has been integral in providing clean water to Broken Hill since its construction in 1892 until today, which in turn has been vital to the growth of Broken Hill as a town. The WTP and reservoir display a high degree of technical achievement in harnessing the natural resource in an arid environment. The structures that currently make up the complex demonstrate the growth, development and operation of the water system in Broken Hill for 125 years. The Reservoir itself is a relic of earlier technological development, it is a rare example of the early use of mass concrete. The reservoir and filtration plant represents a part of the industrial history of Broken Hill and maintains relevance to the local community with its continued operation and as a landmark in the township.
6.12.2 Operational Impacts

**Wentworth Water Tower**

The pipeline would not affect views to, and from, the Wentworth Water Tower as it is to be constructed underground. The new river intake pump station is located immediately adjacent to the most southern part of the Wentworth Water Tower’s heritage curtilage, but would be located at some distance (at least 300m) from the water tower itself. The new pump station would be positioned next to the existing raw water pump station, in an area which is screened from surrounding areas, including the water tower, by natural vegetation. Existing and future water supply infrastructure in this location does not affect significant views to the tower, which exist within the public reserve, along the Silver City Highway approaching from Mildura, and from the town of Wentworth. The Wentworth Water Tower is a prominent feature within the landscape and the construction of the Murray intake pump station would not obstruct or minimise its significant visual setting ensuring people would continue to view and appreciate its significance.

The underground pipeline and Murray intake pump station are not sited on any known or potentially significant historic archaeological deposits and therefore no alternative positions for their placement have been considered.

The Murray intake pump station is required to be adjacent to the heritage curtilage of the Wentworth Water Tower for engineering feasibility; it needs to be located on the bank of the River Murray within close proximity of the existing pump station to allow interconnection between the two items of water infrastructure.

Overall, it has been concluded that there would be no direct or indirect heritage impacts to the Wentworth Water Tower, and impact on/exposure of any significant archaeological deposits is unlikely. There would be no negative impacts to the heritage significance of the Wentworth Water Tower.

**Mica Street WTP and Reservoir**

The additional works areas are temporary and are located away from important heritage items. Adaption of existing elements of the Mica Street WTP is encouraged in the CMP where it would promote ongoing conservation. The new tank is a similar size and would be constructed of a similar material to the existing reservoir tank, with an aluminium roof. Its design and fabric are generally sympathetic to the aesthetic values of the heritage item.

The new tank would be sited more than 15 m away from the existing No 1 reservoir tank. This would allow for visual separation.

The proposal is unlikely to impact or expose any significant archaeological deposits, as the land use history of the site do not indicate the presence of any former structures in this location and no potential archaeological features were observed during the site inspection.

The proposed terminal balance tank is located to the west of the original square tank, downslope from an existing circular reservoir located to the north west of the original reservoir. The new tank would be located upslope of the Reservoir and below the exiting circular storage tank and would be visible from vantage points within the town. The proposed terminal balance tank would not obscure the existing Reservoir as it is sitting to the west of it, but due to the slope of the hill would be taller than the Reservoir tank.
The new water tank would alter the visual appearance of the heritage item. Whilst it would not disrupt views towards the significant reservoir structure, it would alter the views via the additional of a new tank that is taller than its counterpart. This would impact on the item’s setting and, subsequently, its heritage significance. However, the balance tank is required in this location for engineering feasibility reasons, therefore no alternative options have been considered.

6.12.3 Mitigation Measures

General

- No further heritage assessments are required prior to the commencement of works. However, if significant design changes are made, this assessment would need to be revised.

- In the unlikely event that historical archaeological relics were discovered during ground disturbance activities, work in the immediate area would need to cease and suitably qualified archaeologist be engaged to assess the condition, extent and likely significance of the remains. Depending on the results of this assessment, OEH may need to be notified of the discovery in accordance with s146 of the Heritage Act 1977.

Wentworth Water Tower

- Provide written notice of the intention to carry out the proposed works, with a copy of this assessment, to Wentworth Shire Council in accordance with the provisions of SEPP Infrastructure 2007. Any comments received within 21 days must be taken into consideration.

Mica Street WTP and Reservoir

- In order to preserve the current heritage views towards the Mica Street Filtration Plant and Reservoir, the new terminal balance tank should be placed to the north of the current circular reservoir tank, so that significant views from the town are preserved.

- WaterNSW must provide written notice of the intention to carry out the proposed works, with a copy of this assessment, to Broken Hill City Council in accordance with the provisions of SEPP Infrastructure 2007. Any comments received from Council within 21 days must be taken into consideration.

6.13 Waste

6.13.1 Construction Impacts

The construction works would result in waste in the form of excess spoil, drill cuttings and drill mud (associated with the directional drilling), redundant infrastructure associated with the demolition of the Wentworth pumping station, cleared vegetation and general building and miscellaneous wastes such as packaging, off cuts, excess materials and workers wastes such as packaging, containers, food scraps, etc. Additional waste in the form of sewage effluent and increased food and miscellaneous waste would be produced should temporary worker campsites be established.
The exact volume of waste generated is unknown at this stage and would be detailed in the contractors waste management plan. However based on the construction methodology provided in Section 5.5 this waste generation is not expected to be excessive and can be readily managed to avoid offsite impacts.

A summary of the excess spoil likely to result from the construction works is provided in Section 5.5.7 of this REF. Based on the current concept and spoil management measures, the EPA have indicated that an EPL for the works would not be required.

The project has generally minor concrete requirements. Concrete would be used for the establishment of foundations for buildings associated with the TPSs and other buildings. It is assumed that concrete would be mixed off-site and transported to the construction areas as required. This REF has not assessed the impacts associated with a concrete batching plant.

Cleared vegetation would be temporarily stored within the construction area and used in post construction rehabilitation works to assist in the re-establishment of vegetation. Aside from noxious and environmental weeds, green waste would remain on site.

Camps would be dismantled and the site rehabilitated upon completion of the construction works.

To ensure that environmental harm does not occur as a result of uncontrolled or inappropriate collection, transport and disposal the relevant provisions of the following Acts would be implemented:

- *Waste Avoidance and Resource Recovery Act 2001*
- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Waste) Regulation 2014*

The contractor would maintain responsibility for all waste generated during the works. The waste management and contamination control procedures and/or measures listed below would be implemented.

### 6.13.2 Operational Impacts

The main waste stream identified from the operation of the project would be associated with the operation of the dosing plant, however there is insufficient detail to assess the likely waste production at this stage. Once the design of the dosing plant is finalised and the operating protocol determined, a separate environmental assessment would be undertaken.

Wastewater and sediment would result due to pipeline maintenance (pigging) and is discussed in Section 6.8.2. All wastewater and sediment resulting from pipe scouring and pigging would be captured in sedimentation lagoons (located at the TPS sites and at intermediate points along the pipeline) to and settle out the scoured water. It is likely that scoured water would be left to evaporate with the remaining sediment / sludge removed off site for disposal in accordance with the appropriate waste classification. The sedimentation lagoons are subject to detail design by the contractor and would be appropriately sized to ensure no offsite impacts, such as overflows occur.
6.13.3 Mitigation Measures

- The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated.

- Procedures should be established and detailed in the WMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the Waste Avoidance and Resource Recovery Act 2001. Namely, to:
  - Avoid unnecessary resource consumption;
  - Recover resources (including reuse, reprocessing, recycling and energy recovery); and
  - Dispose (as a last resort).

- The Waste Management Plan would also need to be consistent with the Waste Classification Guidelines (EPA, 2014) in that all waste removed from the site is to be classified and disposed of appropriately.

- No batched concrete mixing plants would be established in the works areas without first seeking approval in the form of an EPL from the EPA.

- Following completion of the works, excess concrete would be removed off-site for recycling.

- All waste removed from the site would be classified and disposed of appropriately, and all non-recyclable waste would be disposed of at an appropriate licensed waste disposal facility.

- If required only cleared fill would be used in the construction works.

- Cleared vegetation would be managed consistent with the flora and fauna assessment recommendations. Cleared vegetation would be stored temporarily adjacent to the pipeline corridor and placed over the disturbance corridor post construction.

- Surplus excavated spoil would be reused onsite as backfill or as part of the construction of other infrastructure associated with the works.

- Onsite toilets are to be adequately sized based on workforce numbers / usage.

- Onsite toilets are to be routinely pumped out and serviced.

- Should an alternative sewage treatment system be proposed for the construction workforce, this would be subject to a separate environmental assessment.

6.14 Contamination and Hazards

The Broken Hill Power Station on the corner of Galena and Mica Street, Caltex Service Station (73-87 Oxide Street) and former gasworks site are listed on the EPA Contaminated Lands Register. The Caltex Service Station is the only site subject to a current notice.
No geotechnical investigation or contamination assessment has been undertaken along the pipeline alignment within the town of Broken Hill. Lead is naturally occurring and has been mined in Broken Hill for many years and is present in the dust, soil, dirt and other surfaces throughout the town. The presence of lead dust is exacerbated by the dry climate. A detailed site contamination assessment would be undertaken by the contractor prior to construction within Broken Hill to confirm the presence of lead or other contaminants.

6.14.1 Construction Impacts

A number of hazards have been identified due to the construction of the project as listed below:

- Disturbance of lead soil / dust within Broken Hill,
- Generation of dust impacting on road users along the Silver City Highway,
- Fuel spills,
- Disturbance of hydrocarbons in the vicinity of Coombah Roadhouse, and
- General WH&S hazards associated with working in rural and remote locations such as road kill attracting predators / animals and the associated safety implications, snake bites etc.

The greatest hazard associated with the construction works is the potential to disturb lead laden soil in Broken Hill. Exposure to lead is linked with harmful health effects. Site contamination testing would be undertaken to determine the risk associated with the excavation works proposed within Broken Hill, and site specific management measures developed accordingly in line with WorkCover guidelines and regulations.

Due to the large amount of earthworks proposed adjacent to the Silver City Highway, there is the potential for dust generated from the works to obscure the vision of road users in windy conditions. As discussed in 6.6.1, dust suppression would be undertaken in conditions where dust is considered to cause a hazard or where construction activities are undertaken in fine soils (ie silty clays) or in close proximity to the road shoulder. In addition to dust suppression, the contractor would provide warning signs and reduced speed levels where required.

There is potential for contamination at the Coombah Roadhouse due to the use of the site for the storage and transfer of petroleum products. It would be necessary for the contractor to confirm the presence of contamination at the site prior to construction so that the risk of disturbing contaminated soils can be managed appropriately.

The use of only certified clean fill which meets the EPAs definition of ‘virgin excavated natural material’ (VENM) and ‘excavated natural material’ (ENM) would ensure no site contamination occurs due to the pipeline construction works.

A project specific safety plan would be developed to identify construction hazards. The identification of hazards undertaken through a risk assessment based on the final construction method.

6.14.2 Operational Impacts

The main potential hazard due to the operation of the project would be associated with the dosing plant. The design and operation of the dosing plant would be determined by the
contractor, however may involve the following chemicals to treat the raw water prior to transfer to Broken Hill; lime, poly electrolyte and possibly sodium hypochlorite. Depending on the volume of chemicals to be used, there is the potential that the dosing plant may trigger a preliminary hazard assessment (PHA) in accordance with SEPP 33. It is noted that although this proposal is not subject to the provisions of SEPP 33 as a consequence of being assessed under Part 5 of the EP&A Act, it is considered best practice to undertake a PHA if the thresholds of chemical storage are triggered. There is currently insufficient information to determine whether a PHA would be required, and if required this would need to be undertaken by the contractor.

Regardless of the type and quantity of chemicals to be used at the dosing plant, appropriate safeguards would be implemented as per all current WorkCover and National dangerous goods code. All chemicals would be transported and stored in specially designed and bunded containers. Spill mats are used on site to prevent drips or spills of chemicals entering the environment.

6.14.3 Mitigation Measures

- A detail site contamination assessment of the proposed pipeline alignment through Broken Hill should be carried out in accordance with Australian National Environment Protection Measure (NEPM) for soil contamination (NEPC 2013).

- Site contamination testing is to be undertaken in the vicinity of Coombah Roadhouse and works to be managed in accordance with recommendations.

- Site safety plan is to be developed to assess and manage all potential construction hazards, including lead dust hazards when undertaking earthworks in Broken Hill. This is to detail appropriate protective clothing requirements including AS-1716 approved respirator or face mask fitted.

- The site safety plan is to be;
  - based on a project specific risk assessment taking into account the confirmed construction method,
  - developed in accordance with all relevant WorkCover regulations and guidelines.

- Lead contaminated soil must be handled so as to minimise the release of dust.

- Dust suppression is to be used during all excavation and earthworks undertaken within Broken Hill or in areas confirmed as having lead present.

- Suitable materials as described in Section 4 of AS 3798-2007 Guideline on Earthworks for Commercial and Residential Development is to be used in the construction.

- All imported material should be validated in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM). The fill material should not contain asbestos, and not be acid sulfate soil.

- All imported fill material should be ‘virgin excavated natural material’ (VENM) and ‘excavated natural material’ (ENM), as defined in the EPA’s waste classification guidelines because of their low risk of contamination.
If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.

Flammable or combustible substances are to be kept at the lowest practicable quantity for the workplace.

6.15 Socio-Economic

A Social Impact Assessment (SIA) was prepared for this proposal by Western Research Institute (WRI) in December 2016. This report is provided in Appendix I and summarised below.

The methodology for assessment the potential social impact on the community as a result of the proposal involved:

- Development of a socio-economic profile
- Community interviews
- Economic modelling.

Community Interviews

Community interviews were undertaken in Broken Hill from 31 October through to 3 November 2016. A total of 15 interviews were undertaken from a range of community, business and government organisations to understand the social impacts of the project. These included:

- A landholder living outside of Broken Hill whose land is to be traversed by the proposed pipeline
- Maari Ma (Aboriginal health organisation) – Chief Executive Officer
- Far West Health Local Health Service – Chief Executive Officer
- Broken Hill Council – General Manager
- Broken Hill Golf and Country Club – General Manager
- Broken Hill Chamber of Commerce – Vice President
- Broken Hill Council – Environmental Officer
- Red Earth Motel – Manager
- Broken Hill Council – Councillor
- Regional Development Australia Far West – Executive Officer
- Broken Hill Environmental Lead Program – Project Manager
- Broken Hill Visitor Centre – Staff
- Former Mayor and local business owner
- Aboriginal elder and educator
- Central Broken Hill Football Club – President.
A number of phone interviews with various stakeholders in Wentworth were also undertaken.

**Economic Impact Modelling**

Economic impact modelling was undertaken based on the predicted construction costs for the project. It was assumed that ten percent (10%) of the labour cost would be sourced locally (50 percent from the Broken Hill LGA and 50 percent from the Wentworth LGA).

The economic impacts of construction were assessed at the regional level. Modelling was undertaken through input-output analysis, which provides a detailed picture of the structure of an economy at a point in time, and can be used to estimate the contribution or impact of a particular sector of the economy or an individual organisation including flow-on or multiplier effects.

**6.15.1 Socio-Economic Profile**

Development of the socio-economic profile focussed on the localities of Broken Hill (water supply) and Wentworth (water source).

**Broken Hill**

Broken Hill’s population, as at the 2011 Census, was 18,517. Projections suggest that the population will decline to about 16,150 in 2036 and that the aged (65+) population will become proportionately larger, from 22 percent of the population in 2016 to 31 percent of the population in 2036.

The Gross Regional Product (GRP) for the Broken Hill LGA in 2014-15 is estimated at $825 million.

Key employment sectors in the region are:

- Health Care & Social Assistance
- Retail
- Education
- Other mining
- Hospitality
- Personal & Other Services
- Public Administration

Over the 2011 – 2015 period the number of businesses in the Broken Hill SA2 region declined from 1,059 to 986, a decline of 73 businesses or 7 percent. Whilst there was significant growth (10) in the number of businesses in the Health Care and Social Assistance sector, most sectors saw the number of businesses decline. The five poorest performing sectors, by the number of business declines, were:

- Retail Trade - 21 businesses
- Agriculture, Forestry and Fishing - 14 businesses
- Transport, Postal and Warehousing - 12 businesses
- Administrative and Support Services - 10 businesses
- Education and Training and Rental, Hiring and Real Estate Services sectors - 8 businesses.

### 6.15.2 Construction Impacts

A preliminary estimate of $71.6 million dollars would be spent on the construction of the project in the Broken Hill and Wentworth LGAs to ensure the region’s long term water supply. This expenditure has been modelled on the assumption that has occurred evenly between the two LGAs. Information on the economic impacts of construction is provided at the combined level and at the individual LGA level below. The economic impact of this expenditure is estimated in Table 6-20.

#### Table 6-20 Combined Economic Impacts - Broken Hill and Wentworth LGAs

<table>
<thead>
<tr>
<th>Broken Hill and Wentworth LGAs</th>
<th>Output $m</th>
<th>Value Added $m</th>
<th>Income $m</th>
<th>Employment FTE jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial impact</td>
<td>34.91</td>
<td>11.56</td>
<td>6.31</td>
<td>88</td>
</tr>
<tr>
<td>Flow-on effects</td>
<td>40.65</td>
<td>15.50</td>
<td>6.60</td>
<td>96</td>
</tr>
<tr>
<td>Total Impact</td>
<td>75.55</td>
<td>27.05</td>
<td>12.91</td>
<td>185</td>
</tr>
</tbody>
</table>

Note: Totals may not sum due to rounding.

An estimated $35.8 million would be spent in the construction of the project in the Broken Hill LGA. The economic impact of this expenditure is estimated in Table 6-21.

#### Table 6-21 Broken Hill LGA Economic Impacts

<table>
<thead>
<tr>
<th>Broken Hill LGA Construction Impacts</th>
<th>Output $m</th>
<th>Value Added $m</th>
<th>Income $m</th>
<th>Employment FTE jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial impact</td>
<td>18.83</td>
<td>6.24</td>
<td>3.62</td>
<td>47</td>
</tr>
<tr>
<td>Flow-on effects</td>
<td>22.40</td>
<td>9.28</td>
<td>4.20</td>
<td>55</td>
</tr>
<tr>
<td>Total Impact</td>
<td>41.23</td>
<td>15.52</td>
<td>7.82</td>
<td>102</td>
</tr>
</tbody>
</table>

An estimated $35.8 million would be spent in the construction of the project in the Wentworth LGA. The economic impact of this expenditure is estimated in Table 6-22.

#### Table 6-22 Wentworth LGA Economic Impacts

<table>
<thead>
<tr>
<th>Wentworth LGA Construction Impacts</th>
<th>Output $m</th>
<th>Value Added $m</th>
<th>Income $m</th>
<th>Employment FTE jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial impact</td>
<td>16.08</td>
<td>5.32</td>
<td>2.69</td>
<td>41</td>
</tr>
<tr>
<td>Flow-on effects</td>
<td>18.25</td>
<td>6.22</td>
<td>2.41</td>
<td>42</td>
</tr>
<tr>
<td>Total Impact</td>
<td>34.33</td>
<td>11.54</td>
<td>5.09</td>
<td>83</td>
</tr>
</tbody>
</table>

Note: Totals may not sum due to rounding.

It expected that the construction of the project would have significant positive economic impacts on the economies of the Broken Hill and Wentworth LGAs. Based on a number of
assumptions, it has been estimated that the region would benefit by an additional $75.5 million in output, $15.5 million in value added, 12.9 million in household income and 185 FTE jobs during construction.

6.15.3 Operational Impacts

The main socio-economic benefit due to the operation of the project would be the provision of a secure water supply for Broken Hill and the surrounding communities. There are a number of positive flow-on benefits associated with a reliable water supply and these were captured during the community interviews undertaken as part of the social impact assessment and are discussed below.

The overwhelming feedback from the community engagement undertaken as part of this project was the expectation of strong positive impacts through securing the town water supply in Broken Hill. Issues experienced in recent years brought on by the lack of water security and poor water quality were seen as having a range of negative social, health, land use, employment and economic impacts. Resolving these issues by delivering a secure supply of water was seen as having many positive impacts.

The main negative impact to arise from the SIA and community interviews was the perceived impact which the project may have on the management of the Menindee Lakes Scheme, in that by securing the town water supply through the implementation of the project, authorities would then manage the Menindee Lakes in a way which was seen to be detrimental to the local population and economy. Whilst the management of the Menindee Lakes is considered a separate issue from the project, it was a consistent issue of concern raised by the community.

Foundational Need

The community expressed the obvious and powerful message that water is a fundamental need of human occupation. A secure town water supply is perhaps even more of a necessity in an arid region, without nearby natural water sources.

Social Impacts

Positive social impacts were expected from securing Broken Hill’s water supply through mitigating community friction over water issues and providing for greater social cohesion. Recent water restrictions were felt to have had negative social impacts, as community members have been forced to deal with the issue of scarcity and tightening water management rules. Access to secure water would create a more cohesive community, by allowing for common recreational activities, such as swimming and relaxing in recreational water spaces, and allowing for sporting and other community events utilising green spaces.

A clear message received throughout community interviews was that resolving water security and quality issues would increase general wellbeing in a myriad of ways. Many people are no longer drinking tap water because they thought it tasted like ‘dirt’. Community feedback suggested that water security and quality issues are having significant social/personal impacts. Many of these have no monetary value and may be experienced as stress, discontent or come at a financial cost. It is clear from this feedback that greater water security and quality would make a very real impact on the quality of life for Broken Hill residence in many small ways.
Health Impacts

A more secure water supply has potential impacts on health and health administration in the region. Broken Hill is dealing with environmental and legacy industrial issues that have resulted in heightened blood lead levels for a significant portion of the population. These issues are the focus of the Broken Hill Environmental Lead Program. Creating green spaces and hosing down household/outside areas is an important part of the blood lead level mitigation strategy to contain child blood lead levels. Other health impacts were linked to low water security and poor water quality, including mental health issues and skin problems.

Furthermore, these issues have had real and potential impacts on the administration of public health in the region. For example, water issues have increased operational costs for the Far West Local Health Service, who had to install a reverse osmosis water treatment plant to combat water quality issues. The potential impact of water issues leading to a smaller population also threatens the ongoing operations of the Local Health Service, which is dependent on a minimum population for their operations to be economic. If the population was to fall below the 15,000 threshold, it is likely that these services would be amalgamated into another region, or ceased altogether.

General Land Use and Amenity

The project was also seen as having positive impacts on a number of general land use and amenity issues. The principal impact of securing the Broken Hill water supply is that it would assist to regenerate green spaces, allowing for greater amenity with private gardens and public spaces such as sports fields, public parks and road sides to be watered and looking green and well kept. A further issue related to the ability of households to fill pools, which can assist in providing recreation and alleviating the hot and arid weather. Mitigating these issues was seen as an important way to increase the amenity of living in an arid climate, with positive impacts on wellbeing.

Economic Impacts

The economy was also seen as a very significant beneficiary of securing the local water supply. Again, interviews highlighted that access to water is a foundational need for businesses. Water is required for their operations and more widely, water is necessary to sustain the populations that these businesses serve. The impact of water supply on local business was summed up by one interviewee, saying that “It’s simple, you need to be able to turn the tap on and get water”.

It was also found that businesses are impacted by water quality. Business infrastructure has been deteriorating at a faster rate due to corrosion and mineral build-up, leading to higher business costs. Similarly, other business costs have been rising, with one anecdote from an accommodation provider that they are spending significantly more on cleaner’s wages and cleaning products to manage water based mineral build up on bathroom services.

In addition to higher costs, tourism businesses have experienced lower levels of revenue due to water security and quality issues, owing to significant coverage of negative water issues in the media and on social media. It was felt that this coverage has prevented visitors from coming to the region.
An interview with staff from the Broken Hill Visitor Information Centre highlighted that they had fielded in excess of 130 calls from concerned travellers, who wanted to know if there was sufficient water in Broken Hill for them to visit and if they needed to bring water with them. Whilst some of these concerns were ameliorated over the phone, it was believed that a significant number of potential visitors did not call and chose not to come, with impacts on the tourism revenues being generated in the region. For some tourism businesses, there has been a more direct impact of water issues, with the local golf course suffering declining patronage and revenues due to water issues impacting on the quality and availability of their greens and fairways.

**Employment**

The impact of water issues on businesses also has a direct link to employment in Broken Hill. The extent to which water security and quality issues impact on businesses is reflected in employment. Anecdotal evidence found that the mining and health sectors are heavily dependent on having access to water and that these industries employ in excess of 1,500 people in Broken Hill, directly and indirectly. Securing the local water supply would assist these industries to remain major employers and contributors to employment in the region.

**Water Pricing**

If the issue of water pricing can be managed, it is likely that the project would have a strong positive social impact on the region.

**Downstream Water Users**

The project would operate within the provisions of the NSW Murray and Lower Darling Regulated Rivers WSP which has been developed in line with the MDBA Basin Plan. The WAL would be purchased from the water market and therefore the volume would be within the overall water allocation and cap as defined for the water catchment. In addition, there are expected to be some water savings through surrendering the Essential Water's existing WAL (for 10 GL per annum) on the Lower Darling water source.

The volume of water extracted at the new intake on the River Murray is considered to be insignificant in terms of flows for human and environmental use.

### 6.15.4 Mitigation Measures

- Clear communication to the community with respect to water pricing.
- Ongoing communication of water management associated with the Menindee Lakes scheme, particularly in how it relates to recreational access.

### 6.16 Visual Impacts

#### 6.16.1 Construction Impacts

There would be minor visual impacts during construction of the project due to the presence of construction equipment. Whilst some limited infrastructure associated with the project would be located within the urban areas of Wentworth and Broken Hill (less than 5 km of pipeline), the majority of the works would be in remote locations isolated from residential areas or other sensitive receptors. Visual impacts would generally only occur for short periods at any one location along the pipeline alignment as construction progresses, with somewhat longer construction durations at the aboveground
infrastructure sites (including potential construction camps at TPS2 and TPS3; however much of the aboveground infrastructure is also located in remote areas.

There would also be a visual impact within vegetated areas from a cleared easement used to construct the pipeline. However, over time the width of the easement would decrease as vegetation regenerates and any ongoing/maintained clearing would be restricted to that required for pipeline maintenance purposes. Overall, it is considered that there would not be a significant visual impact on the community due to construction works, with all areas of disturbance to be restored post construction.

6.16.2 Operational Impacts

Visual impacts during operation of the project would be associated with the permanent aboveground components of the scheme, taking into account the buried nature of the pipeline. The new above ground components would include;

- River Murray intake and associated infrastructure (pump building and switch room) to be contained on the council owned lot,
- Dosing plant and TPS 1,
- TPS2 and TPS3 and associated infrastructure (lagoons, PV cells and balance tanks),
- Bulk water storage
- Terminal balance tank at the Mica Street WTP
- Air valves, scour values along pipeline, which could extend approximately 300 mm above ground.

The exact size and scale (including height) of the new infrastructure is currently unknown and subject to detailed design.

With the exception of the River Murray intake, the project would result in the introduction of the new infrastructure in a flat and generally sparcely vegetation setting and would therefore be a noticeable new addition to the landscape. However due to the largely remote and rural setting, visual impacts would be limited to local landowners and users of the Silver City Highway. Significant operational visual impacts are not anticipated.

The new Murray River intake structure would be located on the existing council pump station site and would therefore be consistent with the current visual environment. Only limited tree clearing is proposed at this location. Visual impacts from the project on the Wentworth Water Tower and Mica Street WTP and Reservoir heritage items have been assessed in Section 6.12.2 of this REF. The HIS undertaken for the project has concluded that the River Murray intake would not obstruct or minimise the significant visual setting of the Wentworth Water Tower and that whilst the new terminal balance tank at the Mica Street WTP would alter the visual appearance of the nearby heritage listed reservoir, it would not have a significant visual impact.

6.16.3 Mitigation Measures

- The design and layout of the new infrastructure associated with the River Murray to Broken Hill Pipeline Project is be undertaken to minimise visual impacts.
Post construction landscaping is to be undertaken at the dosing plant, bulk water storage and TPS sites to screen the infrastructure and minimise visual impacts.

6.17 Cumulative Impacts

6.17.1 Construction Impacts
The construction of the project would coincide with the construction and installation of the power supply for the project which would result in additional impacts, including increased traffic and noise, over the 14 month construction period. Traffic and noise estimations for the construction of the power supply infrastructure are unknown, however it is expected to require less labour and construction equipment than that predicted for the River Murray to Broken Hill pipeline project. It is acknowledged that some cumulative impacts would be expected due to some overlap in construction of the two projects; however this is not expected to be significant, with construction works for power supply predicted to be of lesser duration and intensity than the River Murray to Broken Hill pipeline project.

6.17.2 Operational Impacts
The main operational impact from the project would primarily relate to extraction of water from the river at a new extraction point; however the new WAL would be sourced from the NSW water market and would therefore operate within the provisions of the NSW Murray and Lower Darling Regulated Rivers WSP which has been developed in line with the MDBA Basin Plan. The extraction volume would be within the overall water allocation and cap as defined for the water catchment. The operation of the River Murray to Broken Hill Pipeline Project is not expected to result in adverse impacts to the Menindee Lakes system of flows in the Darling River and therefore there would be no cumulative adverse impact on this natural resource.

6.17.3 Mitigation Measures
No mitigation measures have been identified.
7 Environmental Management

7.1 Construction Environmental Management Plan

Under the State Government’s policy to improve the performance of the NSW construction industry, preparation of a CEMP is mandatory for all projects undertaken by or on behalf of government agencies or where funding is being provided by the government. The Construction Policy Steering Committee and the (former) Department of Infrastructure Planning and Natural Resources have produced Environmental Management System and EMP Guidelines which aim to assist contractors both in complying with the Government’s policy and in demonstrating that compliance. The environmental management objectives and supporting actions presented in this section are intended to assist in this process.

The CEMP would also provide details on monitoring and verification for all identified mitigation measures. WaterNSW would review and endorse the CEMP before construction commences.

The CEMP would generally conform to the structure shown in Table 7-1.

Table 7-1 General CEMP Structure

| Background | Introduction to the document  
| Environment Management | Description of the proposal and project details  
| | The context for the CEMP in regards to the overall project  
| | The CEMP objectives  
| | The contractor’s environmental policy  
| Environmental Management | Environmental management structure of the organisation and specific team responsibilities with respect to the CEMP and its implementation  
| | Approval and licensing requirements relevant to the project  
| | Reporting requirements  
| | Environmental training  
| | Emergency contacts and response  
| Implementation | A project specific risk assessment  
| | A detailed list of environmental management safeguards and controls  
| | CEMP sub plans for specific environmental controls  
| | A detailed schedule assigning responsibility to each environmental management activity and control  
| Monitor and Review | Environmental monitoring  
| | Environmental auditing  
| | Corrective action  
| | CEMP review and document control procedures |
The CEMP would include a risk assessment which ensures that the safeguards identified in this REF, as well as any others that are considered relevant or are conditions of approvals issues by government agencies, are effectively translated into actual construction techniques and environmental management activities, controls and monitoring/verification to prevent or minimise environmental impacts. The CEMP would also identify the requirements for compliance with relevant legislation and other regulatory requirements to ensure environmental safeguards described throughout this REF are implemented. The environmental management objectives and supporting actions presented in this section are intended to assist in this process.

7.2 Environmental Management Measures

The following details the environmental objectives during construction and the proposed mitigation to be included in the CEMP. This list is not definitive, and additional measures detailed as part of the determination of the project and conditions of any other approvals must also be included.

Operational safeguards are also listed for incorporation into an Operational Environmental Management Plan for the project.

Implementation of the mitigation measures outlined below would be undertaken during a number of phases of the project. These phases comprise:

1. Detailed design – refinement of the design details
2. Pre-construction – prior to the contractor arriving on site to carry out the works
3. Construction – during construction phase
4. Operation – post construction

7.2.1 Land Use

Objective
- Minimise impacts to surrounding land users during construction and operation

Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Design</td>
<td>Contractor</td>
</tr>
<tr>
<td>Where possible, air valves and scour valves shall be located in areas where disturbance to existing land or land use is minimised</td>
<td>Contractor</td>
</tr>
<tr>
<td>Pre-Construction</td>
<td></td>
</tr>
<tr>
<td>Any works proposed outside the areas indicated in Table 6-1 would be subject to further environmental assessment in accordance with Part 5 of the EP&amp;A Act.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Consultation is to be maintained with RMS during the detailed design process, particularly in relation to;</td>
<td></td>
</tr>
<tr>
<td>- the height and size of the TPS infrastructure</td>
<td></td>
</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>• lighting proposed at the TPS sites</td>
<td>WaterNSW/ Contractor</td>
</tr>
<tr>
<td>• temporary access point locations and spacings as required for the pipeline construction</td>
<td>WaterNSW/ Contractor</td>
</tr>
<tr>
<td>• confirmation of ongoing maintenance access requirements for the pipeline and whether any temporary access points are to be used permanently.</td>
<td>WaterNSW/ Contractor</td>
</tr>
</tbody>
</table>

All necessary approvals are to be obtained and access arrangements / agreements confirmed prior to commencement of construction activities (including site establishment, tree clearing, stockpiling etc).

Consultation would be undertaken with Wentworth Shire Council regarding construction works for the River Murray intake, to identify safeguards required to address potential impacts on public use of the Two Rivers Ski and Recreation Reserve. These safeguards, which would include appropriate measures to ensure the safety of the general public and minimise impacts/disruptions to public use of this site during construction, would be documented in a CEMP prior to construction commencing.

Negotiations would be undertaken with affected landowners where access to private land is impacted (ie across driveways / access points). The outcomes of any access arrangements would be documented in a CEMP prior to construction commencing.

Navigation markers would be installed near the intake site in accordance with RMS requirements to warn those using the waterway of the exclusion zone around the construction site.

Adjoining landowners should be notified about the proposed works at least 14 days prior to the commencement of works onsite.

**Construction**

Ensure the necessary care and maintenance of property facilities and operations including fences, gates and stock. However, if any damage did occur to property it would be restored to a condition equivalent to the original condition. Temporary fencing and gates would be installed where necessary to exclude animals (stock and ground dwelling native fauna) from the work sites. Any temporary fencing or gates no longer required would be removed at the completion of the construction works.

Sufficient closure and or barricading of the area is to be in place for the duration of the construction works.

No works outside standard construction hours detailed in the ICNG would occur within the Wentworth and Broken Hill townships, Coombah Roadhouse or in the vicinity of Red Earth Motel or
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willowbend Caravan Park at Wentworth.</td>
<td></td>
</tr>
<tr>
<td>Provide a 24-hour telephone number so that any issues / complaints during</td>
<td>Contractor</td>
</tr>
<tr>
<td>construction can be recorded and appropriately dealt with.</td>
<td></td>
</tr>
<tr>
<td>All areas impacted by the works are to be rehabilitated in accordance with</td>
<td>Contractor</td>
</tr>
<tr>
<td>a site specific rehabilitation management plan.</td>
<td></td>
</tr>
<tr>
<td><strong>Rail Corridor</strong></td>
<td>Contractor</td>
</tr>
<tr>
<td>Approval is required from ARTC prior to any works within the ARTC rail</td>
<td></td>
</tr>
<tr>
<td>corridor. The pipeline would be designed to ensure it is consistent with ARTC</td>
<td></td>
</tr>
<tr>
<td>engineering requirements.</td>
<td></td>
</tr>
<tr>
<td>The construction methodology would be consistent with ARTC requirements for</td>
<td></td>
</tr>
<tr>
<td>works within the rail corridor ensuring the safety of construction and rail</td>
<td></td>
</tr>
<tr>
<td>personnel.</td>
<td></td>
</tr>
<tr>
<td>• A spotter will be required to monitor any works within the rail corridor</td>
<td></td>
</tr>
<tr>
<td>to ensure no interference or damage to rail infrastructure occurs and to</td>
<td></td>
</tr>
<tr>
<td>monitor train movements. ARTC requires this to be a contract obligation.</td>
<td></td>
</tr>
<tr>
<td>• Works within the rail corridor are to occur in accordance with AS 4799 -</td>
<td></td>
</tr>
<tr>
<td>*Installation of underground utility services and pipelines within railway</td>
<td></td>
</tr>
<tr>
<td>boundaries* and ARTC compliance document ETG1701</td>
<td></td>
</tr>
<tr>
<td>• Any geotechnical investigations within the rail corridor must be kept a</td>
<td></td>
</tr>
<tr>
<td>minimum distance from the track as agreed with ARTC.</td>
<td></td>
</tr>
<tr>
<td><strong>Post Construction and Operation</strong></td>
<td></td>
</tr>
<tr>
<td>Post construction landscaping is to be undertaken at the dosing plant and</td>
<td>Contractor</td>
</tr>
<tr>
<td>TPS sites to screen the infrastructure and minimise visual impacts.</td>
<td></td>
</tr>
<tr>
<td>Adequate procedures must be established and detailed in the OEMP, including</td>
<td>Scheme Operator</td>
</tr>
<tr>
<td>notification requirements to EPA, for incidents that cause material harm to</td>
<td></td>
</tr>
<tr>
<td>the environment.</td>
<td></td>
</tr>
<tr>
<td>The OEMP is to detail consultation requirements with ARTC, DPI Fisheries,</td>
<td>Scheme Operator</td>
</tr>
<tr>
<td>Essential Water and other relevant stakeholders.</td>
<td></td>
</tr>
</tbody>
</table>

7.2.2 **Traffic and Access**

**Objective**

- Ensure that construction vehicles do not cause excessive inconvenience to road and pedestrian users.
- Ensure the safety of road users and construction personnel for the duration of the works.
Minimise the pollution impacts resulting from the use of vehicles during construction.

Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Construction</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

A comprehensive Construction Traffic Management Plan (CTMP) would be prepared and would detail appropriate construction traffic controls and management measures and all aspects would be implemented in co-ordination with the relevant local Councils and RMS. The CTMP is to be prepared in accordance with:

- Traffic Control at Work Sites Manual, Issued December (RTA, 2010), and

The CTMP is to include, but not be limited to, provisions for the following:

- Scheduling of transport deliveries outside peak background travel periods and outside school zone periods.
- Undertaking community consultation before and during all transport and haulage activities, including contact details to ensure community concerns are logged and addressed.
- Upgrading road infrastructure including surface treatment and/or stabilisation of unsealed road sections, if required.
- Managing transport operations including provision of warning and guidance signage, traffic control devices, temporary construction speed zones and other temporary traffic control measures.
- Compliance with a ‘Transport Code of Conduct’ for all staff and contractors detailing designated transport routes, road behavioural requirements, speed limits, etc.
- All heavy vehicles shall travel along the nominated transport routes.
- All heavy vehicles shall travel within daylight hours, where practicable.
- Mud and other debris shall be removed from the wheels and bodies of construction vehicles and equipment prior to leaving the project site and before entering the sealed public road network.
- Consideration of property accesses that have sub-standard sight distances onto the road network due to tight horizontal and vertical road alignments.
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consideration of adverse traffic conditions on the road network due to dust, sun glare, etc.</td>
<td></td>
</tr>
<tr>
<td>• Consideration of surrounding stock crossings and the potential for stock and/or native fauna on the road network.</td>
<td></td>
</tr>
<tr>
<td>• Procedure to monitor traffic impacts and respond to impacts rapidly.</td>
<td></td>
</tr>
<tr>
<td>Prepare road dilapidation reports covering pavement, drainage and bridge structures in consultation with relevant road authorities for all of the proposed transport routes before and after construction. Any damage resulting from construction traffic, except that resulting from normal wear and tear, would be repaired to pre-existing conditions.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Prior to the commencement of construction the contractor shall provide plans and supporting documentation of proposed construction workers’ camps to RMS for comment.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

### Post Construction and Operation

At the completion of the project, the contractor shall provide Works-As-Executed plans to RMS, Wentworth Shire Council and Broken Hill City Council indicating final levels, distances and location of the pipeline and associated infrastructure.  
Establish a procedure to ensure the ongoing maintenance of the internal on-site access roads and access points during the operation phase. This maintenance may include sedimentation and erosion control structures, where necessary.  

### 7.2.3 Noise

#### Objective

- Compliance with relevant recommendations specified in the *Interim Construction Noise Guideline* (DECC, 2009).
- Avoidance/minimisation of noise impacts on nearby sensitive noise receivers.

#### Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Detailed Design</td>
<td>Contractor</td>
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</tbody>
</table>

Once the actual details of the pumping stations are finalised, assistance of an acoustic consultant should be sought during the detailed design stage of the project. The design of the pumping stations and dosing plant are to achieve operational noise level of 35
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB(A) as per the INP.</td>
<td></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>Contractor</td>
</tr>
<tr>
<td>Implement community consultation measures including a Community Liaison Plan to inform the community of construction activity and potential impacts</td>
<td>Contractor</td>
</tr>
<tr>
<td>All employees, contractors and subcontractors are to receive a project induction. The environmental component may be covered in toolbox talks and should include:</td>
<td>Contractor</td>
</tr>
<tr>
<td>• all relevant project specific and standard noise mitigation measures as detailed in a project specific construction noise and vibration management plan prepared by the contractor;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• relevant licence and approval conditions;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• permissible hours of work;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• any limitations on high noise generating activities;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• location of nearest sensitive receivers;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• construction employee parking areas;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• designated loading/unloading areas and procedures;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• site opening/closing times (including deliveries); and</td>
<td>Contractor</td>
</tr>
<tr>
<td>• environmental incident procedures.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Avoid swearing or unnecessary shouting or loud stereos/radios on site.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Avoid dropping of materials from height where practicable, throwing of metal items and slamming of doors.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All construction machinery is to be turned off when not in use.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Noise monitoring should be considered for the duration of the works in urban areas or where sensitive receptors (including the Wentworth District Hospital, Broken Hill High School and Broken Hill Primary School) have been identified.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Works outside the standard construction hours defined in the ICNG are only to occur outside the town boundaries of Wentworth and Broken Hill</td>
<td>Contractor</td>
</tr>
<tr>
<td>Work generating high noise levels should be scheduled during less sensitive time periods if practicable (such as outside of school hours in the vicinity of Broken Hill High School and Broken Hill Primary</td>
<td>Contractor</td>
</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Noise generating activities with impulsive, tonal or low frequency characteristics (such as rock breaking, etc) should only be carried out:</td>
<td>Contractor</td>
</tr>
<tr>
<td>• in continuous blocks, up to but not exceeding 3 hours each; and</td>
<td></td>
</tr>
<tr>
<td>• with a minimum respite period of one hour between each block.</td>
<td></td>
</tr>
<tr>
<td>Use quieter and less noise emitting construction methods where feasible and reasonable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All plant and equipment to be appropriately maintained to ensure optimum running conditions, with periodic monitoring.</td>
<td>Contractor</td>
</tr>
<tr>
<td>The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the applicable criteria (provided in Table 6-8).</td>
<td>Contractor</td>
</tr>
<tr>
<td>Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be limited/avoided where possible.</td>
<td>Contractor</td>
</tr>
<tr>
<td>The offset distance between noisy plant and adjacent sensitive receivers is to be maximised where practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Plant used intermittently to be throttled down or shut down when not in use where practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Noise-emitting plant to be directed away from sensitive receivers where possible.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site for periods of over two months where practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All deliveries to occur during standard construction hours where practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Where reasonable and feasible, use structures to shield residential receivers from noise such as:</td>
<td>Contractor</td>
</tr>
<tr>
<td>• site shed placement;</td>
<td></td>
</tr>
<tr>
<td>• earth bunds;</td>
<td></td>
</tr>
<tr>
<td>• temporary or mobile noise screens (where practicable)</td>
<td></td>
</tr>
<tr>
<td>• enclosures to shield fixed noise sources such as pumps,</td>
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</tbody>
</table>
### Action/Phase

- compressors, fans etc (where practicable); and
  - consideration of site topography when siting plant.

<table>
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<th>Responsibility</th>
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<tr>
<td>Contractor</td>
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</table>

High noise generating plant and equipment, such as rock hammers, should be used only when required (if hard rock is encountered) during construction of the pipeline alignment in suburban areas in Wentworth and Broken Hill.

<table>
<thead>
<tr>
<th>Responsibility</th>
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<tr>
<td>Contractor</td>
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</table>

Where potential noise impacts are predicted to be up to 15 dB(A) above the noise management level (as presented in Table 4.11 and Table 4.12 of the noise assessment in Appendix G), reasonable and feasible noise reduction measures should be investigated. When possible, the operation of all equipment and mechanical plant simultaneously should be avoided.

<table>
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<tr>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Contractor</td>
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</table>

Where potential noise impacts are predicted to be more than 15 dB(A) above the noise management levels (as presented in Table 4.11 and Table 4.12 of the noise assessment in Appendix G), all reasonable and feasible noise control measures should be implemented prior to the commencement of construction works. Noise levels during construction should be monitored when required (eg. to address complaints) and where exceeded, further noise reduction measures (where reasonable and feasible) should be implemented eg. restrict working hours, use silencing equipment, etc.

<table>
<thead>
<tr>
<th>Responsibility</th>
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<tr>
<td>Contractor</td>
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</table>

A management procedure should be implemented to deal with vibration complaints. Each complaint should be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures should be put in place to mitigate future occurrences.

<table>
<thead>
<tr>
<th>Responsibility</th>
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<tr>
<td>Contractor</td>
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</table>

Where vibration is found to be excessive (above the criteria in Table 6.8), management measures should be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller equipment, establishment of safe buffer zones, and if necessary, time restrictions for the most excessive vibration activities. Time restrictions are to be negotiated with affected receivers.

<table>
<thead>
<tr>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Contractor</td>
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</table>

Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to their commencement of site operation to determine acceptable buffer distances to the nearest affected receiver locations.

<table>
<thead>
<tr>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Contractor</td>
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</table>

The contractor is to undertake a risk assessment to identify buildings and structures that have the potential to be affected by vibration and then undertake the dilapidation survey as required. These surveys

<table>
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<tr>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Contractor</td>
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</tbody>
</table>
are used to address potential community concerns that perceived vibration may have caused damage to property.

**Operation**

Noise verification is to be undertaken at the dosing plant and River Murray Intake to ensure compliance with the INP (noise emission not greater than 35 dB(A)).

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

### 7.2.4 Air Quality

**Objective**

- Avoidance/minimisation of off-site dust nuisance to neighbouring land uses and the community.
- Minimisation of air quality impacts resulting from machinery and vehicle emissions.

**Actions**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Construction</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

Vehicles and equipment are to be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period. The excessive use of vehicles and powered construction equipment is to be avoided.

**Construction**

| A specific Air Impact Management and Monitoring Plan is to be developed by the contractor and incorporated into the CEMP. The Plan is to be developed in reference to the document *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). | Contractor |
| All reasonable and feasible measures would be undertaken to minimise dust impacts from the construction works, with a particular focus on identified sensitive areas, these being; the communities of Broken Hill and Wentworth, the Coombah Roadhouse, road users and waterways. | Contractor |
| The Air Impact Management and Monitoring Plan is to be based on the available geotechnical information to target areas at higher risk of dust generation. | Contractor |
Existing climate and conditions should be evaluated to determine the most appropriate dust suppression methodology, having regard to limited water resource availability in dry climates or drought conditions.

No works are to be undertaken during extremely windy conditions or when dust has the potential to be a hazard to road users (such as through poor visibility) unless dust can be adequately suppressed.

Dust suppression is to be undertaken in sensitive areas including within the towns of Wentworth and Broken Hill, in the vicinity of the Coombah Roadhouse and near watercourses.

Potential dust impacts would be managed by limiting the area of bare ground exposed at any one time (such as through progressive land clearing). Sediment and erosion control measures are to be installed prior to the use of water carts in the vicinity of waterways / drainage lines.

The time that trenches are left open during the pipeline laying works should be minimised as far as practicable.

Any stockpiled spoil/fill is to be protected to minimise dust generation.

Exposed surfaces would be progressively stabilised as soon as practicable.

Construction vehicles and equipment are to be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period. The excessive use of vehicles and powered construction equipment is to be avoided.

All construction machinery is to be turned off when not in use to minimise emissions.

Vehicles transporting spoil from the project sites are to be covered.

7.2.5 Topography, Soils and Geology

Objective

- To effectively manage sediment and erosion control during the construction stage of the project.
- To minimise impacts to sensitive environments
## Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Construction</strong></td>
<td></td>
</tr>
<tr>
<td>Construction contractor is to define likely annual water requirements within the CEMP and work with Essential Water to ensure water consumed for construction is available within Essential Water's water allocation.</td>
<td>Contractor</td>
</tr>
<tr>
<td>A detailed Soil and Water Management Plan (SWMP) will be prepared as part of the CEMP. The SWMP would describe the site specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication <em>Managing Urban Stormwater: Soils and Construction, 4th edition</em> (“The Blue Book”) and Volume 2a Installation of Services.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
| The SWMP would to be site specific and developed on a risk based approach to address the following issues with the aim to minimise erosion, sediment loss and water quality impacts:  
  - Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas.  
  - Minimisation of disturbance to soil and water adjacent to, and within, all sensitive areas (refer to Figure 6.6) and watercourses in the works area.  
  - Identification of site specific sediment and erosion control measures wherever erosion is likely to occur such as across slopes, around stockpiles and storage areas and near natural drainage lines and waterways. | Contractor |
<p>| A site specific spill management plan would be prepared. | Contractor |
| Workers would be trained in the spill management plan and the use of the spill kits. | Contractor |
| <strong>Construction</strong>      |                |
| Requirements for vegetation clearing to be kept to a minimum required to construct the works. Consideration is to be given to vegetation slashing as the preferred construction methodology where possible. | Contractor |
| Vegetation removal to be undertaken in stages in line with the pipeline laying activities. | Contractor |
| Backfilling of trenches once pipelines are installed to be undertaken as soon as practicable. | Contractor |</p>
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Deep ripping to be implemented as the preferred site stabilisation method.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Construction compounds to be located at least 50 m from any drainage lines.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Stockpiles to be located at least 50 m away from any drainage lines.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All erosion and sediment controls would be regularly inspected and maintained, especially when rain is expected and directly after any rain events.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Excavated spoil will be temporarily stockpiled on flat, cleared land where possible and would be backfilled as soon as practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All areas where ground disturbance has occurred would be stabilised following completion of works to minimise the erosion hazard. This would involve, where required, re-application of topsoil excavated from the site and deep ripping, to facilitate the natural re-establisment of vegetation cover.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Any excess spoil would either be spread across the ground in nearby areas in such a manner as to avoid creating an erosion hazard, or removed off site for disposal in accordance with relevant EPA requirements.</td>
<td>Contractor</td>
</tr>
<tr>
<td>The contractor is to identify areas where saline soils are present (in reference to the geotechnical report) and outline recommended management measures that should be adopted during construction and reinstatement to maximise land management and rehabilitation outcomes, this should include;</td>
<td>Contractor</td>
</tr>
<tr>
<td>• minimise disturbance of saline soils;</td>
<td></td>
</tr>
<tr>
<td>• ensuring saline soils are keep stockpiled separately and protected from runoff;</td>
<td></td>
</tr>
<tr>
<td>• monitoring should be undertaken to ensure that rehabilitation in suspected saline soil areas is successful.</td>
<td></td>
</tr>
</tbody>
</table>

### 7.2.6 Surface and groundwater

#### Objective

- To effectively manage sediment and erosion control during the construction stage of the project.
- To minimise impacts to sensitive environments
- Prevention/minimisation of impacts to nearby waterways during the construction works.
## Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td><strong>Pre-Construction</strong></td>
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<tr>
<td><strong>Construction</strong></td>
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<tr>
<td>Procedures are to be detailed in the CEMP, including notification requirements to the EPA for incidents that cause material harm to the environment.</td>
<td></td>
</tr>
<tr>
<td>Construction contractor is to define likely annual water requirements within the CEMP and work with Essential Water to ensure water consumed for construction is available within Essential Water’s water allocation.</td>
<td></td>
</tr>
<tr>
<td>Compaction relief shall be undertaken, as required, by ripping or scarifying soils along the contours.</td>
<td></td>
</tr>
<tr>
<td>The pipeline corridor shall be re-profiled to original or stable contours, re-establishing surface drainage lines and other land features</td>
<td></td>
</tr>
<tr>
<td>Erosion and sediment control measures are to be documented in the SWMP and are be installed and maintained as necessary to manage the disturbed area.</td>
<td></td>
</tr>
<tr>
<td>All fuels and combustible liquids would be managed and handled in accordance with AS 1940 <em>The storage and handling of flammable liquids</em>, the WH&amp;S Act and Regulation and the <em>Storage and Handling of Dangerous Goods – Code of Practice 2005</em> (WorkCover 2005).</td>
<td></td>
</tr>
<tr>
<td>A site specific spill management plan would be prepared and include the following requirements:</td>
<td></td>
</tr>
<tr>
<td>• Emergency spill kits are to be kept at the site (vehicle kits).</td>
<td></td>
</tr>
<tr>
<td>• Refuelling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan.</td>
<td></td>
</tr>
<tr>
<td>• Fuels, lubricants and chemicals, including drilling fluids, shall be stored and, where practicable, handled within containment facilities such as bunded areas designed to prevent the release of spilled substances to the environment and capable of storing 120% of the volume of material stored there.</td>
<td></td>
</tr>
<tr>
<td>• Bunded areas are to be at least 50 m from any waterway or drainage line.</td>
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<tr>
<td>• Workers would be trained in the spill management plan and the</td>
<td></td>
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<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
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</tr>
<tr>
<td>use of the spill kits.</td>
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</tr>
<tr>
<td>• All concrete washout water and solids are to be collected and retained in leak proof containers and disposed of in accordance with the Waste Classification Guideline 2014.</td>
<td></td>
</tr>
<tr>
<td>• Collected concrete washout water and solids are to be recycled.</td>
<td></td>
</tr>
<tr>
<td>In the event of flooding being predicted, construction works in affected areas would cease prior to the flood events and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.</td>
<td></td>
</tr>
<tr>
<td>The design and construction of the river/creek crossings would include measures to ensure that:</td>
<td></td>
</tr>
<tr>
<td>• Geomorphology and hydraulics are not affected.</td>
<td></td>
</tr>
<tr>
<td>• Bed levels or profile will not be altered.</td>
<td></td>
</tr>
<tr>
<td>• Pre-stripping and stockpiling of topsoil and bed material (for creek crossings) will be stored separately above the bank and where required stormwater diversion drains are to be placed near to the top of the banks. Bed sediment will be put back on top of the pipeline trench to match the existing bed levels.</td>
<td></td>
</tr>
<tr>
<td>• All necessary erosion protection measures are in place during construction and thereafter for each crossing.</td>
<td></td>
</tr>
<tr>
<td>Watercourse crossings, including temporary access tracks, are to be at right angles to the direction of water flow to minimise scour potential.</td>
<td></td>
</tr>
<tr>
<td>Crossing sites to be selected to avoid unstable banks, bends in the channel, deep pools, and confluences with other channels.</td>
<td></td>
</tr>
<tr>
<td>The quality of water discharged from the cofferdam associated with the River Murray Intake is to be monitored and if necessary treated to ensure compliance with Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).</td>
<td></td>
</tr>
<tr>
<td>All water discharges are to be consistent with s120 of the POEO Act.</td>
<td></td>
</tr>
<tr>
<td>A directional drilling management plan is to be developed as part of the CEMP to detail the appropriate management of drilling slurry so as to avoid off site impacts. This is to include details for the management, treatment and disposal of drilling chemicals.</td>
<td></td>
</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
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<tr>
<td>Drilling fluids are to be contained within the fluid circulation system (ie mud tanks) during the directional drilling works.</td>
<td></td>
</tr>
<tr>
<td>Drilling fluids are to be recycled where practicable or disposed of in accordance with the waste classification (EPA guidelines).</td>
<td></td>
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<table>
<thead>
<tr>
<th>Operation</th>
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<tbody>
<tr>
<td>Contractor is responsible for obtaining all necessary approvals and consents to discharge water during pipeline testing and commissioning.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Pipe scouring and pigging procedures and management controls are to be documented in an operational management plan developed for the project.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Effective and suitably-sized scour protection must be in place when actively releasing water from scour valves.</td>
<td>Contractor</td>
</tr>
<tr>
<td>During operation of the project, any water containing silt and sediment generated as a result of scouring pipelines would be treated (if required) and disposed of as appropriate. Depending on the resultant water quality, this is likely to involve discharge to land.</td>
<td>Operator</td>
</tr>
<tr>
<td>Any water discharged to a waterway must be consistent with the requirements of the Protection of the Environment Operations Act 1997, specifically s120 in relation to water pollution.</td>
<td>Operator</td>
</tr>
<tr>
<td>Work procedures including appropriate safeguards for all routine maintenance works are to be included in the Operations and Maintenance Manual for the system.</td>
<td>Operator</td>
</tr>
<tr>
<td>The flood prone elements of the River Murray Intake are to be constructed above the 1 in 100 year flood level.</td>
<td>Operator</td>
</tr>
<tr>
<td>All build infrastructure (such as that associated with the dosing plant and TPS sites) are to incorporate suitable drainage to prevent excessive scouring and run off.</td>
<td>Operator</td>
</tr>
<tr>
<td>All equipment containing fluids / chemicals that have the potential to cause water pollution would be located within a concrete bunded area.</td>
<td>Operator</td>
</tr>
<tr>
<td>Collection of contaminated water and rainwater within the bunded area and provision for connection of bunded water to the water treatment system is to be considered as part of the design.</td>
<td>Operator</td>
</tr>
<tr>
<td>Ongoing inspection of watercourses and bank stability at the intake site during operation will be undertaken and remedial action will be</td>
<td>Operator</td>
</tr>
</tbody>
</table>
### Flora and Fauna

#### Objective
- Avoidance/minimisation of impacts to flora and fauna
- Minimise clearing of vegetation
- Avoid the introduction or spread of weeds during construction and post construction

#### Actions

<table>
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<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>All areas of known threatened flora or EEC are to be mapped and included in the CEMP. The contractor would consider opportunities to avoid impacts on these areas where practicable.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Pre-clearance surveys of woodland areas by an ecologist for nesting threatened birds would occur prior to any clearing works during winter and spring.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Pre-clearance surveys by an ecologist would occur in all works areas prior clearing and topsoil stripping to relocate any ground dwelling fauna. Burrows that may be occupied by native fauna would be identified.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Any burrows identified during pre-clearance surveys would be carefully excavated by an ecologist to recover fauna occupying the burrow.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Prior to the commencement of clearing and topsoil stripping the limits of impact would be clearly marked using temporary flagging tape, or pegs.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Prior to construction, a hollow-bearing tree survey would occur along the impact area.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Removal of hollow-bearing trees would be managed by an ecologist and would follow a pre-clearing process and staged habitat removal approach as described in the <em>Hollow-bearing Tree Removal Protocol</em> included as Appendix E of the Flora and Fauna Assessment.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Pre-construction and regular targeted control of noxious and environmental weeds would take place to manage noxious weeds,</td>
<td>Contractor</td>
</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
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</tr>
<tr>
<td>woody weeds and exotic perennial grasses within the proposal site.</td>
<td></td>
</tr>
<tr>
<td>All workers would be made aware of potential threatened flora and fauna during works and understand the procedures if threatened fauna are detected.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

**Construction**

<p>| A clearing and grubbing protocol would be included in the Contractor’s Environmental Management Plan (CEMP). This would include best practice methods for the removal of woody and non-woody vegetation. Woody vegetation removed for the works &lt;600mm in diameter is to be mulched/chipped and used as ground cover. Larger timber should be placed in the general area as scattered course woody debris. | Contractor     |
| Where Purple-wood Wattle <em>Acacia carneorum</em> and <em>Acacia loderi</em> shrubland EEC occurs along the pipeline route, the footprint of works would be minimised to a 10 metre corridor. Vehicles, equipment and machinery movements would be minimised and no equipment, vehicle or material storage would occur in this area. | WaterNSW/Contractor |
| Surveys to mark the extent of <em>Acacia loderi</em> shrubland EEC within the Transfer Pump Station 2 (option 3) should be undertaken before works commence. Impacts to <em>Acacia loderi</em> shrubland EEC should be minimised and avoided where possible. Opportunities to move the construction footprint further South would reduce the impacts to the <em>Acacia loderi</em> Shrubland EEC. | Contractor     |
| Topsoil removed would be stored in stockpiles or windrows less than 1m in height, particularly within the area of <em>Acacia loderi</em>, Purple-wood Wattle Shrubland and Spinifex Linear Dune Mallee woodland. Topsoil would be spread over the adjacent disturbed areas as soon as possible. | Contractor     |
| The current hydrological flows of the unnamed creeks in the Bulk Water Storage Site at Chainage 249,000 would be maintained to avoid impacts to the <em>Acacia loderi</em> EEC and Purple Wood Wattle surrounding the Bulk Water Storage Site. | Contractor     |
| If nesting threatened birds identified within the works area, works would be managed in accordance with the onsite ecologist’s advice. Avoidance of impact would be a priority. | Contractor     |
| Within the Spinifex Linear Dune Mallee community, Spinifex would be relocated from the works area so as to protect any fauna within the spinifex. Spinifex relocation would be planned and supervised by an ecologist. | Contractor     |</p>
<table>
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<th>Action/Phase</th>
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<tr>
<td>Trenches and pits would be filled/closed as soon as possible after creation. If they are required to be left open, measures would be undertaken to ensure fauna would not be trapped in the pits overnight. This may be achieved by placing escape ramps into pits or by covering the pit if practical. The trench/pit would be inspected each morning prior to the commencement of works for trapped fauna.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Trees to be retained would be protected by a buffer zone during works in the immediate area, in line with AS 2009 4970.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Trees must be removed causing minimal damage to surrounding vegetation. This would ensure groundcover disturbance would be kept to a minimum.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Removal of hollow-bearing trees would follow a pre-clearing process and staged habitat removal approach as described in the Hollow-bearing Tree Removal Protocol included as Appendix E of the Flora and Fauna Assessment.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Declared noxious weeds would be managed according to the requirements stipulated by the local control authority and recommendations made by the Noxious and Environmental Weed Hand Book (DPI, 2014), which contains details as to the management of specific noxious weeds.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be cleaned prior to entering the work site if the machinery is used off the hard stand or road areas and prior to leaving the site if operating in areas containing noxious weeds.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All plant material containing seed heads, weeds that contain toxins, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Weed-free fill would be used for on-site earthworks.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All herbicides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application should be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Any fallen timber, dead wood and bush rock encountered in the impact area would be relocated to a suitable place nearby (a suitable place would be deemed as an area with similar characteristics as to where the log/dead wood/rock was originally located). These items</td>
<td>Contractor</td>
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### Action/Phase

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<td>Contractor</td>
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would not be placed on top of existing habitat features.

### Action/Phase

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<td>Contractor</td>
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A site stabilisation and weed management plan would be prepared for the works. The plan would identify native flora species endemic to the area that could be used for site stability and habitat rehabilitation.

### Action/Phase

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Revegetation and any landscaping is to be timed to take advantage of natural rainfall and not be dependent on hand water where practicable.

### Action/Phase

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<tr>
<td>Operator</td>
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Permanent access points constructed along the pipeline would be used for operational maintenance activities.

### 7.2.8 Aquatic

#### Objective

- Avoidance/minimisation of impacts to aquatic ecology during the construction and operation of the River Murray to Broken Hill Pipeline Project.

#### Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
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<tbody>
<tr>
<td>Pre-construction</td>
<td>WaterNSW/Contractor</td>
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The River Murray Intake would be designed with aperture screens of 3m and to ensure approach velocities of no more than 0.1m/s at the intake screens.

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The Contractor will finalise the design for the intake in consultation with DPI Fisheries.

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Preclearance surveys of riparian habitat at the proposed intake would occur prior to the removal of riparian vegetation.

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<td>Contractor</td>
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Ephemeral waterways work would be programmed to avoid rainfall events >20mm.

### Construction

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Any amphibian species detected within the works area would be relocated to nearby suitable habitat.

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<td>Contractor</td>
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Works would not occur within ephemeral waterways when inundated.

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Follow appropriate hygiene protocols for the control of disease in
<table>
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<th>Action/Phase</th>
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<tbody>
<tr>
<td>Frogs (NPWS 2008), particularly with regards to vehicles entering and exiting aquatic habitats within the proposal area.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Removal of instream habitat structures such as boulders, vegetation and large woody debris, should be avoided where possible. Such features should be relocated within 100m of where they were found. Relocation of large woody debris would be undertaken in consultation with DPI Fisheries.</td>
<td>Contractor</td>
</tr>
<tr>
<td>The construction and access footprint would be minimised (particularly on the river banks and bed) and demarcated on the ground. Areas outside of the construction access footprint would be identified as no-go areas and this would be communicated to all staff during site induction.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Observed fish or crustacean deaths as a result of the work would be managed in accordance with the biodiversity management plan (or similar) for the works.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Any aquatic fauna contained within the cofferdam are to be translocated prior to or during dewatering.</td>
<td>Contractor</td>
</tr>
<tr>
<td>In order to minimise sedimentation, fill or excavated material must not be stockpiled in flood prone areas. Particular care should be taken in siting stockpiles and dumps. Sites should be situated be secure from a 1 in 10 year flood level and have effective sediment control works to contain any runoff.</td>
<td>Contractor</td>
</tr>
<tr>
<td>A spill management plan to prevent and contain spillage of potential contaminants would be prepared and implemented.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Erosion and Sedimentation Control Plans would be prepared and the controls put in place prior to construction to minimise potential water quality impacts during construction. The design of the controls where works are occurring on the river bank immediately adjacent to the river would be sensitive to flow impacts. The use of in stream erosion measures would be considered to minimise potential downstream impacts, particularly during instream works and works on the river banks.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All debris created by demolition work would be fully contained and disposed of appropriately.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
| In the event of a spill or other contamination of the waterway:  
  - Works would cease and the spill management plan implemented immediately.  
  - Any pollution of the waterway would be reported to the EPA in accordance with the notification requirements of the Protection of | Contractor |
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>A spill kit including boom would be accessible to the work area at all times to manage any accidental spills.</td>
<td>Contractor</td>
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**Operation**

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<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Rock armouring at discharge valves along the pipeline is to be installed and maintained (routinely inspected) to prevent erosion during controlled releases of water for maintenance.</td>
<td>Operator</td>
</tr>
</tbody>
</table>

### 7.2.9 Aboriginal Archaeology

#### Objective

- Minimise potential impacts to items and places of Aboriginal heritage due to the works
- Ensure the construction works are consistent with all relevant OEH guidelines.

#### Actions

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Pre-construction</td>
<td></td>
</tr>
<tr>
<td>Prior to the commencement of works, an Aboriginal Heritage Impact Permit (AHIP) is required, and should include:</td>
<td>WaterNSW/Contractor</td>
</tr>
<tr>
<td>- Salvage a representative sample of Aboriginal objects from sites of moderate or higher significance</td>
<td></td>
</tr>
<tr>
<td>- Collect dating samples from viable hearths</td>
<td></td>
</tr>
<tr>
<td>- Collect a representative sample of dates from Aboriginal sites within the moderate to very high archaeological sensitivity areas</td>
<td></td>
</tr>
<tr>
<td>- Reduce knowledge gaps and improve regional understanding of the subsurface archaeological resource by undertaking subsurface archaeological salvage in a representative sample of sites of moderate significance in moderate to very high subsurface archaeological sensitive landforms and landscapes.</td>
<td></td>
</tr>
<tr>
<td>- Include a protocol for the management of unexpected finds, including but not limited to stone artefact sites, hearths, culturally modified trees, shell, burials</td>
<td></td>
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<tr>
<td>- A protocol for the discovery and management of human remains, including stop work provisions and notification protocols.</td>
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</tr>
<tr>
<td>- Include a protocol for managing gender-specific cultural values</td>
<td></td>
</tr>
<tr>
<td>- Include an adaptive management framework to manage the</td>
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</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
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<tr>
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</tr>
<tr>
<td>discovery of any Aboriginal sites and values of high regional significance (such as Pleistocene aged sites)</td>
<td></td>
</tr>
<tr>
<td>An AHIP authorising the harm will be required prior to any activity commencing that would impact on Aboriginal cultural heritage. WaterNSW and its contractors will comply with the conditions of the AHIPs.</td>
<td>WaterNSW/Contractor</td>
</tr>
</tbody>
</table>

**Construction**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle and people movements should be constrained to defined disturbance footprints (to minimize the risk of disturbance outside of the footprints).</td>
<td>Contractor</td>
</tr>
<tr>
<td>Implementation and maintenance of controls for sediment, erosion and waterflow through instruments such as an Environmental Sediment Control Plan.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Avoidance of known sites and areas of archaeological sensitivity (via temporary fencing, no-go areas. signage etc)</td>
<td>Contractor</td>
</tr>
<tr>
<td>Protocols for heritage awareness training to be incorporated into the work site inductions for both employees, sub-contractors and site visitors who may be conducting works within the project area.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Managers of the infrastructure should be trained in procedures to recognise and avoid disturbance to cultural heritage places and items</td>
<td>Contractor</td>
</tr>
<tr>
<td>Communication of Aboriginal heritage sites and values identified as a result of the project with other stakeholders who utilise the road corridor (for example local council, RMS, utilities holders).</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

**7.2.10 Historic Heritage**

**Objective**

- Minimise potential impacts to items and places of historical (European) heritage due to the works

**Actions**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Pre-construction</td>
<td></td>
</tr>
<tr>
<td>Prior to commencement, provide written notice of the intention to carry out the proposed works, with a copy of Historic Heritage Assessment to Broken Hill City Council and Wentworth Shire Council in accordance with the provisions of SEPP Infrastructure 2007. Any comments received within 21 days must be taken into consideration.</td>
<td>WaterNSW/Contractor</td>
</tr>
</tbody>
</table>
If historical archaeological relics were discovered during ground disturbance activities, work in the immediate area would need to cease and suitably qualified archaeologist be engaged to assess the condition, extent and likely significance of the remains. Depending on the results of this assessment, OEH may need to be notified of the discovery in accordance with s146 of the Heritage Act 1977.

In order to preserve the current heritage views towards the Mica Street Filtration Plant and Reservoir, the new terminal balance tank should be placed to the north of the current circular reservoir tank, so that significant views from the town are preserved.

**7.2.11 Waste**

**Objective**

- Maximise reuse/recycling of waste material and minimise waste disposed of to landfill.
- Minimise offsite impacts associated with spoil and waste generation.

**Actions**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>Detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
| Procedures should be established and detailed in the WMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the Waste Avoidance and Resource Recovery Act 2001. Namely, to:  
  - Avoid unnecessary resource consumption,  
  - Recover resources (including reuse, reprocessing, recycling and energy recovery); and  
  - Dispose (as a last resort).  
<p>| Contractor |
| The Waste Management Plan would also need to be consistent with the Waste Classification Guidelines (EPA, 2014) in that all waste | Contractor |</p>
<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>removed from the site is to be classified and disposed of appropriately.</td>
<td></td>
</tr>
<tr>
<td>No batched concrete mixing plants would be established in the works areas without first seeking approval in the form of an EPL from the EPA.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Following completion of the works, excess concrete would be removed off-site for recycling.</td>
<td>Contractor</td>
</tr>
<tr>
<td>All waste removed from the site would be classified and disposed of appropriately, and all non-recyclable waste would be disposed of at an appropriate licensed waste disposal facility.</td>
<td>Contractor</td>
</tr>
<tr>
<td>If required only cleared fill would be used in the construction works.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Cleared vegetation would be managed consistent with the flora and fauna assessment recommendations. Cleared vegetation would be stored temporarily adjacent to the pipeline corridor and placed over the disturbance corridor post construction (see section 7.2.6).</td>
<td>Contractor</td>
</tr>
<tr>
<td>Surplus excavated spoil would be reused onsite as backfill or as part of the construction of other infrastructure associated with the works.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Onsite toilets are to be adequately sized based on workforce numbers / usage.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Onsite toilets are to be routinely pumped out and serviced.</td>
<td>Contractor</td>
</tr>
<tr>
<td>Should an alternative sewage treatment system be proposed, this would be subject to a separate environmental assessment.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

**Operation**

| Waste streams associated with the operation of the dosing plant would be determined and assessed as part of a separate environmental assessment process | Scheme operator |
| An OEMP would be developed specifically for the operation of the dosing plant. | Scheme operator |

### 7.2.12 Contamination and Hazards

**Objective**

- Compliance the provisions of the *Protection of the Environment Operations Act and (Waste) Regulation*.
- Ensure the works do not result in contamination
## Actions

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<tr>
<th>Action/Phase</th>
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<tbody>
<tr>
<td><strong>Pre-Construction</strong></td>
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<tr>
<td>A detail site contamination assessment of the proposed pipeline alignment through Broken Hill should be carried out in accordance with Australian National Environment Protection Measure (NEPM) for soil contamination (NEPC 2013).</td>
<td>Contractor</td>
</tr>
<tr>
<td>Site safety plan is to be developed to assess and manage all potential construction hazards, including lead dust hazards when undertaking earthworks in Broken Hill. This is to detail appropriate protective clothing requirements including AS-1716 approved respirator or face mask fitted.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
| The site safety plan is to be;  
  - based on a project specific risk assessment taking into account the confirmed construction method,  
  - developed in accordance with all relevant WorkCover regulations and guidelines. | Contractor |
| **Construction** | |
| Notification procedure would be implemented in the event that notifiable pollution incident as defined under section 147 of the POEO Act (see Section 5.8.2). | Contractor |
| Lead contaminated soil must be handled so as to minimise the release of dust. | Contractor |
| Dust suppression is to be used during all excavation and earthworks undertaken within Broken Hill. | Contractor |
| Site contamination testing is to be undertaken in the vicinity of Coombah Roadhouse and works to be managed in accordance with recommendations. | Contractor |
| Suitable materials as described in Section 4 of AS 3798-2007 “Guideline on Earthworks for Commercial and Residential Development” is to be used in the construction. | Contractor |
| All imported material should be validated in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM). The fill material should not contain asbestos, and not be acid sulfate soil. | Contractor |
| All imported fill material should be ‘virgin excavated natural material’ (VENM) and ‘excavated natural material’ (ENM), as defined in the EPA’s waste classification guidelines because of their low risk of | Contractor |
If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>Flammable or combustible substances are to be kept at the lowest practicable quantity for the workplace.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

### 7.2.13 Socio-Economic

**Objective**

- Minimise the impacts to the community due to the construction and operation of the River Murray to Broken Hill Pipeline Project.

**Actions**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Construction Ongoing communication of water management associated with the Menindee Lakes scheme, particularly in how it relates to recreational access.</td>
<td>NSW Government</td>
</tr>
<tr>
<td>Post Construction</td>
<td>IPART</td>
</tr>
</tbody>
</table>

### 7.2.14 Visual

**Objective**

- Minimise the visual impacts to the community due to the construction and operation of the River Murray to Broken Hill Pipeline Project.

**Actions**

<table>
<thead>
<tr>
<th>Action/Phase</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Design</td>
<td>Contractor</td>
</tr>
<tr>
<td>The design and layout of the new infrastructure associated with the River Murray to Broken Hill Pipeline Project is be undertaken to</td>
<td>Contractor</td>
</tr>
<tr>
<td>Action/Phase</td>
<td>Responsibility</td>
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</tr>
<tr>
<td>minimise visual impacts.</td>
<td></td>
</tr>
<tr>
<td><strong>Post Construction</strong></td>
<td>Contractor</td>
</tr>
<tr>
<td>Post construction landscaping is to be undertaken at the dosing plant, bulk water storage and TPS sites to screen the infrastructure and minimise visual impacts.</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
8 Conclusion

8.1 Proposed Works

The project has been developed with the objective of providing a secure, reliable and long term source of water to Broken Hill and the surrounding communities that complies with the NSW Guidelines on Assuring Future Urban Water Security. The main components of the proposal are summarised as:

- A lift pump station at the River Murray with associated inlet works located adjacent the existing Wentworth Town Water Supply pumping station in Wentworth, and demolition of a disused wet well;
- A dosing plant;
- A pipeline comprising 750 mm diameter mild steel concrete lined (MSCL) pipes located predominantly within the Silver City Highway road reserve on the western side of the highway. The total pipeline length is approximately 270 km;
- Three transfer pumping stations (TPS1, TPS2 and TPS3), and associated balance tanks and photovoltaic power generation system, located along the main pipeline alignment adjacent to the Silver City Highway;
- A bulk water storage;
- A terminal balance tank and associated pipework at Mica Street WTP; and
- Associated electrical, mechanical and civil works.

This REF has assessed the potential environmental impacts and these are summarised below.

Land use

The project would be located on land including road reserves that is owned or managed by Wentworth Shire Council, Broken Hill City Council, DPI – Lands, or RMS. Temporary land use impacts would be related to the presence of construction compounds. Land use adjacent to the project area would be affected by amenity based impacts such as traffic, noise and air emissions. This would affect sensitive receivers including residences and those using adjacent recreational areas. Construction of the pipeline would move progressively along the alignment and impact on individual locations for a short period of time. Construction of elements such as the pumping stations, bulk storage and works at Mica Street WTP would require works at these locations for a number of months.

Operational impacts on land use would result from the need to acquire land or easements. WaterNSW would consult with potentially affected landholders to enter into agreements to access land for the project.

Traffic and Access

A large number of construction vehicles would utilise the Silver City Highway and local road network over the 14 month construction period. Traffic related impacts can be managed through by developing and implementing a traffic management plan in consultation with Broken Hill City Council, Wentworth Shire Council, and RMS. Any damage to roads attributed to the project would be rectified post construction.
**Noise and vibration**

Construction would require plant, machinery and vehicles that would generate noise and vibration. The level of noise generated by construction works would be dependent on the construction program, methodology and equipment. These details will be determined by the successful construction contractor. Noise impacts have been estimated via specialist noise assessment undertaken as part of this REF that considered an indicative construction method (Renzo Tonin, 2017). For those aspects of the works in close proximity to residential properties within Wentworth and Broken Hill, the assessment found that noise management objectives as set out in the Interim Construction Noise Guideline (DECC, 2009) are unlikely to be met. These impacts would be short term and temporary. Management measures will be implemented to minimise noise associated impacts to the affected community. Operational noise arising from the scheme will comply with the NSW Industrial Noise Policy (EPA, 2000).

**Air Quality**

Construction would require excavation and movement of spoil around the site and this has the potential to result in dust which may affect road users and residences within Wentworth and Broken Hill. These impacts would be short term and temporary, and management measures would be implemented to minimise impacts on nearby sensitive receivers.

**Water Quality**

The greatest potential for water quality impacts would be due sediment runoff from the construction sites and through instream works such as the construction of the River Murray intake and pipeline creek crossings. Given the environmental setting and remote nature of the project area, a risk based approach in the evaluation and minimisation of potential water quality impacts has been adopted, with a focus on protecting sensitive receiving environments, notably waterways and drainage lines. Construction practices that minimise soil erosion and sedimentation would be implemented consistent with established guidelines and industry practice and documented within the CEMP.

**Aquatic Ecology**

The project would impact on the Darling River EEC which is listed under the FM Act. Construction impacts would be associated with works within watercourses and would be minimise by implementing mitigation measures. Operational impacts would focus on the potential for entrainment or impingement of aquatic organisms due to operation of the River Murray intake pumping station. These impact would be minimised by ensuring the intake is designed so the approach velocity is below 0.1 m/sec and the screen aperture is less than 3 mm.

Assessments of Significance were prepared under Section 5A of the EP&A Act which determined that the project is unlikely to result in any significant impact to threatened species, populations or ecological communities, or their habitats. A species impact assessment (SIS) is therefore not required.

**Terrestrial Flora and Fauna**

Construction of the project would disturb existing vegetation and fauna habitats. Assessments of Significance under Section 5A of the EP&A Act were undertaken for the Sandhill Pine Woodland and Acacia Loderi EECs as listed under the TSC Act 1995 (NGH,
2017). The seven part tests determined that the project is unlikely to result in any significant impact to threatened species, populations or ecological communities, or their habitats. A species impact assessment (SIS) is therefore not recommended.

Similarly, assessments of significance in accordance with the Environment Protection and Biodiversity Conservation Act 1999 concluded that significant impacts to federally listed migratory and threatened species, populations or communities are unlikely to occur as a result of the proposal. No impacts to other matters of national environmental significance were identified during the preparation of this REF and therefore referral to the Federal Minister for Environment and Energy is not recommended.

Aboriginal Heritage
The project would impact on Aboriginal objects protected under the NPW Act. Therefore an AHIP under Section 90 of the NPW Act to take or destroy Aboriginal objects will be required prior to construction works commencing. Due to the extent of the project area, four separate AHIPs are proposed to be obtained for the project. This approach would enable construction of the project to commence once the AHIP has been obtained for that section.

Historical Heritage
The project would impact on the heritage significance of the City of Broken Hill which listed on the national heritage list. It would also impact on a number of local heritage items. These impacts are unlikely to be significant and as such no approvals or permits are required.

Socio economic
The project is being specifically developed to provide a benefit to the community by providing a long term sustainable water supply that complies with the NSW Guidelines on Assuring Future Urban Water Security. The proposal would meet future water demands and facilitate growth in the region. Securing the water supply will assist the Broken Hill region better manage the difficulties of its climate, remoteness and unique socioeconomic issues.

Mitigation Measures
Mitigation measures have been identified based on the likely potential impacts of the project and would be implemented during both construction and operational phases.

A CEMP would be prepared and implemented by the construction contractor, and would include the mitigation measures identified in this REF, plus any conditions of the project determination or any other licences / approvals. The CEMP would include a risk assessment which ensures that the safeguards are effectively translated into actual construction techniques and environmental management activities, controls and monitoring/verification to prevent or minimise environmental impacts.

8.2 Conclusion
Pursuant to the provisions of the Environmental Planning and Assessment Act 1979, and Environmental Planning and Assessment Regulation 2000, an environmental assessment of the project has been undertaken. The REF has been prepared in accordance with relevant legislation, including but not limited to Section 111 of the EP&A Act, Clause 228
of the EP&A Regulation and the Commonwealth EPBC Act. The REF documents the potential environmental impacts of the proposal, and recommends management and mitigation measures to protect the environment where required. On the basis of the information presented in this REF, it is concluded that by adopting the safeguards identified in this assessment it is unlikely that there would be significant adverse environmental impacts associated with the project. Based on this, the project does not require an EIS, SIS, or referral under the EPBC Act.

If the scope of work or study area assessed in this REF change, WaterNSW would determine whether additional environmental assessment is needed to ensure that their obligations under the EP&A Act are addressed.
9 References


NSW Department of Primary Industries 2017 *Summary of the Final Business Case Broken Hill Long-Term Water Supply Solution*, DPI Water, Sydney.

NSW Government, 2016, *Direction to the Board of WaterNSW to secure the water supply of Broken Hill 2016*,


NGH, 2016, *Broken Hill Long Term Water Supply Ecological Assessment*


WRI (2016) *Broken Hill Long Term Water Supply Social Impact Assessment*
10 Appendices
Appendix C - Concept Design Plans and Figures
Appendix D - Flora and Fauna Assessment
Appendix E - Aboriginal Cultural Heritage Access
Appendix G - Noise Impact Assessment
Appendix H - Historical Heritage Assessment
Appendix I - Social Impact Assessment
Appendix J – Wind Rose Data
Appendix K – Land Tenure Details
Appendix L – Geology Maps
Appendix M – Archaeological Sensitivity Maps