LIVERPOOL PLAINS SHIRE COUNCIL

Review of Environmental Factors

QUIPOLLY WATER PROJECT

NOVEMBER 2018

ngh environmental

Document Verification

Project Title: Quipolly Water Project

Project Number:	18-299
Project File Name:	18-299 Quipolly Water Treatment Plant REF Final 1.1

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft 1.0	22/08/18	Zeina Jokadar Lauren Byrne	Fiona McKay	Fiona McKay
Final 1.0	08/11/18	Zeina Jokadar Lauren Byrne	Fiona McKay	Fiona McKay
Final 1.1	27/11/18	Lauren Byrne	Minor changes	

NGH Environmental Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622)

www.nghenvironmental.com.au e: ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
8/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Brisbane
suite 4, level 5, 87 wickham terrace
spring hill qld 4000 (t 07 3129 7633)

Newcastle - Hunter and North Coast
2/54 hudson st
hamilton nsw 2303 (t 02 4929 2301)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Bega - ACT and South East NSW
89-91 auckland st (po box 470)
bega nsw 2550 (t 02 6492 8333)

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

ADD	Average Daily Demand
AHD	Australian Height Datum
AHIMS	Aboriginal heritage information management system
ARTC	Australian Rail Track Corporation
ASL	Above sea level
ASRIS	Australian Soil Resource Information System.
ASS	Acid Sulfate soils
AWS	Automatic weather station
AWTS	Aerated wastewater treatment system
BC Act	*Biodiversity Conservation Act 2016*
BS Act	*Biosecurity Act 2015*
BOM	Australian Bureau of Meteorology
CEMP	Construction environmental management plan
Cwth	Commonwealth
DECCW	Department of Environment, Climate Change and Water, now known as OEH
DICL	Ductile Iron Cement Lined
DN	Diameter nominal
DoEE	Department of the Environment and Energy (Cwth)
DOI	Department of Industry (NSW)
DPI	Department of Primary Industries (NSW)
EEC	Endangered ecological community – as defined under relevant law applying to the Proposal
EIA	Environmental impact assessment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994* (NSW)
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
HLR	High Level Reservoir
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
KFH	Key Fish Habitat

km	kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environment Plan
LPSC	Liverpool Plains Shire Council
LPRWSS	Liverpool Plains Regional Water Supply Strategy
ML	Mega Litres
m	Metres
NCA	Noise Catchment Area
NES	Matters of National environmental significance under the EPBC Act (c.f.)
NML	Noise Management Levels
NPV	Net Present Value
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
PAC	Powdered Activated Carbon
PDD	Peak Daily Demand
PPEA	Preliminary Planning and Environmental Assessment
RBL	Rating Background Level
REF	Review of Environmental Factors
RWPS	Raw Water Pump Station
RWSS	Regional Water Supply Strategy
SEPP	State Environmental Planning Policy (NSW)
SDS	Safety Data Sheet
SIS	Species Impact Statement
sp/spp	Species/multiple species
TWPS	Treated Water Pump Station
TWST	Treated Water Storage Tank
WTP	Water Treatment Plant

1 INTRODUCTION

Liverpool Plains Shire Council (LPSC) proposes to upgrade the regional water supply, which forms part of the Liverpool Plains Regional Water Supply Scheme (RWSS). One stage of this work, the pipeline from Quirindi to Willow Tree, has now been constructed. The second stage of the works is known as the Quipolly Water Project (the Proposal) and is the subject of this report.

The Proposal includes the supply of water from Quipolly Dam to Werris Creek and Quirindi through the design of a new Water Treatment Plant (WTP), modifications to the existing intake at Quipolly Dam and new distribution system works. The key features of the Proposal would include:

- A dam intake tower upgrade at Quipolly Dam
- Installation of a bubble plume destratification system at Quipolly Dam
- A new Raw Water Pump Station (RWPS) located adjacent to Quipolly Dam to transfer raw water to a new treatment plant via a 720 m long pipeline
- A new WTP of 6ML/d (reconfigurable up to 9 ML/day in future) located on Quipolly Dam Road/Lowes Creek Road. The WTP includes a new treated water storage reservoir, residuals lagoons, one emergency overflow lagoon, and a Treated Water Pump Station (TWPS) to transfer treated water to the distribution system
- Approximately 20 km of new trunk main from the WTP to the existing Werris Creek Reservoir (4.5 ML) and North Quirindi Reservoir (2.1 ML), as follows:
    - Pipeline from the WTP along the road reserve of Lowes Creek Road, heading west to the intersection with Bells Gate Road
    - Pipeline to the existing Werris Creek Reservoir along the road reserve of Back Werris Creek Road
    - Pipeline to the North Quirindi Reservoir along the road reserve of Bells Gate Road
- A new High Level Reservoir (HLR) at Werris Creek
- Pump station alterations at Quirindi.

A Preliminary Planning and Environmental Assessment (PPEA) was completed by GHD in July 2014 for the Liverpool Plains Regional Water Supply Scheme. The PPEA was a high-level document which identified potential environmental constraints with the construction and operation of the proposal. This Review of Environmental Factors (REF) has been prepared for the Quipolly Water Project, taking into consideration the results and recommendations of the PPEA.

1.1 BACKGROUND

The Liverpool Plains Regional Water Supply Strategy (RWSS) was developed by LPSC to ensure an improved and secure water supply to the townships of Quirindi, Werris Creek and Willow Tree. One stage of this Strategy, the pipeline from Quirindi to Willow Tree, has now been constructed (refer to appendix I). The next two stages of the Strategy, the Quipolly WTP, and the Werris Creek and Quirindi Water Pipeline will be procured under the Quipolly Water Project.

LPSC worked in partnership with the Federal and State Governments to prepare funding to the amount of $20 million for this proposal. It is estimated that the proposal would cost $28.3 million, with Council making a contribution of up to $8.3 million to complete the proposal (LPSC Quipolly Water Project website https://www.lpscwater.com.au/).

Currently, the township of Quirindi is supplied by bore water and Werris Creek is supplied with raw water from Quipolly Dam, which is subsequently treated at the Werris Creek WTP. The water quality from the Upper Namoi Alluvial Groundwater Aquifer is not reliable and availability is restricted during drought periods. The treatment plant at Werris Creek was built in the 1930s and is operating beyond its useful life.

The objective of the Quipolly Water Project is to manage water quality, secure treated water supply to Werris Creek and provide options for the management of Quirindi water supply by constructing a state of the art WTP near Quipolly Dam and a pipeline to Werris Creek and Quirindi. The proposal would also facilitate opportunity for growth associated with local mining developments, and would provide greater flexibility and additional security for the works now completed for Willow Tree.

1.2 LOCATION OF THE ACTIVITY

The proposal is located within the headwaters of the Namoi Valley catchment in north-west NSW, around 60 kms south-west of Tamworth, refer to Figure 1-1 and Figure 1-2.

The planned location of Quipolly WTP would be between the townships of Werris Creek and Quirindi on Lowes Creek Road, approximately 0.5 km from the Quipolly Dam outlet, refer to Figure 1-3.

The treated water distribution pipeline would follow existing roads and would be situated mostly in road reserve consisting of pasture and some native vegetation. The proposed route would commence at Quipolly Dam at the new RWPS, then proceed to the new raw WTP and along Lowes Creek Road until it intersects with Bells Gate Road. Here, the pipeline would split north to Werris Creek and south to Quirindi, along the following alignment:

- To Werris Creek, the pipeline would run along a stock route and Back Werris Creek Road to the existing 4.5 ML low-level reservoir at Werris Creek.
- To Quirindi, the pipeline would follow Bells Gate Road and includes a crossing of the Australian Rail Track Corporation (ARTC) rail line. The pipeline would connect at north Quirindi to the existing reservoir off Werris Creek Road, adjacent to the Quirindi Waste Management Facility.

The pipeline route would cross the following ephemeral watercourses (refer to Figure 1-3):

- Black Gully: crossed by pipeline along Back Werris Creek Road
- Box Gully: crossed by pipeline along Bells Gate Road, before intersection with rail road.
- Little Quipolly Creek (tributary to Quipolly Creek): crossed by pipeline along Bells Gate Road
- Quipolly Creek: crossed by pipeline along Lowes Creek Road and Bells Gate Road.
- Various tributaries to the above streams and drainage lines

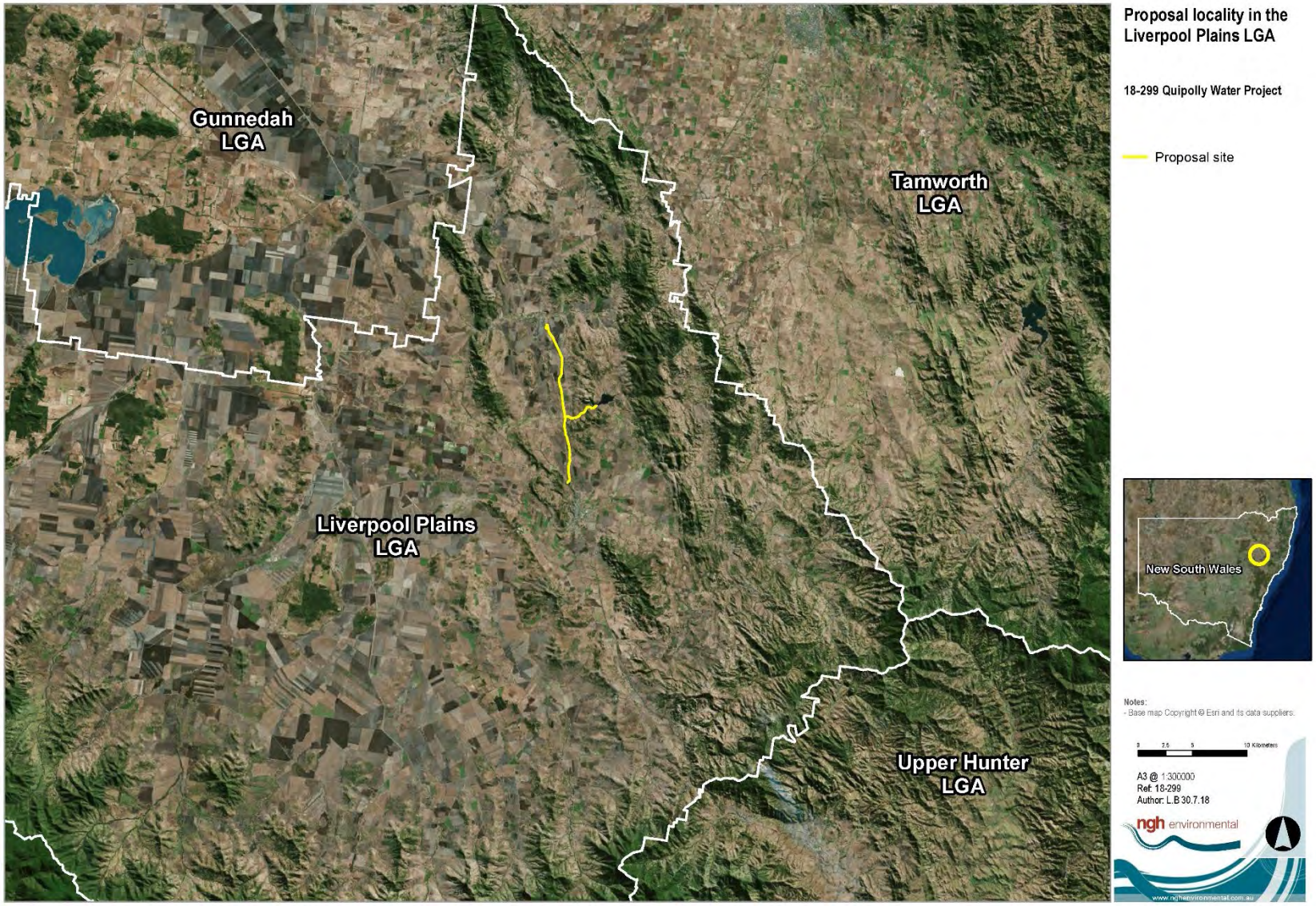

Figure 1-1 Proposal locality

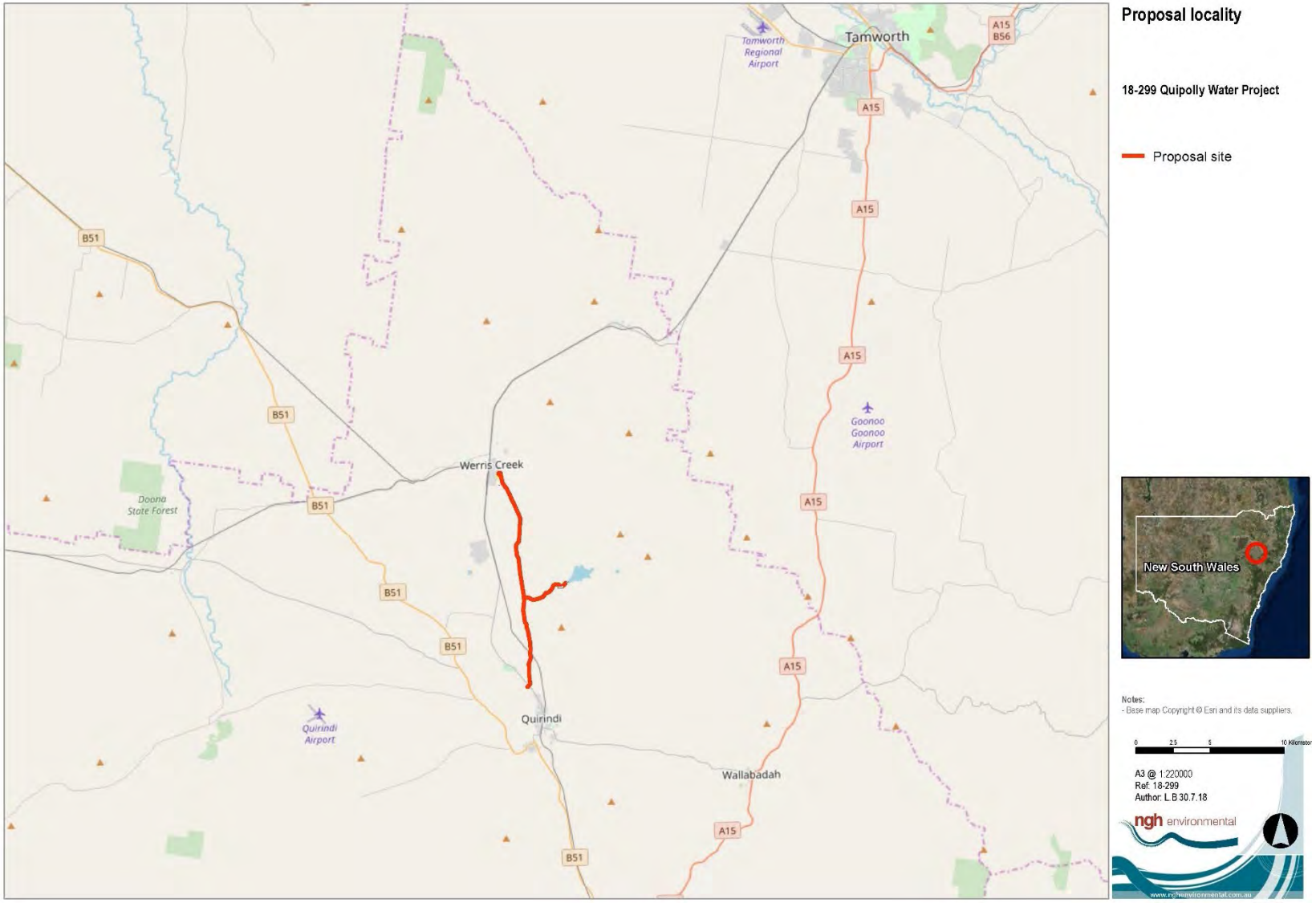

Figure 1-2 Proposal regional locality

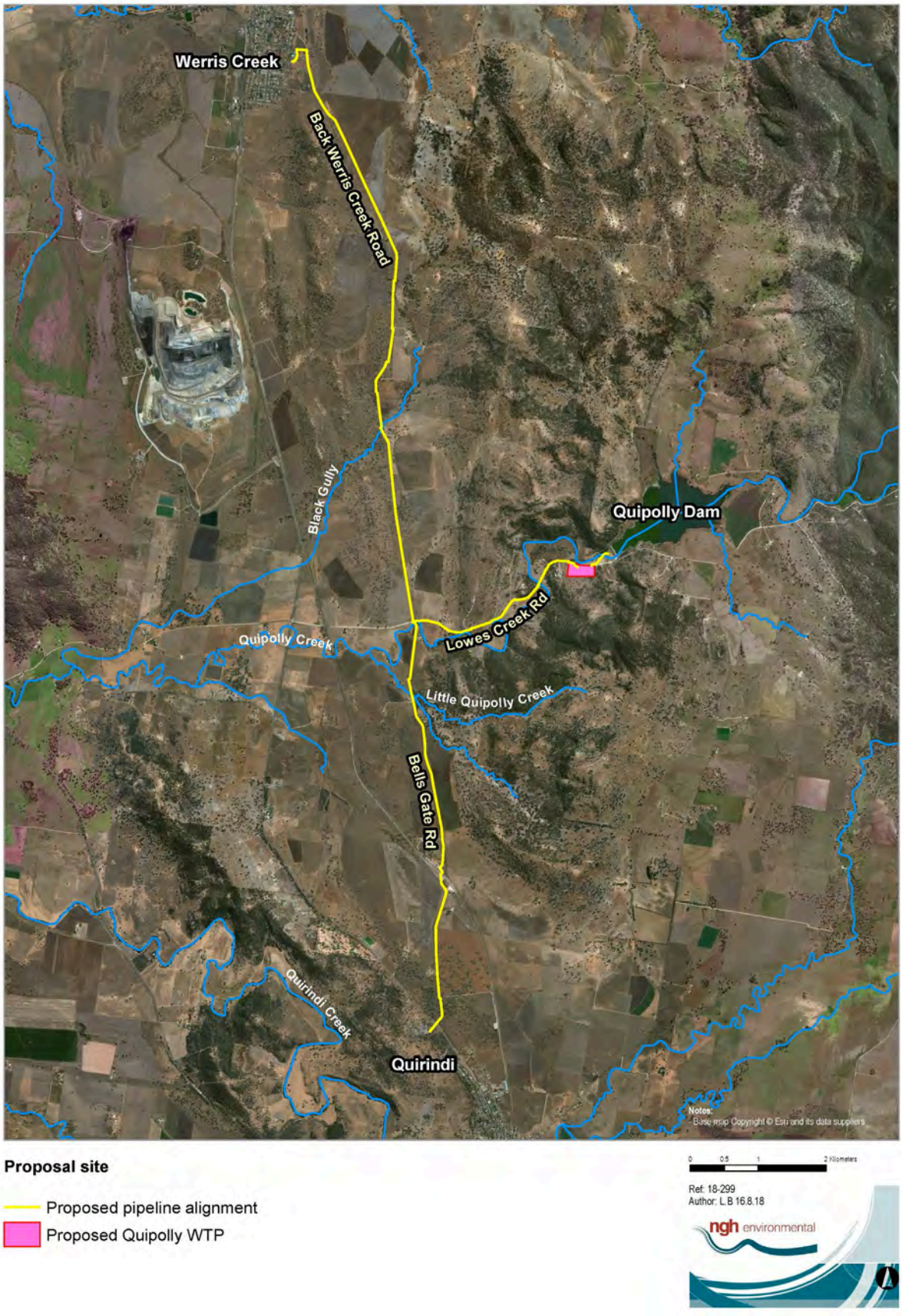

Figure 1-3 Proposal site and alignment

1.3 PROPERTY ACQUISITION

LPSC has acquired the property required for the Proposal, to allow for the footprint of the WTP, new reservoir, and alignment of the pipeline. No further property acquisition is required for the Proposal.

1.4 PURPOSE OF THE REF

This report has been prepared by NGH Environmental Pty Ltd on behalf of LPSC. The purpose of this REF is to assess potential environmental impacts arising from the construction and operation of the Quipolly Water Project and in doing so, satisfy LPSC's duty under Section 5.5 and 5.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). LPSC is the determining authority for the Proposal.

1.5 DEFINITIONS OF THE PROPOSAL

The following definitions apply to this report:

Proposal site - the footprint of the proposed work including the extent of construction works and ancillary facilities.

Proposal area – land within 50m of the Proposal site.

Study area – land within 10km of the Proposal area.

2 PROPOSAL NEEDS AND ALTERNATIVES

2.1 REASONS FOR THE ACTIVITY

Quirindi

Groundwater resources in the Namoi are intensively developed in NSW and the subregion has high levels of groundwater extraction within the Murray–Darling Basin (CSIRO, 2007). There are over 18,000 bores in the Namoi catchment which are licensed to provide over 343,000 ML of groundwater entitlement per year. The residents of Quirindi currently source their water from bores linked to a gravel aquifer on the Borambil Creek west of Quirindi. These bores are mainly rainfall dependent and have a peak capacity of 6.5 ML/d. Aquifer licences cover a variety of purposes including town supply, irrigation, industrial, stock and domestic water.

Groundwater levels in the subregion have generally been falling at a rate of 0.5 m/year since the late 1960s/early 1970s due to high extraction, with water levels stabilising or recovering during wetter years (Welsh *et al.* 2014). In 2006–2007, many parts of the Namoi subregion experienced their lowest groundwater levels on record. In particular, the township of Willow Tree almost ran dry (Level 7 restrictions were imposed), and water supply in Wallabadah failed requiring emergency cartage (January 2007 to March 2007). More recently Willow Tree required emergency water cartage between November 2014 to June 2015.

High allocation of the alluvial aquifers in the past has led to the Namoi being included in the Achieving Sustainable Groundwater Entitlements Program, a program to reduce allocation in key inland catchments in NSW. Quirindi is located in Zone 1 of the Namoi Groundwater Water Sharing Plan. Extraction entitlements in this zone were 4 times the estimated recharge, so an 87% reduction was applied for non-urban usage.

Quirindi is the centre of support services including education, health and administration for the shire; as such water security is critical. Currently, Quirindi relies on a single source of water, and there is no back up in the event of contamination or scarcity. System failure would mean noncompliance with the Customer Service level in the Integrated Water Cycle Management (IWCM), and extensive coal mining may also interfere with groundwater supply.

Werris Creek

Residents of Werris Creek are supplied by surface water from Quipolly Dam which is treated at the +80year old Werris Creek WTP. The township's reticulation system is supplied by a low level reservoir (clear water tank) and high level reservoir. The Quipolly WTP Concept Design Review (CDR) (Hunter H_2O, 2018) and Quipolly WTP Jar Testing Memorandum (Hunter H_2O, 2018) concluded that there were significant challenges in treating raw water sourced from Quipolly Dam. These challenges include:

- The Quipolly Dam catchment is likely to be deemed a Category 4 catchment (Water Services Association of Australia, 2015), therefore microbial pathogens represent a significant risk which needs to be reflected in the Quipolly WTP process design
- Variable and high levels of turbidity and colour
- Periods of high pH, at times reaching pH 9.0
- Cyanobacteria concentrations in Quipolly Dam can be extreme, up to 80 times greater than the red alert limit as defined by DI Water (NSW Office of Water, June 2014)

- Algal species known to produce toxins are in excess of Australian Drinking Water Guidelines (ADWG) (NHMRC, 2016) alert values between 25 - 50% of occasions when detected
- High dissolved organic carbon (DOC) level of 18.3 mg/L was recorded in 2018 (Hunter H_2O, 2018)
- The most effective coagulation trialled during jar testing was an aluminium sulphate dose in excess of 300 mg/L which would generate significant volumes of treatment residuals (Hunter H_2O, 2018)
- Bromodichloromethane (BDCM) concentrations in treated water show that significant levels of bromide may be present in the Dam water

The existing treatment plant at Werris Creek was built in the 1930's and despite upgrades it is now due for replacement. The complexities of treating the raw water from Quipolly Dam would require significant modifications/retrofitting to the existing WTP which would not be economically feasible. Additionally, ongoing maintenance of the ageing plant components, operational reliability of the plant and extension of the life of the plant would not be ensured by the modification process.

It is also a water security risk for the township to rely on a single source for its water supply. The current arrangement does not provide any redundancy if (LPSC, 2017):

- The water supply from Quipolly Dam is contaminated or suffers algal blooms
- The >100 year old lead-jointed transfer pipeline fails
- There are issues with the processes at the WTP itself

In 2009, Werris Creek was placed on water restrictions due to issues with the capacity of the WTP and contamination with algae blooms in Quipolly Dam.

Additionally, the existing infrastructure does not have redundancy measures such as back-up generators or sufficient reserve storage to secure water supplies in the event of power failure (which has been experienced in the past).

Water resource demand

The current water supply network in the Liverpool Plains LGA services the townships of Quirindi, Werris Creek, Wallabadah, Willow Tree, Spring Ridge, Premer, Blackville and Caroona. This covers an area of 5,086km^2 and a combined population of 8,000 (GHD, 2014).

Business and employment is currently dominated by agriculture. Water demand from agriculture was estimated at 456GL/annum for agriculture during 2005/06 (LPSC, 2018 pers. comm.) and growth projections see this number rise.

Population growth, increased commerce, agriculture, construction and mining are all contributing to growth in water resource demands in the LGA. Studies forecasting water demand growth in the LGA have shown that the maximum demand (from now until 2050) is expected to occur in the year 2040 due to activity in the mining area. The peak daily demand has been estimated at 3.4ML/day for Werris Creek in the year 2040, and 6.2ML/day for Quirindi in the year 2050 (LPSC, 2017), based on construction demand, increased employment from construction and operation and the multiplier effect from supporting industries.

A Development Application has also been lodged for a miner's village in Werris Creek. The village would require water and sewer services equivalent to 525 dwellings (1,500 rooms), effectively doubling the population of the township.

The existing WTP at Werris Creek has insufficient capacity to meet demand growth, and the Upper Namoi Alluvial Groundwater Aquifer is governed by a water sharing plan and is at continued risk of overexploitation. From an economic perspective, the townships of Quirindi and Werris Creek are located within socioeconomically disadvantaged regions of NSW. Therefore, these townships have potentially lower near term capacity to adapt to water security issues.

Quipolly Dam has enough capacity to supply all townships, but is only currently connected to Werris Creek, and the Dam water requires state of the art treatment to meet *Australian Drinking Water Guidelines* (ADWG) (NHMRC, 2011) and the *National Water Quality Management Strategy* (NWQMS) (ANZECC, 2000).

2.2 QUIPOLLY WATER PROJECT OBJECTIVES

The implementation of the Quipolly Water Project seeks to fulfil the following key objectives:

- Provide drought security to the townships of Quirindi and Werris Creek
- Provide water source redundancy to the connected townships through flexible supply arrangements from either Quipolly Dam or groundwater sources. This would reduce or mitigate risks such as algal blooms preventing the use of Quipolly Dam water or groundwater sources have water quality issues
- Provide a high capacity WTP in order to service economic growth and provide capacity to the connected townships.

2.3 CONSIDERATION OF ALTERNATIVES

The consideration of alternative water supply strategies was based on the results of a risk assessment (GHD, 2014) commissioned by LPSC and Gunnedah Shire Council (GSC) in 2010. The risk assessment identified the following issues to the current water supply in Quirindi and Werris Creek:

1. High to extreme risks associated with short and long term water supply security during dry periods
2. High to extreme risks associated with capacity of water treatment and storage infrastructure. Pressures from growth being realised already
3. High to extreme risk to supply security caused by reliance on a single water source
4. High to extreme risk associated with reliability of water supply infrastructure
5. High risk of Climate Change impacts
6. Significant structural pressures (particularly in next 5 years)
7. Low adaptive capacity to water security risks
8. Infrastructure funding constraints. Water billing revenue base insufficient for immediate problems.

A number of alternatives were considered in the Risk Assessment. A comparison of the alternatives against the project objectives is outlined below.

2.3.1 Do nothing

Continued operation under the current water supply system, whereby the town of Quirindi continues to receive its water supply from the Upper Namoi Alluvial Groundwater Aquifer, and the town of Werris Creek continues to be supplied by surface water sourced from Quipolly Dam.

This option was discounted due to aging infrastructure, increased difficulty in meeting drinking water standards and meeting the future demands for water in the Liverpool Plains LGA.

2.3.2 Other options

A number of options were investigated against the Proposal objectives, outlined in Table 2-1 below.

Table 2-1 Assessment of alternatives against Proposal objectives

Other Alternatives	Objectives		
	Reduces Risk Assessment Factors 1 to 8	Meet water quality criteria	Value for money
Updated water accounting and leakage management	☒ Does not reduce risks 1 to 7	N/A	N/A
New groundwater bore development	☒ Does not reduce risks 1, 3, 4, 5,6,7.	☒ Over extraction of groundwater leads to deterioration of water quality	☒ Limitation of bore licenses, indirect economic impact from loss of productivity
Supply all townships from the Quirindi groundwater supply	☒ Does not reduce risks 1, 3, 4, 5,6,7	☒ Over extraction of groundwater leads to deterioration of water quality	☒ Limitation of bore licenses, indirect economic impact from loss of productivity
Supply Werris Creek and Quirindi from Quirindi groundwater supply	☒ Does not reduce risks 1, 3, 4, 5,6,7	☒ Over extraction of groundwater leads to deterioration of water quality	☒ Limitation of bore licenses, indirect economic impact from loss of productivity
Supply each township from its closest source only	☒ Does not reduce risks 1, 3, 4, 5,6,7	☒ Over extraction of groundwater leads to deterioration of water quality	☒ Limitation of bore licenses, indirect economic impact from loss of productivity
Supply Werris Creek from Quipolly Dam and Quirindi from Quirindi groundwater supply	☒ Does not reduce risks 1, 3, 4, 5,6,7	☒ Over extraction impacts water quality. Werris Creek WTP does not have sufficient capacity and is past is useful life.	☒ Limited water supply, indirect economic impact from loss of productivity
Supply all townships from a combination of Quipolly Dam and Quirindi groundwater mixed	☑ Reduces risks 1, 2, 3, 4, 5, 6, 7	☑ Minimise risk of over extraction of groundwater	☑ Ensures reliable supply for continued population and economic growth. The new pipeline would incorporate meters to track any leaks and water loss. The pipeline would also replace the aging and leaking pipeline.

2.3.3 Selection of the preferred option

The preferred option is to supply all townships from a combination of Quipolly Dam and Quirindi groundwater mixed.

The preferred option is justified because:

- An integrated, dual water supply would reduce risk of water supply failure to Quirindi, Werris Creek and Willow Tree. These towns currently rely on a single water supply and face a high to extreme risk of water supply failure due to contamination of water sources or infrastructure failure e.g. due to extreme weather events.
- Increased town reservoir volumes would provide sufficient storage reserves to accommodate peak daily demand in 2030 under low and step change population projections, and provide improved storage to cover cases of water supply failure.
- The additional water supply would address existing water availability issues associated with insufficient groundwater supply capacity to meet peak demand during dry periods, and would improve supply coverage to meet a greater range of demand scenarios, e.g. peak day demand following a step change in populate due to mining or construction projects.
- A new WTP which would improve continuity and quality of supply during water quality incidents from Quipolly Dam and ensuring future compliance with Australian Drinking Water Guidelines.
- It may facilitate expansion to other supplies if required
- It is a technically sound and low risk water supply augmentation option, which generally improves the operational flexibility of the scheme.

The WTP site location and pipeline alignment of the preferred option was previously chosen based on the recommendations of the previous PPEA, consultation with stakeholders, government agencies and input from geotechnical studies. Through the development of this REF, minor changes were made to the proposed alignment so as to reduce impacts or potential impacts on biodiversity constraints.

3 THE PROPOSAL

3.1 PROPOSAL PROCUREMENT STAGES

The Proposal includes the supply of water from Quipolly Dam to Werris Creek and Quirindi through the design of a new Water Treatment Plant (WTP), modifications to the existing intake at Quipolly Dam and new distribution system works. The key features of the Proposal would include:

- A Dam intake tower upgrade at Quipolly Dam
- Installation of an aeration system (destratification system) at Quipolly Dam
- A new Raw Water Pump Station (RWPS) located adjacent to Quipolly Dam to transfer raw water to the new treatment plant via a 720 m long pipeline
- A new Water Treatment Plant (WTP) located on Quipolly Dam Road/Lowes Creek Road. The WTP includes a new treated water storage reservoir, residuals lagoons, and a Treated Water Pump Station (TWPS) to transfer treated water to the distribution system
- Approximately 20 km of new trunk main from the WTP to the existing Werris Creek Reservoir (4.5 ML) and North Quirindi Reservoir (2.1 ML), to be predominantly open-trenched, with the exception of the ARTC rail line at Bells Gate Road and Werris Creek Road which would be underbore (trenchless bore). The pipeline route would be as follows:
    - Pipeline from the WTP along the road reserve of Lowes Creek Road, heading west to the intersection with Bells Gate Road (approximately 3 km)
    - Pipeline to the existing Werris Creek Reservoir along the road reserve of Back Werris Creek Road (approximately 10 km)
    - Pipeline to the North Quirindi Reservoir along the road reserve of Bells Gate Road (approximately 10 km)
- A new High Level Reservoir (HLR) at Werris Creek
- Pump station alterations at Quirindi.

3.1.1 Procurement

The Proposed works are intended to be procured via a Design and Construct contract, which may be preceded by an Early Tenderer Involvement (ETI) phase. This procurement method has been selected so as to foster innovation from a panel of specialist contractors (who have been selected via an Expression of Interest phase).

Contractors will be provided with a conceptual reference design to provide general guidance on the nature of infrastructure that will be required. However, proposals to depart from the reference design may be accepted provided that meet the same objections and functional outcomes.

This Review of Environmental Factors has been prepared assuming the footprint will be the same as and that the nature of the works constructed will be similar to the conceptual reference design.

Figure 3-1 shows an overall layout of the reference design.

Further more, detailed descriptions, diagrams and drawings pertaining to the technical development of the Proposal are provided in the following reports:

- Regional Water Supply Strategy. Water Network Concept Design report (GHD, 2014a)

- Liverpool Plains Water Supply Scheme. Water Treatment Plant Concept Design report (GHD, 2014b)
- Water quality and treatability investigations (Hunter H_2O, 2018)

Further details of each of the Proposal elements is provided in section 3.2.

3.1.2 Staging of Commissioning

Water supply to Werris Creek and Quirindi townships would not be interrupted for an extended period by the Proposal. Existing infrastructure would generally remain in place and be operational throughout the Proposal construction program. Minor interruptions may occur during connections and commissioning, however, these would be of short duration and undertaken as part of a managed process. The existing supplies of groundwater to the Werris Creek and North Quirindi reservoir would continue, with supplemental water delivered by the WTP.

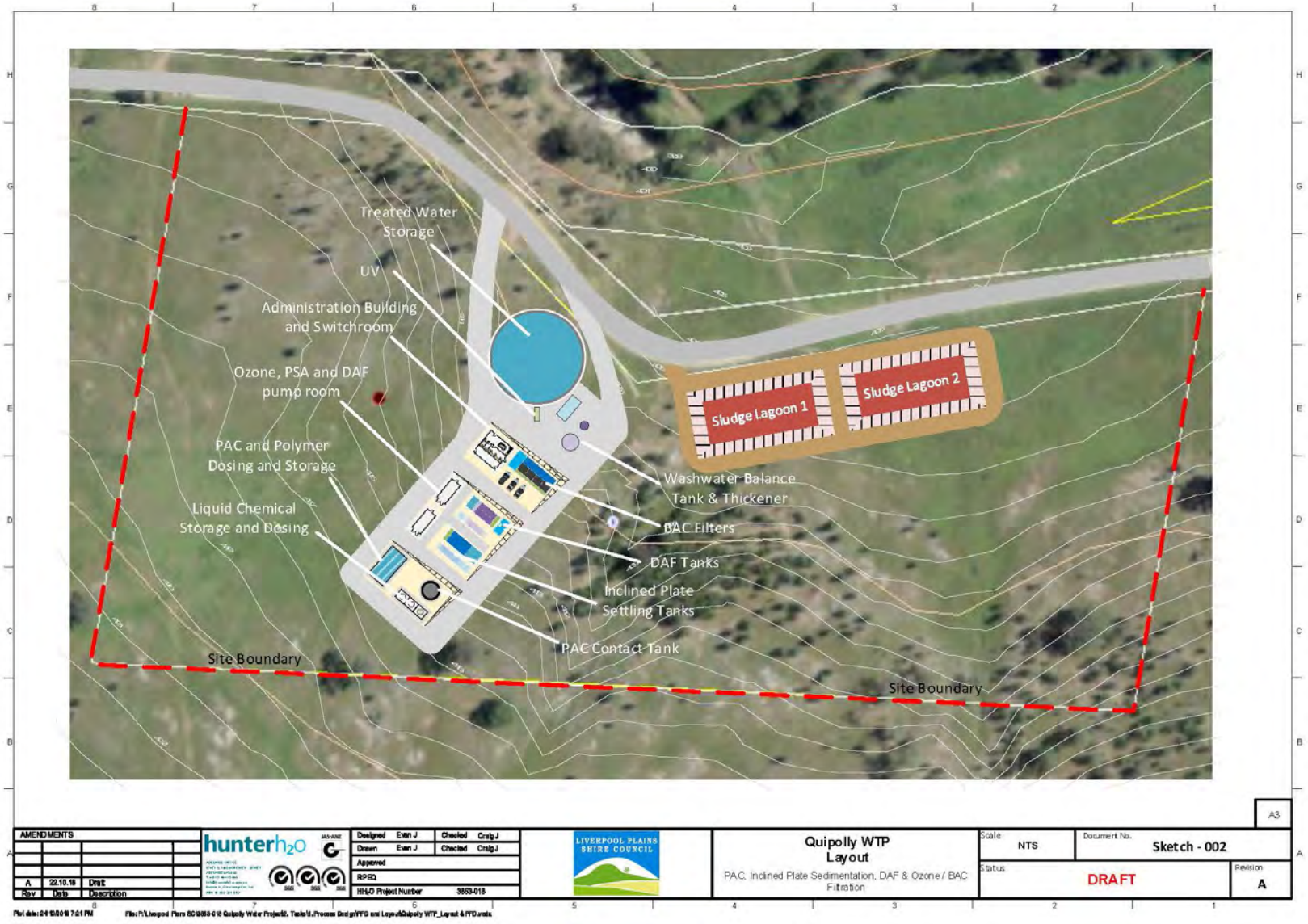

Figure 3-1 WTP Conceptual Reference Design General Arrangement

3.2 DETAILS OF NEW PROPOSAL ELEMENTS

The conceptual reference design for the WTP contemplates the following components:

3.2.1 Variable Intake Tower

The current intake tower at the Quipolly Dam has been designed to draw water from one level, based on the minimum holding volume of the Dam. During conditions where algae cell counts are high in the water column, this intake system does not have the capability to avoid drawing the algae into the water that is supplied to the WTP. As such, a variable intake tower and Dam aeration system (destratification system) would be installed at the existing intake, to minimise the amount of algae drawn from the Dam.

The existing intake structure in the Dam would not be removed, it would only be modified to accommodate the destratification system and the variable intake inlet.

3.2.2 Raw Water Pump Station (RWPS)

A new RWPS would be constructed to boost raw water supply from Quipolly Dam to the WTP. This new RWPS would replace the existing pump station, which does not have enough capacity to pump the required volumes of water to the WTP. The pump station would meet lift requirements from varying Dam levels and water treatment plant processes. The station would integrate with the existing system following construction of the new WTP as follows:

- A new suction pipe would be constructed and connect into the existing scour pipe at the bottom of the existing wet tower
- A new masonry pump station building would be located at Reduced Level (RL) 405 m (where flood level is approximately RL 405 m). This location would provide a balance between flood protection during low probability events whilst still maintaining adequate suction for low Dam levels (minimum RL 407m). The building would house an electrical switchboard, three end suction pumps (2 duty/1 standby arrangement) and gantry system for pump maintenance
- A new 300mm diameter rising main would be constructed from the new pump station to the new WTP inlet (i.e. the inlet to the PAC Contact Tank).

The pump station would be accessible from Lowes Creek Road with access across Quipolly Creek, utilising a proposed concrete causeway to maximise access during small flood events. A new bitumen access road would extend from Lowes Creek Road to the new Quipolly Dam RWPS.

Two DN450 low flow pipes would be installed under the causeway to drain away residual flows and flood events.

3.2.3 Water Treatment Plant (WTP)

A new WTP would be constructed between the townships of Werris Creek and Quirindi on Lowes Creek Road, approximately 0.5 km from the Quipolly Dam outlet. A conceptual layout of WTP infrastructure is shown in Figure 3-1. The conceptual reference design for the WTP contemplates civil, mechanical and electrical infrastructure that may include:

- Water storage structures and tanks, pipelines, pump stations and similar water transfer infrastructure

- Structures for mixing, clarifying, settling, dosing, backwashing
- Water treatment gas / chemical storage and dosing systems
- Buildings for housing administration facilities, electrical infrastructure or chemicals
- Power supply infrastructure
- Lagoons for storage of residuals
- Roads, drainage, landscaping, lighting and general infrastructure for safe and secure access into and around the plant.

The WTP site covers approx. 5.5 ha on the south side of the existing Lowes Creek Road (refer Figure 1-3), with a fall of roughly 22 m tending from south west to north east towards Quipolly Creek, which is located around 50 m from the northern boundary of the WTP site (approximately 10% from the southwest to the northeast). The WTP would take advantage of gravity flows through the main treatment processes of the plant, minimising energy use and operational costs with re-lift pumping. Night pumping would be proposed during low seasonal demand periods to benefit from off-peak tariffs.

The nearest residence would be located about 90 m to the west of the south-west corner of the WTP site.

Construction of the WTP would require realignment and bitumen resurfacing of parts of Lowes Creek Road along the northern property boundary of the WTP. The realigned section is expected to be about 100m. Further details are provided in section 3.2.7.

Operation

Operational efficiency would be maximised by providing:

- Automation Systems. The plant would be fully automatic and capable of unattended operation including automatic recovery following a power supply failure without the need for operator intervention
- Continuous monitoring equipment, alarms etc. to prevent against process failure
- Remote monitoring and control of the plant through the Council's SCADA system
- Flowrates between the minimum and maximum plant throughput would be achieved with reliable unattended operation.

The plant would be staffed most days during regular business hours but would still rely on automatic control systems. A permanent standby generator would be installed to ensure continued operation during any power outages.

Environmental and OHS obligations

The new plant would comply with statutory requirements for implementation of works, operation and maintenance including:

- Environment Protection Authority (EPA) requirements for noise and discharges to the environment
- Dangerous Goods Regulations (DGR) – chemical storage and handling (particularly gaseous chlorine), State Environmental Planning Policy 33 (SEPP33) regulations
- Work Health and Safety (WHS) requirements – eg. general access, confined spaces, lighting, emergency stopping of mechanical equipment, exposure to explosive and toxic gases, exposure to pathogens and protection against electric shock, manual handling.

All plant components would have a design service life of between 15-50 years.

Treatment Process

Raw water would be extracted from the Quipolly Dam via the new RWPS and transferred to the WTP, where treatment of the Dam water would occur. The conceptual reference design treatment process consists of the following main elements:

- Powdered Activated Carbon (PAC) dosing for taste and odour control (up to 50 mg/L dose at design flow
- Dosing with Potassium Permanganate
- Dosing of pre-soda ash for pH correction
- Coagulation by dosing Sulfuric Acid and aluminium sulphate followed by mechanical inline mixing
- Clarification (in a reactivator clarifier) with flocculant aid polymer dosing to assist with settling process
- Pre-contact and sedimentation (incorporating lamella plate to aid settling)
- Dissolved air flotation on filtration (DAFF)
- UV disinfection for cryptosporidium inactivation
- Final pH correction with soda ash (post-dose)
- Disinfection with chlorine gas

The treated water would gravitate into a new Treated Water Storage Tank (TWST), which provides contact time for chlorine disinfection, treated service water uses and balancing storage for control of the plant and the treated water pumps.

New treated water pumps would transfer water from the TWST to the distribution system. Water for backwashing of the filters would be supplied from the TWST via a set of three dedicated Backwash Pumps.

A wash-water balance tank and residuals thickener tank would receive wastewater from sedimentation, DAF and filtration. The thickener supernatant would be returned to the head of the works for retreatment and thickener residuals would be directed to residuals drying beds.

The risk of the intake of toxins from algal blooms would be mitigated by the variable intake tower and Dam aeration system (destratification system) located in the Quipolly Dam. In the event that algae cell counts in the Dam exceed the destratification system's capacity, the Quipolly Dam source water would be isolated and an alternative groundwater source would be used. In these instances, water restrictions may be required.

Chemical Usage and Waste Generation

Chemical usage volume estimates were based on modelling and testing conducted as part of the water quality and treatability investigations (Hunter H_2O, 2018). Table 3-2 outlines the estimated chemical usage at Quipolly WTP based on the conceptual reference design.

Table 3-1 Estimated chemical usage for Quipolly WTP (Hunter H_2O, 2018)

Chemical	Reason for Use	Estimated Yearly Usage (t/annum)	Basis
PAC	Adsorption of Organic Molecules	16	High dose rate of 30 mg/L in algal blooms, 5 mg/L for other times.
Potassium Permanganate	Oxidation of Manganese	4	Dose varied around soluble Mn and Fe removal. Averaging ~3 mg/L
Sulphuric Acid	Pre-Coagulation pH Correction	11	Results of jar testing and historic data to reach coagulation pH of 6.4, ~ 10 mg/L (in addition to alum dose)

Chemical	Reason for Use	Estimated Yearly Usage (t/annum)	Basis
Soda Ash	Post-Filtration pH Correction	47	Modelling and results of jar testing to lift pH to 7.5, ~ 45 mg/L
Alum	Coagulation	348	Historic data and results of jar testing, ~315 mg/L (as delivered)
Polymer	Flocculant Aid	0.2	Nominally 0.2 mg/L
Chlorine Gas	Disinfection	12	Jar testing results and historic data, ~11 mg/L

The estimated dry residuals production would be ~61 tonnes/annum which in the proposed configuration would be likely to achieve a 40% solids concentration by weight. Treatment residuals would be removed from the residuals lagoons by contractor and disposed to local landfill.

Treatment wastewater would be recycled with almost all water recovered and treated for potable use. Some water would be lost from the residuals lagoons due to evaporation (~2000mm/yr).

Residuals lagoons

The following waste, overflow and drainage streams produced by the plant would be directed via a common gravity pipeline to residuals lagoons:

- Residuals from the Reactivator Clarifiers
- Filter washwater from backwashing of the filters
- Filter to waste from filters during the ripening period following backwashing
- Sampling waste streams
- Tank/process unit drainage associated with tank/process unit cleaning
- Clean water from chemical bund and delivery bay (in the event of a chemical spill or other contamination, the contents would be removed off-site via an eductor truck)
- Floor drainage from the chemical building

The residuals lagoons would be fitted with sand beds and under-drains to improve the drainage and drying process. The lagoons would produce thickened, dried residuals and clarified supernatant. Treatment wastewater, the supernatant, would be recycled with almost all water recovered and treated for potable use. Subnatant from an off-line lagoon would be pumped back into the common inlet pipe to the residuals lagoons.

The Quipolly WTP would not include routine off-site discharge. An emergency overflow from the Quipolly WTP would be provided to Quipolly Creek. This emergency overflow would only operate under abnormal conditions. Stormwater drainage from the site would also discharge to Quipolly Creek.

Emergency overflow

The emergency overflow would not be used as part of routine operations, but this discharge may be required for the following scenarios:

1. To provide controlled overflow from the water treatment plant tanks under an emergency overflow condition that would otherwise result in localised overflow from treatment tanks. These events are considered unlikely (once in 10 years or less). The maximum overflow rate could be high (in the order of 350 L/s), but would be of short duration (less than 5 minutes). The WTP would be fitted with overflow detection and would automatically shut down in the event of an emergency overflow event.

2. To drain down treatment tanks to enable inspection or repair. These events are likely but infrequent (approximately once in five years or less). Flow rates may be in the order of 100 L/s over 24 hours.
3. To discharge partially treated water that is unfit for drinking water quality. In the event of abnormal operating conditions, the water treatment plant may discharge partially treated water that is unsuitable for drinking water via the emergency overflow while the treatment process is recovered and stabilised. These events are unlikely (once in 10 years or less). The discharge flow rate may be in the order of 130 L/s for 2 -3 hours.

The water quality of the overflow in the above circumstances would be similar to the water quality in the raw water from Quipolly Dam or better.

The design of the overflow would depend on the final design. However, standard design requirements would include a dedicated drainage system for the overflow under Lowes Creek Road, and an outlet with appropriate flow dispersion/erosion limitations e.g. rock gabion mattress or similar system to suit the final discharge flows to Quipolly Creek.

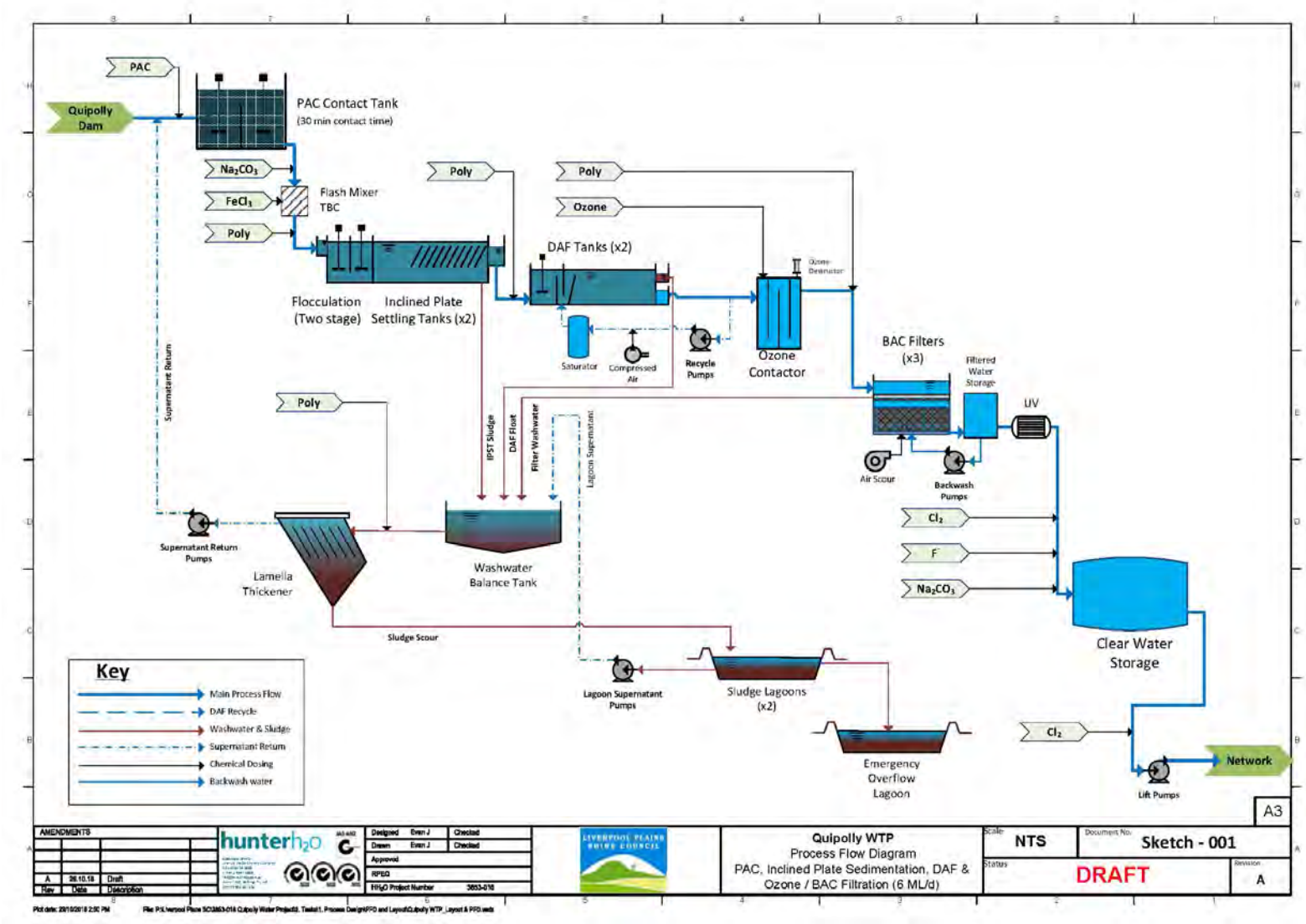

Figure 3-2 Process flow Diagram

Ancillary systems

The following ancillary systems would be provided as part of the WTP:

- Filter air scour system
- Compressed air system
- Service water systems
    - The Filtered Service Water System would supply filtered water from the Filter Weir Chamber via the Filtered Service Water Pumps to the chemical systems (e.g. for batching, dilution etc.). This water would also be used for flushing the Reactivator Clarifiers on shut down.
    - The Treated Service Water System would supply water from the Treated Water Storage via the Treated Service Water Pumps to the toilets and amenities areas, to hose taps around the site, and to the safety showers and eye wash stations.
- Sample water systems (for manual sampling and analyser sampling systems)
- Fire water system.

Administration building

The administration building would be located near the site entrance, away from the chlorine room in the chemical building to minimise interactions with any hazardous chemicals.

The administration building would likely include offices, control room with two workstations, Laboratory, IT/IS server room, store room, unisex/disabled combined bathroom and lunchroom with kitchenette (6 people).

Car parking would be adjacent to the building to cater for disabled access, operators and periodic tour groups. The building has been oriented roughly north-south to run 'across slope' and minimise foundation works.

3.2.4 WTP Treated Water Pump Station (TWPS)

A new pump station would be constructed at the WTP to provide treated water supply to Werris Creek, North Quirindi and South Quirindi reservoirs.

The new TWPS would enclose the treated water pumps (for transfer to distribution), the backwash pumps (for transfer to filters for backwashing), and the treated service water pumps (for transfer to potable water users located around the plant).

The TWPS would be located adjacent to the TWST at the WTP site. The TWPS would be accessible from a small vehicle access track, from the main internal access road that is part of the proposed construction (refer Figure 3-1).

3.2.5 Pipeline

Approximately 20 km of new pipeline would be constructed to transfer water supply from Quipolly Dam to Werris Creek and Quirindi. The proposed layout of the pipeline is shown in Figure 1-3.

The extent of new pipework includes:

- Quipolly Dam to WTP
- WTP to the junction of Bells Gate Road/ Lowes Creek Road

- Junction of Bells Gate Road/Lowes Creek Road to Werris Creek (follows back along Werris Creek Road)
- Junction of Bells Gate Road/Lowes Creek Road to Quirindi (follows Bells Gate Road)

The draft alignment of the pipeline has been chosen to minimise impacts on environmental and infrastructure constraints. The final horizontal alignments of the sections of pipeline listed above would be determined during detailed design and would be governed by the location of existing main roads, ARTC railway and existing and proposed network infrastructure including water treatment plant, pump stations and reservoirs. The vertical alignment of the pipeline would be governed by the existing geotechnical conditions and obstructions and consultation with agencies, including ARTC.

The pipework would be open-trenched along the majority of the route, with some small sections underbored, including under the ARTC rail line and Werris Creek Road.

Pipe sizes would be developed during the strategy design phase and would be sized assuming all townships are supplied from Quipolly Dam (as this is the higher flow scenario that governs sizing). The pipes would range in size from 250 to 375 DN.

Pipe material would be Ductile Iron Cement Lined (DICL) to minimise cover, provide good resistance to accidental damage and avoid additional excavation costs.

Pipelines would generally meet Water Service Association of Australia code requirements, and would include:

- Flexible joints for differential settlement
- Anchored or rigid joints for unbalanced forces
- Pipe supports to prevent over stressing
- Puddle flanges where pipes go through walls.

3.2.6 Power supply

On advice from Essential Energy (GHD 2014), it is proposed that the new WTP and water pump stations would be serviced from an existing incoming 11 kV feeder line from the east.

A new incoming low voltage supply would be constructed for the Quipolly Dam and would include:

- New 200 kVA pole mounted substation
- Two intermediate poles and one intermediate span. The existing pole mounted transformer and power poles are to remain at the existing raw water pump station.

An emergency generator would be located at the old raw water pump station site. The decommissioning of the old raw water pump station would not be undertaken under the current Proposal.

Switchboard

A new indoor switchboard would be designed for the RWPS and TWPS. The switchboard would contain a manual change over switch to enable switching between the main supply and portable back-up generator. The switchboard would contain all necessary metering and protective equipment. The switchboard would be a suitably rated Ingress Protection switchboard (IP 66) The switchboard would include telemetry equipment to communicate with the WTP. The switchboard would include an auxiliaries panel for small power and general lighting and power.

3.2.7 Roadworks

Design of modifications to Lowes Creek Road

The existing Lowes Creek Road would be locally realigned by LPSC to free up additional flat area for siting of the WTP facilities and residuals lagoons. The realigned road would:

- Meet Council standards for sight distances for large vehicles
- Allow for safe access for trucks into the WTP site

Two independent accesses would be provided from the realigned Quipolly Dam Road, one to the main part of the plant for everyday operational access, and the other to the residual lagoons for removal of dried residuals; refer to Figure 3-1.

Internal site access road design

The access road in the main part of the plant would be bitumen paved and designed for chemical deliveries by semi-trailers. A chemical delivery unloading area (to contain spillage during deliveries) and a loop road would be provided to enhance safety during chemical deliveries.

Equipment and structures would be located for convenient access from this loop road.

A gravel access only would be provided to the residuals lagoons for intermittent use of residuals disposal trucks.

3.2.8 Stormwater drainage

Chemicals would be either bunded or stored inside the chemical building and any spillage would be contained. Contained contaminated water would be trucked offsite. The chemical delivery area (unloading bay) would also be bunded. The residuals lagoons would be raised above the general site level so that runoff cannot enter into the lagoons from the uphill slope to the south.

On this basis, stormwater would be allowed to flow off-site with no treatment or detention considered necessary. Based on current site topology, the current overland stormwater drainage paths towards the Quipolly Creek would be maintained where practical and diverted around structures as required. Depending on the final site levels, a culvert under Lowes Creek Road would be installed during the road realignment (using dish drains, pits and some minor pipework).

Flooding models indicate that the 1 in 100 Average Recurrence Interval Event flooding level is around RL 404 m AHD; this would only pond around the northern embankments of the residuals lagoons. The final drainage network would ensure that flows are diverted around and do not enter the residuals lagoons.

3.2.9 Site security and fencing

A chain mesh security fence (2.4m high with three strands of barbed wires) would be provided around the water treatment plant site as well as around the new and existing Werris Creek reservoirs. Manual gates would be provided at the main entrance to the plant and at the entrance to the residuals lagoons.

3.2.10 Landscaping

A landscaping plan has been developed following initial consultation with the LPSC and the nearest sensitive receiver. This would include:

- Reinstatement of any natural surfaces disturbed during construction to their former conditions and profile.
- Plantings for screening the WTP and lagoons to the west at the closest residential receiver and along Lowes Creek Road, as shown on the site layout plan (refer Figure 3-3).

Footpaths would be provided to connect building doorways and structure stairways to the nearest access road, and to provide pedestrian access around individual plant structures. Hardstand areas would also be provided.

3.2.11 Werris Creek Reservoir

A new reservoir would be built at Werris Creek, located adjacent to, and 3 m to the west of, the existing high level reservoir at Werris Creek, and would operate in conjunction with the existing reservoir to provide additional storage.

The reservoir would have a 0.4 ML capacity to secure water supply for the township should the existing high level pumps fail, and would be constructed of concrete to match the existing adjacent reservoir.

The site would be accessible from Punyarra Street via an existing gravel access track; no modification to the existing access track would be required. The site falls to the east and west and rises to the south, following the ridgeline to the north.

A new 1.8 m high manproof wiremesh security fence with barbed wire would be constructed around the new and existing reservoirs.

3.3 OPERATIONAL PROCESS

The existing pump operation at Quirindi balance tank currently transfers water from the Quirindi bores to the southern and northern Quirindi reservoirs and would be arranged to normally deliver the duty flow from one pump to each tank.

Once the WTP is operational, it would be designed to provide treated water under four operational scenarios (GHD 2014b). The operational process for the Proposal is shown in Figure 3-2.

Scenario	Operation Process
Scenario 1: All townships are supplied from the WTP (Quipolly Dam).	This scenario would be 'operation as usual' and has been used to govern system infrastructure sizing.
Scenario 2: Should supply from the WTP fail.	The existing bores at Quirindi groundwater would supply Willow Tree and Southern and Northern Quirindi tanks (refilling simultaneously and individually). The Quirindi groundwater bores would operate at five different rates assuming all reservoirs have capacity to be refilled simultaneously (i.e. there are no specific controls on individual reservoirs controlling preferential refill).
Scenario 3: This operating scenario may occur in the situation that the main between the Lowes Creek Road/Bells Gate Road intersection and Quirindi is broken.	Werris Creek supplied from Quipolly Dam. Quirindi and Willow Tree supplied from Quirindi groundwater supply The Quirindi bore would operate at three different rates assuming all Quirindi and Willow Tree tanks have capacity to be refilled simultaneously. The pumps at the water treatment plant would operate constantly at 40.5 L/s at 110 m head, necessary to service Werris Creek reservoir.

Scenario	Operation Process
Scenario 4: All townships supplied by a combination of water from Quipolly Dam and Quirindi groundwater mixed	During Average Daily Demand, a single groundwater pump would fill the north Quirindi tank, with limited outflow from the southern Quirindi tank. The proportion of flow sourced from the groundwater and treated water supplies can be controlled by modifying pump operation between one to four pumps at the water treatment plant to provide a blended water quality in the northern tank that feeds Quirindi and Willow Tree. This would be modified during operation based on desired blend quality, pumping costs and source availability. The capacity of the flow limiting valve on the northern Quirindi reservoir inlet receiving flow from the water treatment plant would increase from 35 L/s to 58 L/s. Under Peak Daily Demand (PDD) scenarios, a single groundwater pump would fill the south Quirindi tank. Flow to the north Quirindi and Werris Creek tanks would be sourced from the treated water pump station at the WTP. Under PDD conditions, although strict mixing may not be achieved, the model run confirms that Quirindi can be serviced with both treated and bore water (flow from south Quirindi tank can't be restricted).

The maintenance of additional or modified infrastructure arising from the Proposal would be incorporated into LPSC's existing maintenance programs.

3.4 CONSTRUCTION ACTIVITIES

The construction of the infrastructure would include vegetation removal, excavation (cut and fill), concrete pouring, building and infrastructure erection, electrical works, and formal road construction.

Pipeline installation would require a construction corridor of approximately 20 m wide. Materials would be required to be temporarily stockpiled within the pipeline corridor, and the corridor used for machinery and vehicle movements.

Where the pipelines would be buried it would be a maximum of 600 mm below the existing surface. Concrete encasement under named ephemeral watercourses and minor drainage lines would be required to protect against future scour risk.

The associated pipelines would be open-trenched in stages along the majority of the route. Trenchless crossing would be required at the ARTC Bells Gate Road rail line crossing and Werris Creek Road. Initial consultation with ARTC has provided detailed construction and design requirements to ensure that the rail operation would be not compromised during construction and operation of the Proposal.

Where ground conditions are not suitable for open cut trench installation, the pipeline would be installed aboveground, approximately 0.5m above the existing surface. This strategy is likely to occur along sections of Lowes Creek Road.

The approximate proposed works impact area including earthworks, laydown area and vegetation removal would be a maximum of 44.8 ha hectares.

3.4.1 Works methodology

The expected works methodology for the Proposal are outlined below in Table 3-3.

Table 3-2 Works methodology

Activity	Associated work
Pre-construction	• Obtain leases for compounds and road occupancy licences • Secure property acquisition • Notify the public, businesses, public transport companies, council and other stakeholders before work starts • Carry out geotechnical investigations and other investigation work • Locate & protect existing utilities • Set out, demark and fence the site to establish routes, accesses, and no-go zones • Install safety barriers and environmental controls (eg. Erosion and sedimentation controls temporary drainage controls) • Establish the site compound approximately 50m X 100m and access routes • Clear land (vegetation removal, clearing and grubbing) and property adjustments
Construction	• Implement diversions and traffic management controls (where needed) • Sequentially strip and excavate top soil and sub soil in segments, as needed, storing topsoil separately to the subsoil • Construct new WTP • Construct new RWPS • Construct new HLR • Realign and resurface parts of Lowes Creek Road in the vicinity of the WTP • Open trenching along the pipeline route. Excavated material would be kept to the side during the works, and reinstated following completion of pipe laying of each segment Pipes would be laid adjacent to the trench and progressively welded in situ • Trenchless bore under ARTC rail line and Werris Creek Road • Backfill trenches as soon as possible • Grade and compact areas • Ongoing rehabilitation as each segment of work is completed including respreading topsoil and subsoil over disturbed areas as appropriate, to encourage natural regeneration
Remediation and rehabilitation	• Carry out final grading, levelling and compaction • Landscape screening at WTP • Rehabilitate road surfaces and other areas affected by construction works
Finalisation work	• Electrical and mechanical commissioning • Testing and commissioning of WTP and RWPS
Demobilisation, remediation and rehabilitation	• Demobilise the site compounds and remove temporary traffic management controls • All areas disturbed during the construction works would be stabilised and rehabilitated • Topsoil removed from excavations would be stockpiled separately to the subsoil, and would be respread over disturbed areas as appropriate to encourage natural regeneration • Construction erosion and sediment control structures would be maintained until the disturbed areas are stable.

Underbore crossings

The underbores could be constructed by multiple construction methodologies including micro-tunnelling and horizontal directional drilling. Pipe Jacking methods are not likely to be suitable through the hard clays,

very dense sands and gravels and upper rock profile. Construction methodology would be determined during detailed design and by the designated construction contractor.

A drill pit at each underbore location for the entry and exit points of the drill head would be established, approximately 10 m^2. The final pit locations would be determined by the construction contractor. Excavated materials would be stockpiled adjacent to the pit.

The pipeline material which would be employed in the directional drill would likely be DICL. Pipes would likely be supplied in 12 m lengths and butt-fusion welded into a long pipeline string on-site.

Temporary pipe stringing areas would be established, approximately 450 m by 6 m along the pipeline alignment, within the 20m construction corridor.

The contractor may elect to progressively weld lengths together as the pipe is pulled through, but would more likely weld the full length of each pipe into a single string prior to pulling through. The strung pipe would then be pulled through by connection to the drill at the entry/exit pit and pulled back through the hole. Drilling fluids are applied to both pits as there would be drilling to and from both ends.

Drill fluids used would be vacuumed and temporarily stored within the pit/laydown area, to be removed offsite for possible reuse or disposal.

The underbored pipeline would terminate below ground level at its determined end points, to extend between the end of the underbore pipeline through to connect with the open-trench pipes.

Trench boxes may be used in areas of deep excavations, in particular for drill launch and retrieval pits.

Other materials which would be used/present on site, discreet from the pipeline installation, are likely to include stockpiled excavated material from pipeline construction, stockpiled pipeline bedding materials, pre-mix concrete, stockpiled trench and excavation backfill material and topsoil for restoration.

Construction of the residuals lagoons, would include excavation to achieve the following profile:

- Bank slopes 1:3 internal, 1:4 external (required for mowing).
- Overall depth 2.5m including 0.5m freeboard.
- 4m wide crest with gravel road.

The residuals lagoons would be orientated east-west to limit extent of earthworks and modifications to Lowes Creek Road alignment.

A ramp into residuals lagoons, suitable for dump truck access for residuals removal, would be constructed.

The following materials and equipment would be installed to complete the construction of the residuals lagoons:

- Clay lining: 600mm thick and 10-9m/s permeability and dispersive (would require addition of lime or gypsum)
- Washwater inlets: 500 mm diameter with valves, and concrete inlet pads.
- Supernatant collection: Offtake bellmouth or weir; 150mm diameter supernatant collection pipes. Supernatant pump station to return supernatant to the raw water inlet pipeline.
- Underdrains and subnatant collection: 100mm diameter slotted pipes in gravel (rodding points to be provided). Geofabric spaced at 5m centres. 150mm sand layer.
- Subnatant pump station to collect residual water from drying residuals and return it to the online (active) lagoon. Transfer would be via temporary hose. The pump station would be a package type pump station located centrally but not on the access roads

Construction of the RWPS and access tracks would comprise of:

- Construction of a small gravel vehicle access track from Lowes Creek Road appropriate for access by a small Council maintenance vehicle
- Construction of a new 6.7 x 5.4 m masonry pump station building to house an electrical switchboard, three end suction pumps (2 duty/1 standby arrangement) and gantry system for pump maintenance
- Install new suction pipework from the existing outlet main from Quipolly Dam
- Install new delivery main pipework (including bypass arrangement) from the raw water pump station to new water treatment plant

A DN300 below ground electromagnetic flowmeter would be located on the delivery pipework to the new water treatment plant.

Construction of the Treated Water Pump Station and access tracks would comprise of:

- Small vehicle access track from the main internal access road
- Construction of a new masonry pump station building with acoustic treatment to house separate switch room, 5 treated water pumps (4 duty/1 standby arrangement), 3 backwash pumps and gantry system for pump maintenance
- Install new incoming pipework from the DN600 suction header
- Install new DN300 discharge header from the pump station to distribution main.

3.4.2 Construction equipment

Plant and equipment that would be utilised during construction include, but would not be limited to:

- Tracked excavator
- Forklift
- Backhoe
- Compactor
- Crane
- Roller
- Concrete Agitator Truck/Pump
- Dozer
- Large excavators fitted with teeth 40t
- Generator
- Rock saws
- Dewatering pumps
- Mobile crane
- Rock hammers
- Impact Pile Driver
- Horizontal Boring Hydraulic Jack
- Concrete trucks
- Scraper
- Hydraulic hammers fitted to 20 tonne excavators
- Concrete Saw
- Auger Drill Rig
- Boring Jack Power Unit
- Front End Loader
- Flotation equipment (work in dam)
- Grader
- Underbore/drilling machine
- Delivery trucks
- Grinder
- Trucks
- Hand tool (hammer noise)

3.4.3 Key Materials

Key materials required to carry out the construction of the proposed works would include, but would not be limited to:

- Pipe work i.e PVC pipe, DICL pipe, MSCL pipe, PE / PB pipe
- Road materials i.e. subgrade, sub base, asphalt, concrete, kerbing, guttering, stormwater
- Process Equipment i.e. analysers, dosing equipment, process units etc
- Mechanical equipment i.e. pumps, mixers etc
- Buildings
- Instrumentation
- Valves/ fittings
- Concrete
- Steelwork
- Aluminium
- Blockwork
- Process units
- Nuts/bolts/connections
- Sand and rock
- Stainless Steel
- Pits
- Tanks (many types)
- Electricals

3.4.4 Earthworks

Key materials may need to be brought to the site to build the Proposal. The quality of some of the excavated material may or may not be suitable for reuse onsite as engineering fill. All excavated materials would be managed under the following hierarchy:

- Reuse as engineered fill onsite (if suitable)
- For storage at a stockpile site to allow for its future reuse (where the contractor is able to locate a suitable site)
- To another construction site for use as engineering fill (where the contractor is able to locate a suitable site)
- To a licenced waste recovery site
- For disposal at a licenced facility.

Any materials reused onsite, or imported to site from another project, would be subject to testing for suitability and waste classification. Should the material be classified as a controlled or restricted waste or found to contain weed seed stock or contaminants of concern at elevated concentrations, it could not classify for exemption and reuse. It would be stored in a contained separate location onsite before being transported offsite to a licenced facility. This is further discussed in Section 6.11.

3.4.5 Ancillary Facilities and Site Access

A construction compound is proposed to be adjacent to the new WTP, within an area of land previously cleared and used as a construction compound during the construction of the Quipolly Dam. An area has been already set aside for this and has been included in the project impact area; refer to Figure 3-3. The location of construction compound and storage areas would be confirmed with the preferred Contractor and LPSC

The construction compound would be fenced, allowing for shed and toilet facilities, as well as storage for equipment (including laydown areas), machinery and materials and possibly vehicles, as required.

Several other storage areas/laydown/pipe-stringing areas would be established along the alignment of the pipeline leading to North Quipolly Reservoir and Werris Creek Reservoir. These storage areas would be used for temporary storage of materials and plant and facilitate the staged installation of the pipework along the entire pipeline corridor. Excavated materials would be stockpiled adjacent to the pipeline trench. The storage areas would be fenced and established within the 20 m wide construction corridor allocated for the trenching and installation of the pipeline.

A drill pit at each underbore location for the entry and exit points of the drill head would be established, approximately 10 m^2, and could include site sheds, offices, laydown areas, storage for drilling equipment, pipe-stringing and a drilling mud storage 'pond'.

Access to the work sites would be provided from existing roads along the proposed pipeline route and WTP.

3.4.6 Site Personnel

It is envisaged the following number of onsite employees and contractors would be required during the peak of construction:

- Approximately 30 personnel for pipework installation and pump station / valve pit construction
- Approximately 50 personnel for the water treatment plant construction.

3.4.7 Construction Timing

Construction is estimated to commence in late 2018. The work would be completed in segments progressively to minimise impacts on the environment. It is estimated that completion of the project would take 24 months.

Working hours

Construction would occur during standard working hours as defined in the Interim Construction Noise Guidelines (DECCW, 2009):

- Monday to Friday – 7am to 6pm
- Saturday – 8am to 1pm
- Sunday and public holidays – no work

However, certain stages of the Proposal would be located in relatively remote areas, with few to no sensitive receivers. In these instances, the Contractor may choose to schedule fortnightly work shifts, to optimise the construction schedule and mobilisation of staff.

Equally, in the area of the ARTC Rail line, construction of the pipeline would occur during a planned rail possession or as approved by ARTC. As such pipeline construction timing may extend into out of work hours in order to ensure that the pipeline installation works are completed before rail operations resume.

Where out of work hours are planned, the Contractor would obtain approval from LPSC prior to commencing these works. The Contractor would implement the safeguards and respite periods stipulated in the REF and conditions of approval.

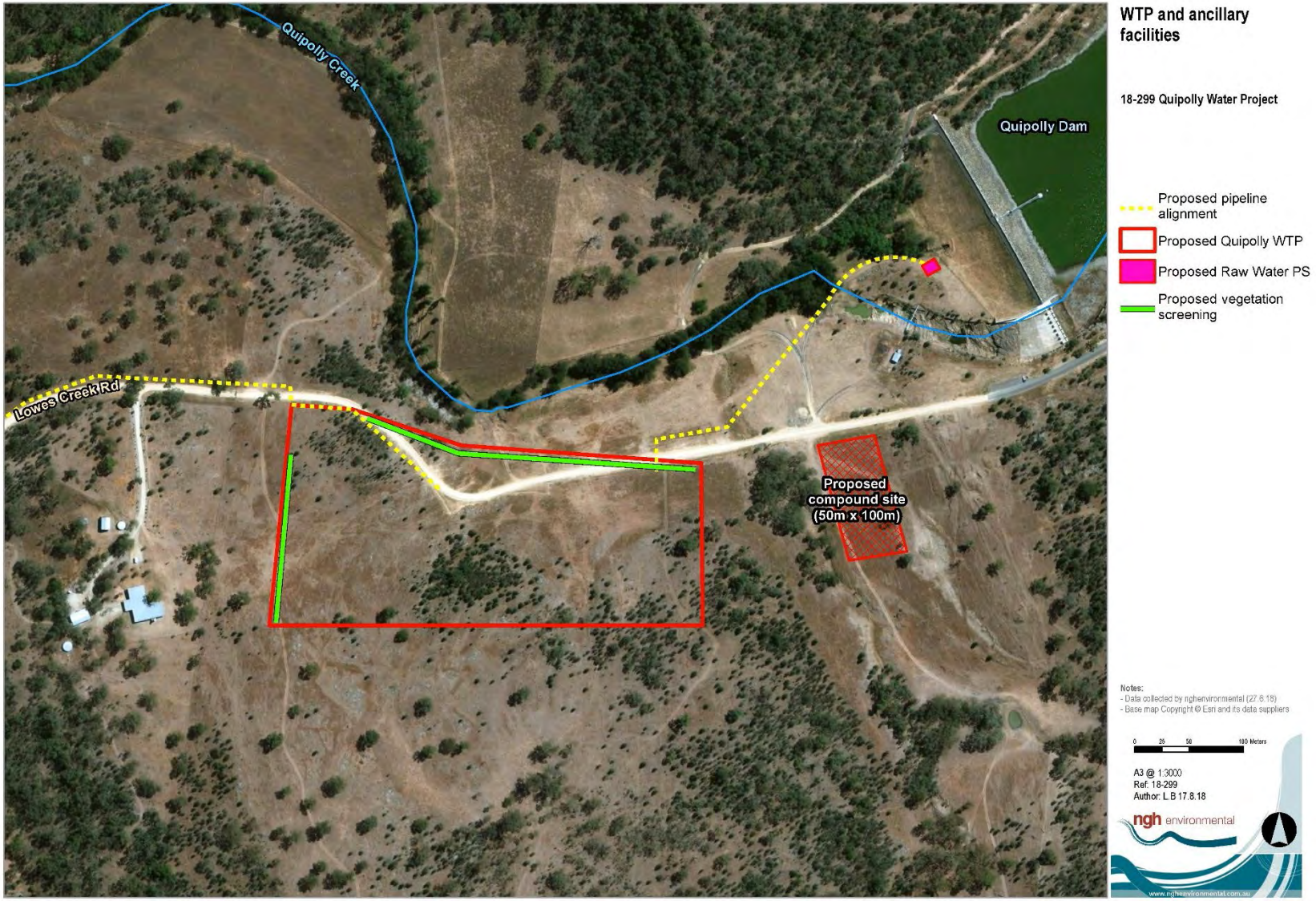

Figure 3-3 WTP and ancillary facilities boundaries

4 LEGAL AND POLICY REQUIREMENTS

4.1 LEGAL PERMISSIBILITY

Table 4-1 Legal requirements for the Proposal

Law, Policy or Regulation	Objective	Requirement for the Proposal
Liverpool Plains Shire Council Local Environment Plan 2011	This Plan aims to make local environmental planning provisions for land in the Liverpool Plains LGA area in accordance with the relevant standard environmental planning instrument under section 33A of the EP&A Act. The particular aims of this Plan are as follows: (a) to encourage the orderly management, development and conservation of natural and other resources within the Liverpool Plains region by protecting, enhancing or conserving: (i) productive agricultural land, and (ii) timber, minerals, soil, water and other natural resources, and (iii) areas of significance for nature conservation, and (iv) places and buildings of archaeological or heritage significance, (b) to manage the urban areas of Liverpool Plains by strengthening retail hierarchies and employment opportunities, promoting appropriate tourism development, guiding affordable urban form and providing for the protection of heritage items and precincts, (c) to promote ecologically sustainable urban and rural development, (d) to provide a secure future for agriculture by expanding Liverpool Plains' economic base and minimising the loss or fragmentation of productive agricultural land, (e) to minimise land use conflict, (f) to ensure that development has regard to the capability of the land, (g) to provide a choice of living opportunities and types of settlement within Liverpool Plains,	The Proposal would be located in land zoned RU1 (Primary Production). The Proposal is permitted with consent within this land zone. Clause 5.12 of the Liverpool Plains LEP does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under *State Environmental Planning Policy (Infrastructure) 2007*. Under Clause 125 of *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) the entire project is permissible without consent (see row below) and falls under Part 5 of the EP&A Act. The objectives of the Liverpool Plains LEP zones would be preserved during construction and operation of the proposed works and the considerations of the Liverpool Plains LEP have been factored into this REF.

Law, Policy or Regulation	Objective	Requirement for the Proposal
	(h) to ensure that the efficiency of arterial roads is not adversely affected by development on adjacent land, (i) to enable development that has proper regard to the environmental constraints of the land and minimises impacts on biodiversity, water resources and natural landforms.	
State Environmental Planning Policy 2007 (Infrastructure SEPP)	The aim of the Infrastructure SEPP is to facilitate the effective delivery of infrastructure across the State by: improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services, and providing greater flexibility in the location of infrastructure and service facilities, and allowing for the efficient development, redevelopment or disposal of surplus government owned land, and the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development), and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing.	Clause 125 of Part 1 states that development for the purpose of water reticulation systems may be carried out by or on behalf of a public authority without consent on any land. Consequently, the raw water intakes, the pump stations, and all water reticulation pipework (both raw and untreated water) is permitted without consent. *Water reticulation system* means a facility for the transport of water, including pipes, tunnels, canals, bores, pumping stations, related electricity infrastructure, dosing facilities and water supply reservoirs. Clause 125 of Part 3 of SEPP (Infrastructure) applies to water supply systems. Under this clause, development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in any of the following land use zones: (a) RU1 Primary Production, (b) RU2 Rural Landscape, (c) RU4 Rural Small Holdings, (d) IN1 General Industrial, (e) IN3 Heavy Industrial, (f) SP1 Special Activities, (g) SP2 Infrastructure. The Proposal is for the purpose of a water treatment facility and would be undertaken by LPSC, which is a public authority. The proposed WTP would take place within RU1 (Primary Production). As such, the Proposal is permitted without consent.
SEPP 33 – Hazardous and Offensive Development	SEPP 33 provides a systematic approach to planning and assessing Proposals for potentially hazardous and offensive development for the purpose of industry storage.	SEPP 33 is not applicable to Division 5.1 activities.

Law, Policy or Regulation	Objective	Requirement for the Proposal
		However, it provides guidance on whether chemicals transported to and stored at the sites are potentially hazardous. If a Division 5.1 determining authority considers that an assessment of hazard or offence is relevant to its environmental considerations of the Proposal it can apply the assessment principles outlined in SEPP 33. Refer to Section 3.3 for the proposed chemicals to be used and stored during construction and operation of the Proposal.
SEPP No. 44 - Koala Habitat Protection	SEPP 44 aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas.	SEPP 44 is not applicable to Division 5.1 activities, however the principles of the SEPP have been applied in the ecological assessment – see Section 6.2 for details.
SEPP No. 55 – Remediation of Land (SEPP 55)	SEPP 55 provides a state-wide planning approach to planning approach to the remediation of contaminated land. It specifies when consent is required, and when it is not required, for a remediation work.	A search of the Environment Protection Authority (EPA) contaminated sites register was completed on 9 May 2018 (Appendix A) and did not identify any contaminated sites within the Proposal area. No further consideration of this SEPP is required in this REF.
State Environmental Planning Policy (State and Regional Development) 2011	The SEPP identifies where development is State significant development (Division 4.2 of the EP&A Act) and development that is state significant infrastructure (Division 5.2) and critical State significance infrastructure.	Under Clause 12, (1) Development is declared, pursuant to section 115U (2) of the Act, to be State significant infrastructure for the purposes of the Act if: (a) the development on the land concerned is, by operation of a State environmental planning policy, permissible without development consent under Division 4.1 of the Act, and (b) the development is specified in Schedule 3. As the proposed works are not consistent with the development specified in Schedule 3, the provisions of State significant infrastructure do not apply to the proposed works. Schedule 3 states that development for the purpose of water treatment facilities (not including desalination plants) carried out by or on behalf of a public authority

Law, Policy or Regulation	Objective	Requirement for the Proposal
		that has a capital investment value of more than $30 million becomes SSI. The capital cost of the Proposal is estimated to be in the order of $28.3 million and therefore is not SSI.
Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act provides for a co-ordinated approach to development ensuring the proper management, development and conservation of natural and cultural resources and promoting social and economic welfare and a better environment.	This REF has been completed under Division 5.1 of the EP&A Act, and aims to address LPSC's duty in respect to considering the environmental impact of the proposed activities under Section 5.5 of the EP&A Act and Section 228 of the Environmental Planning and Assessment Regulation 2000. Subsection 5.7 of the EP&A Act requires an Environmental Impact Statement (EIS) to be prepared (instead of or in addition to an REF) if an activity is likely to significantly affect the environment. However, Subsection 5.7 also provides that if the activity is only likely to significantly affect the environment in respect of: • land that is, or is part of, critical habitat, OR • threatened species, populations or ecological communities, or their habitats, then an EIS is not required, provided a Species Impact Statement has been furnished. Subsection 5.7 also requires the concurrence of the Director-General of OEH if there is likely to be significant impact to the above listed entities. The Proposal is not likely to significantly affect the environment.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act provides an integrated system of licensing for polluting activities within the objective of protecting the environment.	There is potential risk for the Proposal to pollute the environment if not adequately mitigated. The impact of the Proposal and measures to prevent pollution are discussed in Section 6. Waste generated during construction would be managed in accordance with the POEO Act and associated regulations.

Law, Policy or Regulation	Objective	Requirement for the Proposal
		Wastewater generated by the WTP would not be discharged to the environment. Water residuals generated by the WTP would be managed in accordance with the POEO Act and associated guidelines.
Water Management Act 2000 / Water Act 1912 (WM Act)	Provides for the preparation and implementation of Water Management Plans, Works Approvals and Water Sharing / Licencing agreements. It regulates controlled activities within 40m of a watercourse and extraction of water within an area covered by a WSP. In the absence of coverage by water sharing plans under the WM Act, the WA Act continues to regulate the use of water. If more than 3ML of groundwater is likely to be encountered, approval is required from NSW Office of Water (NOW), either under the *Water Management Act 2000* if the WSP applies to the groundwater extracted or otherwise under Part 5 of the *Water Act 1912*.	The applicable Water Sharing Plan (WSP) for the area is the Upper Namoi and Lower Namoi Regulated River Water Sources, which commenced in 2004. The work approvals under the WM Act are 90WA8000010 and 90WA806412. The construction of the proposed works is unlikely to encounter surface water or groundwater at locations along the pipeline routes or reservoir lagoons. Further detail on hydrology and water quality (including groundwater) is provided in Section 6.1. As less than 3ML of groundwater is likely to be encountered, approval is not required for dewatering. Under the WM Act, a controlled activity means: • The erection of a building or the carrying out of a work (within the meaning of the EP&A Act), or • The removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or • The deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or • The carrying out of any other activity that affects the quantity or flow of water in a water source. The Proposal would involve the carrying out of work within 40m of a waterway, and hence would be classed as

Law, Policy or Regulation	Objective	Requirement for the Proposal
		a 'controlled action'. However, LPCS is exempt from the requirements to obtain a controlled activities approval for works within 40 m of a waterway, as it is a public authority (Clause 38 of the Water Management (General) Regulation 2011).
Local Government Act 1993	The Act provides the legal framework for the operation of local government in NSW.	LPSC is required to obtain approval from the Minister for Primary Industries under s60 of the *Local Government Act 1993* to construct the Proposal.
Biodiversity Conservation Act 2016 (BC Act)	The BC Act identifies threatened species, populations, endangered ecological communities, critical habitats and key threatening processes. It establishes assessment requirements and a planning approval process for Proposals that may impact these environmental values.	A Biodiversity Assessment was conducted including a search of the OEH Bionet database which was undertaken on 9 May 2018 (see Appendix C). The potential for the Proposal to impact threatened species, populations and endangered ecological communities is assessed in Section 6.2.
Fisheries Management Act 1994 (FM Act)	The FM Act regulates activities that pose a threat of damage to aquatic habitats, threatened species, populations or ecological communities. The FM Act requires an assessment of whether threatened species of fish and marine vegetation, populations or ecological communities are likely to be affected by the activity. Where a significant impact is considered likely, a Species Impact Statement must be prepared and concurrence sought from the Director-General of NSW Trade and Investment. The Minister for Primary Industries may also need to be consulted. The FM Act also provides for the management of dredging and reclamation work and requires approvals for specific activities on 'waterfront land'. Waterway crossings by trenching are considered dredging activities under Part 7 of the FM Act. Additionally, under Part 7 of the FM Act, any structure (such as a weir, causeway or dam) that may inhibit or obstruct the movement of fish within a waterway requires approval.	Under Section 200 of the FM Act, a local government authority must not carry out dredging or reclamation work in a waterway except under the authority of a permit from Fisheries NSW. The proposed works would involve dredging and blocking fish passage during construction, therefore a Part 7 Permit would be required. Refer to Section 5.2.5.
Biosecurity Act 2015	The primary object of the *Biosecurity Act 2015* is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other	A search of the Department of Primary Industries WeedWise database for regional priority weeds for the Liverpool Plains LGA was undertaken in June 2018 (see Appendix A).

Law, Policy or Regulation	Objective	Requirement for the Proposal
	activities that involve biosecurity matter, carriers or potential carriers. The biosecurity framework and tools safeguard our economy, environment and community and Any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about.	Section 6.2 addresses impacts relating to priority weeds.
Heritage Act 1977	The *Heritage Act 1997* provides for the protection of non-indigenous heritage.	A historic heritage investigation was undertaken; the findings are summarised in Section 6.8 and the search is included in Appendix A.
National Parks and Wildlife Act 1974 (NPW Act)	The objectives of the *National Parks and Wildlife Act 1974* are to conserve and preserve nature; conserve objects, places or features (including biological diversity) of cultural value within the landscape; foster public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation; and provide for the management of land reserved under this Act.	The NPW Act requires that the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW is followed to determine if there is likelihood that an activity would impact on Aboriginal objects. A Due Diligence assessment has been undertaken with the outcomes discussed in Section 6.7.
Soil Conservation Act 1938	The purpose of the Act is to conserve soil and water resources and mitigate soil erosion. Section 15A of the Act provides for Notices that would allow EPA to prescribe measures for erosion and sediment control that must be adopted.	Construction of the Proposal would be undertaken in accordance with Landcom (2004) soils and construction guidelines and DECCW (2008) Managing Urban Stormwater soils and construction Volume 2A Installation of Services and the mitigation measures outlined in Section 6.1.
Contaminated Land Management Act 1997	*The Contaminated Land Management Act 1997* (CLM Act) enables EPA to respond to contamination that risks causing significant harm to human health or the environment and sets out criteria for determining whether such a risk exists. The onus is on the landholder to advise EPA if it suspects that land represents a significant risk of harm.	A search of the EPA contaminated sites register on 9 May 2018 (refer Appendix A) did not identify any contaminated or remediation sites under Section 21 of the CLM Act.
Waste Avoidance and Resource Recovery Act 2001	Repeals and replaces the *Waste Minimisation and Management Act 1995* and promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs.	Waste generation would be avoided where possible; however, some waste is unavoidable. The principles of reduce, reuse, recycle, with disposal as the last resort, would be adopted. Consideration of contaminated and hazardous waste is discussed in Section 6.11.

Law, Policy or Regulation	Objective	Requirement for the Proposal
Work Healthy and Safety Act 2011 **Work Health and Safety Regulations 2011**	The storage and handling of dangerous goods is regulated under Part 7.1 of the *Work Health and Safety Regulation 2011*.	WorkCover must be notified if any dangerous goods, stored and handled above statutory defined quantities, are used during construction or operation of the assets. This would include transport of chemicals to the WTP. A register of hazardous chemicals used, handled or stored at the workplace must be kept and include: (a) a list of hazardous chemicals used, handled or stored, and (b) the current safety data sheet for each hazardous chemical listed
Public Health Act 1991	The objective of the *Public Health Act 1991* is to control public health risk and to protect public health.	There are no approval requirements under this act relevant to the proposed works. Under the Act, the Minister for Health has powers to issue orders and direct public authorities to act to prevent public health risks. The new WTP would be located in an area with adequate buffer to sensitive receivers. The new WTP would supply treated water in accordance with the Australian Drinking Water Guidelines (2011). All hazardous chemicals would be appropriately stored, handled and used during the treatment process in accordance with relevant Safety Data Sheets, OH&S guidelines and the WTP Operational Management Plan.
Roads Act 1993	The objectives of the *Roads Act 1993* are to: (a) set out the rights of members of the public to pass along public roads; (b) set out the rights of persons who own land adjoining a public road; (c) establish the procedures for the opening and closing of a public road; (d) provide for the classification of roads; (e) provide for the declaration of the RMS and other public authorities as roads authorities for both classified and unclassified roads;	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, or dig up or disturb the surface of a public road, otherwise than with the consent of the appropriate roads authority. The pipeline would require the crossing of Werris Creek Road, part of the RMS Tamworth-Yetman State Road. Consultation with and consent from RMS would therefore be required for construction under Werris Creek Road. The Proposal would also cross a number of Council roads, managed by LPSC; as Council is the proponent and roads authority, no further approvals are required.

Law, Policy or Regulation	Objective	Requirement for the Proposal
	(f) confer certain functions (in particular, the function of carrying out road work) on the RMS and on other roads authorities; (g) provide for the distribution of the functions conferred by this Act between the RMS and other roads authorities; and (h) regulate the carrying out of various activities on public roads.	

4.2 CONFIRMATION OF STATUTORY POSITION

Clause 125 of the Infrastructure SEPP permits development for the purpose of water treatment facilities and water reticulation systems, to be carried out by or on behalf of a public authority without consent.

As the Proposal does not require development consent and would be carried out by LPSC it would be assessed under Division 5.1 of the EP&A Act and therefore development consent is not required.

5 CONSULTATION

5.1 COMMUNITY CONSULTATION

LPSC have undertaken community consultation prior to the preparation of this REF to inform residents and relevant stakeholders of the Proposal.

An REF was prepared for the original Quipolly WTP in July 2011 (GHD, 2011). This REF was publicly displayed for 32 days between 16 May and 13 June 2014. No submissions were received in response to the REF.

Current consultation for the Proposal includes a project website, project social media platforms (Facebook, Twitter and Instagram) and project newsletters which commenced in January 2018. The project newsletters detail latest updates for the proposal, frequently asked questions and contact details on how to stay informed.

5.2 GOVERNMENT AGENCY AND OTHER STAKEHOLDER CONSULTATION

Part 2 of the Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consideration of the items listed in Clauses 13 to 16 of the Infrastructure SEPP determines whether or not consultation with council or other public authorities is required. This assessment is provided in Table 5-1 below.

Table 5-1 Assessment of items of Clauses 13 to 16 of the SEPP (Infrastructure)

Item	Response
Clause 13 – Developments with impacts on council-related infrastructure or services	
Substantial impact on stormwater management services provided by a council	The Proposal would not have substantial impacts on council stormwater infrastructure. Works would include reinstating the original stormwater following the completion of construction at Quipolly WTP, Bells Gate Road, Back Werris Creek Road and Lowes Creek Road.
Likely to generate traffic to an extent that will strain the capacity of the road system in a local government area	The Proposal would not generate substantial traffic.
Involve connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council	The Proposal would not involve connection to any part of a sewerage system owned by a council.
Involve connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council	The Proposal would involve connection to the existing water supply system. However, as LPSC is the proponent, LPSC would organise appropriate coordination of the infrastructure within the organisation.
Involve the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor	The Proposal would cause a disruption to pedestrian and vehicular access along Bells Gate Road, Back Werris Creek Road and Lowes Creek Road. This triggers the requirement to notify.
Involve excavation of the surface of, or a footpath adjacent to, a road for which a council is the roads authority that is not minor or inconsequential	Yes - The Proposal would require excavation of the road along Back Werris Creek Road which is a classified road, managed by RMS and maintained by Council. This triggers the requirement to notify.

Item	Response
Clause 14 Consultation with councils—development with impacts on local heritage	
Is likely to have an impact on a local heritage item (that isn't also a State heritage item) or a heritage conservation area that is not minor or inconsequential	No impact to any item of local heritage.
Clause 15 Consultation with councils—development with impacts on flood liable land	
Involves development on flood liable land and will they alter flooding patterns more than to a minor extent.	The Proposal is not located within flood liable land.
Clause 16 Consultation with public authorities other than councils	
Involves development adjacent to land reserves under the *National Parks and Wildlife Act 1974* – The Department of Environment and Climate Change (now OEH).	The Proposal is not adjacent to land reserves under the NPW Act.
Involves development adjacent to a marine park declared under the *Marine Parks Act 1997* – The Marine Parks Authority.	The Proposal is not adjacent to a marine park declared under the MP Act.
Involves development adjacent to an aquatic reserve declared under the *Fisheries Management Act 1994* - the Department of Environment and Climate Change (DPI Fisheries).	The Proposal is not adjacent to an aquatic reserve declared under the FM Act.
Involves development comprising a fixed or floating structure in or over navigable waters—the Maritime Authority of NSW.	The Proposal does not involve any development in or over navigable waters. It would be submerged and therefore would not cause any impacts to navigation.

Based on the legislative requirements outlined in Section 4.2 and Table 5-1, no consultation under ISEPP is required. However, consultation and notification has been undertaken with the following public authorities:

- ARTC
- Roads and Maritime Services
- NSW Environment Protection Authority
- Department of Primary Industries – Water and Fisheries

Details of consultation is provided below; related correspondence is included in Appendix B.

5.2.1 ARTC

LPSC sent a letter to ARTC on 3 July 2018 requesting comments on the Proposal as the construction of the proposed pipeline would require underboring under the ARTC rail line near Bells Gate Road.

A response was received in an email from ARTC dated 2 August 2018 outlining that as the pipeline crosses a rail corridor an application would be needed to be made to ARTC for this section of works and that ARTC would need to review the final REF as part of this application process. Details of consultation is provided in Appendix B.

5.2.2 Roads and Maritime Services

The Proposal would impact Back Werris Creek Road, which is a Classified Road managed by Roads and Maritime Services and maintained by LPSC. Consultation with Roads and Maritime was undertaken for the REF with a letter sent by LPSC on 3 July 2018. As of 16 August 2018 no response has been received.

5.2.3 NSW EPA

LPSC sent a letter to the EPA on 3 July 2018 providing notification of the Proposal and asking for comment. A response was received dated 25 July 2018 that outlined that EPA' response is the same as that identified in previous advice in 2014. EPA noted that the Proposal will not be integrated development (IDA) for the purposes of the EPA under the *Protection of the Environment Operations Act 1997* (POEO Act). However, Environment Protection Licences may also be issued for activities that are not listed in Schedule 1 of the POEO Act (called 'non-scheduled activities') that are likely to cause water pollution. While not IDA, the EPA is the Appropriate Regulatory Authority (ARA) under the POEO Act for non-scheduled activities where they are subject to a licence, or are carried on by the State or a public authority.

EPA also outlined that the following issues are to be addressed in the REF; Water quality, noise, dust, storage of chemicals/ fuels, waste management and incident management procedures. These issues are addressed in Section 6. Details of consultation is provided in Appendix B.

5.2.4 DOI – Water

LPSC is carrying out direct consultation with Department of Industry (DOI) Water throughout the planning and design process. On 2 November 2018 discussions occurred with DOI Water with the new Reference Design, towards obtaining a Section 60 approval under the *Local Government Act 1993* to construct a WTP.

5.2.5 DPI – Fisheries

LPSC sent a letter to the Department of Primary Industries (DPI) Fisheries on 3 July 2018 providing statutory notification under Section 199 of the *Fisheries Management Act 1994*, and asking for comment on the Proposal. The Proposal would require open trenching through three ephemeral watercourses including; Black Gully, Box Gully and Quipolly Creek which are all classified as Key Fish Habitat. Works may block fish passage temporarily which would fall under the definition of 'dredging'.

A written response was received from DPI Fisheries on 3 July, included in Appendix B, outlining that there are no objections to the proposed works. Additional concerns included in the correspondence raised by DPI Fisheries are provided below in Table 5-2.

Table 5-2 DPI Fisheries comments on Proposal

DPI Fisheries comments	Response / where addressed in REF
A permit will be required by LPSC for any proposed dredging and reclamation works in 'waterland' on 3rd order streams or greater (Strahler Stream Ordering System) such as Black Gully, Little Quipolly Creek, Colly Creek and Quipolly Creek in accordance with section 198-203 of the FM Act. Such works may include, but are not limited to pipeline construction, construction of sidetracks, creek diversions, excavating or reclaiming the bed or banks of these waterways. The environmental	Noted. Section 8 and Section 3.2.

DPI Fisheries comments	Response / where addressed in REF
assessment should describe the type and extent of such proposed works along the pipeline route.	
A permit may also be required to temporarily block fish passage under section 219 of the FM Act. Such works may include the bunding of waterways during works, use of silt fences across waterways and other similar works. The environmental assessment should describe the type, extent and duration of such works.	Noted.
DPI Fisheries requests that the REF needs to consider whether the proposed pipeline route is likely to impede the free passage of fish. The publication "Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings" on the website outlines important considerations when designing or constructing waterway crossings.	Noted. Addressed in Biodiversity Assessment and Section 6.2 of REF.
The design and construction of pipeline crossings across all waterways within Key Fish Habitat should be undertaken in accordance with the Department's Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013). The waterway crossings need to ensure that the works are undertaken with minimal impact on the aquatic environment.	Noted.
DPI Fisheries seeks information on any destabilisation of any watercourses with heavy machinery or damage to the bed or banks. DPI Fisheries requests that any bed and bank rehabilitation works be completed immediately after the completion of works.	Noted.
The "degradation of native riparian vegetation" has been listed as a Key Threatening Process under the provisions of the FM Act. DPI Fisheries have a 'no net loss' policy to ensure that that fish stocks are conserved and the key fish habitats upon which fish depend on is conserved. Where there is the likelihood of a loss of riparian vegetation due to pipeline construction there should be rehabilitation /replanting within the riparian zone.	Noted. Addressed in Biodiversity Assessment and Section 6.2 of REF.
DPI Fisheries requests information on any proposed sediment and erosion controls required during construction works near the waterways.	Noted. Section 6.2.
DPI Fisheries requests information on any proposal to remove, realign or relocate snags (large woody debris) during works. Proposed works should be outlined within the REF. Snags should not be removed, realigned or relocated without first contacting DPI Fisheries. **Note: that the removal of large woody debris is listed as a Key Threatening Process under the FM Act.**	Noted. Addressed in Biodiversity Assessment and Section 6.2 of REF.
The REF must address the threatened species provisions of the FM Act for species, populations or communities listed under schedules 4 and 5 whose historical geographical distribution extends to the area of works.	Noted. Addressed in Biodiversity Assessment and Section 6.2 of REF.

6 ENVIRONMENTAL ASSESSMENT

6.1 SOILS AND WATER

6.1.1 Existing environment

The terrain along the proposed pipeline route generally comprises of undulating to rolling rises and low hills (GHD, 2014c). The proposed site for the WTP is located on gently sloping hills ranging from 400 m Australian Height Datum (AHD) to 420 m AHD. The proposed pipeline route and WTP site has previously been disturbed for agricultural uses and during road and road infrastructure construction.

The Proposal is located within the Nandewar Bioregion within the Tamworth Zone of the New England Fold Belt. The *Soil Landscapes of the Tamworth 1:100 000 Sheet* (Department of Land and Water Conservation, 2001) indicates a mixture of erosion, alluvial and transferral soil profiles across the study area. The soil profiles and characteristics are described in Table 6-1.

The landscape geology is dominated by sands, silts, clays and gravels derived from Carboniferous sedimentary rocks and volcanics of the Melville Ranges. In areas classified as Gaspard Road soils are also underlain with alluvium and colluvium derived from Permian-Carboniferous conglomerates.

Table 6-1 Soil profiles and characteristics

Soil profile	Type of landscape	Location	Main limitations and constraints
St Mervins	Erosional	At proposed WTP site and Lowes Creek Road pipeline alignment	Localised engineering hazard, localised gully erosion risk and localised poor moisture availability
Eurunderee	Transferral	At proposed WTP site and along sections of Bells Gate Road	Localised dieback, poor drainage and localised shallow flood hazard (lower slopes)
Gaspard Road	Transferral	Sections along Lowes Creek Road pipeline alignment	Localised dieback, poor drainage and localised flood hazard (lower slopes and drainage plains)
Currabubula Creek	Alluvial	Along Quipolly Creek and where Lowes Creek Road intersects Back Werris Creek Road	Complex soils, localised dieback and flood hazard
Duff's Gully	Transferral	Sections along Bells Gate Road pipeline alignment and where Lowes Creek Road intersects Back Werris Creek Road	Localised dieback, localised poor drainage and localised shallow flood hazard
The Siphon	Transferral	Majority of Back Werris Creek Road pipeline alignment	Localised dieback, poor drainage and erosion risk
Dunover	Erosional	Small section along Lowes Creek Road, Bells Gate Road and pipeline alignment and at existing Werris Creek WTP	Engineering hazard, high erosion risk and poor moisture availability

The Proposal is not within a proclaimed Mine Subsidence District, therefore there would be no impacts or restrictions relating to mine subsidence.

There is no risk mapping for acid sulfate soils for the Proposal site. Works are not expected to require excavation of acid generating sediments.

A preliminary geotechnical investigation was undertaken by Regional Geotechnical Solutions in 2018 for the proposed new underbore alignments at Bells Gate Road beneath the ARTC rail crossing and at the Werris Creek Road Crossing.

Figure 6-1 Proposed underbore locations (Source: Regional Geotechnical Solutions, 2018)

ARTC rail crossing

The ARTC rail underbore is located where the level crossing at Bells Gate Road occurs and would cross the rail line in a generally north-east to south-west direction.

The subsurface conditions at the location of the Bells Gate Road rail underbore are alluvial and residual soils overlying weathered basalt. Alluvial soils found at BH3, refer to Figure 6-2, contained sand at depths from 1.0 to 2.1m (refer to Table 6-2). Excavations within the alluvial sands encountered in BH3 would be problematic as the sands would tend to collapse particularly if seepage is encountered. It is noted that the investigations were undertaken during an extended dry period and no groundwater seepage was encountered. A dry creek is situated near BH3 and groundwater seepage may occur through the sand when the creek is in flow.

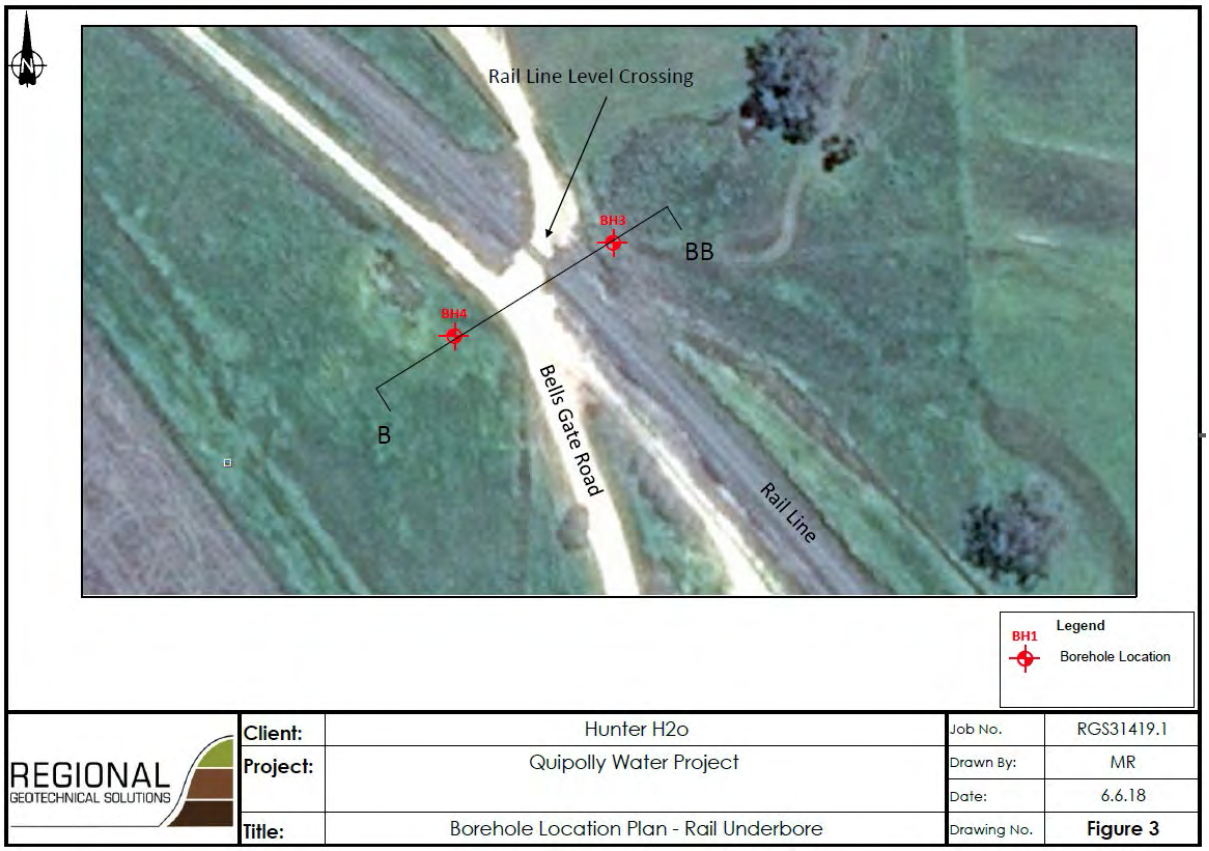

Figure 6-2 Borehole location plan at Bells Gate Road ARTC rail crossing (Source: Regional Geotechnical Solutions, 2018)

Table 6-2 Summary of subsurface conditions at Bells Gate Road ARTC rail crossing (Source: Regional Geotechnical Solutions, 2018)

Unit	Material Description	Depth to Base of Material (m)	
		BH3	BH4
1	**Topsoil:** Silty Clay, high plasticity.	0.10	0.10
2	**Alluvial Soil:** Sandy Clay, high plasticity, hard and Sand, very dense.	2.10	0.90
3	**Residual Soil:** Clay, high plasticity, very stiff and Clayey Gravel, very dense.	3.44	2.5
4	**Slightly Weathered to Fresh Basalt:** High strength to 4.1m and then low strength in BH3. High to very high strength in BH4. Typically, highly fractured.	≥7.65	≥7.8

Werris Creek Road Crossing

The Werris Creek Road underbore is located near the intersection of Bells Gate Road. The underbore would cross Werris Creek Road in a generally north east to south west direction (refer to Figure 6-3).

The subsurface conditions at the location of the Werris Creek Road underbore are predominately alluvial and residual soils overlying weathered basalt (refer to Table 6-3). No groundwater or sand was encountered at this location.

Figure 6-3 Borehole location plan at Werris Creek Road underbore (Source: Regional Geotechnical Solutions, 2018)

Table 6-3 Summary of subsurface conditions at Werris Creek Road underbore (Source: Regional Geotechnical Solutions, 2018)

Unit	Material Description	Depth to Base of Material (m)	
		BH1	BH2
1	**Topsoil:** Silty Clay, high plasticity.	0.20	0.4
2	**Residual Soil:** Silty clay, high plasticity and clayey silt, low plasticity. The residual soils were hard. (Undrained shear strength > 600kPa)	0.6	1.5
3	**Extremely to Highly Weathered Rock:** Including tuff and basalt. Very low to low strength. Highly fragmented and fractured.	2.8	2.3
4a	**Highly to Moderately Weathered Basalt:** Low to medium strength with medium strength bands. Highly fractured.	3.8	2.5
4b	**Moderately to Slightly Weathered Basalt:** Low to medium strength with medium to high strength bands from 5.5m (BH1 and 5.75m (BH2). Some HW bands. Highly fractured.	≥7.65	≥7.8

Contaminated land

A search of the EPA Contaminated Sites Register on 18 June 2018 identified zero sites within the Liverpool Plains Shire Council. A site visit from 27 to 29 June 2018 showed no evidence of contamination from previous land uses.

Hydrology and water quality

The majority of the proposed pipeline route is within road reserves consisting of roadside pasture and native vegetation. The WTP plant would be located approximately 400m south-west from the Quipolly Dam. The Proposal pipeline would cross over the following ephemeral streams (refer Figure 1-3):

- Black Gully: crossed by pipeline along Back Werris Creek Road
- Box Gully: crossed by pipeline along Bells Gate Road, before intersection with rail road.
- Little Quipolly Creek (tributary to Quipolly Creek): crossed by pipeline along Bells Gate Road
- Quipolly Creek: crossed by pipeline along Lowes Creek Road and Bells Gate Road.
- Various tributaries to the above streams and drainage lines

All these streams are ephemeral and at the time of the site visit were all dry with notable vegetation growth and dry soils in the stream bed. No water pools were observed within the proposed 20m wide construction corridor for the pipeline.

Activities that may also be contributing to changed flow conditions and particularly low flows for all these streams and tributaries include extraction and use of water for irrigation, domestic and stock purposes, and changes in land use.

Finally, natural flow conditions of Quipolly Creek have been directly altered by the Quipolly Dam. The creek would go through long periods of no water flow (GHD 2014c), which has negatively impacted the habitat value and biodiversity of the Creek downstream of the Dam. The rating of Quipolly Creek for Fish Communities is “Poor” according to the DPI - Fisheries spatial data portal results analysis.

Groundwater

Limited information is available on groundwater resources in the vicinity of the study area. Available information indicates that the alluvial aquifer downstream of Quipolly Dam (GHD 2014c):

- Occurs at approximately four to eight metres below ground level within highly permeable quaternary alluvial sediments
- The aquifer is recharged through direct infiltration of rainfall, and from the upper catchment of the Quipolly Creek to the east of the Dam
- Water quality tends to be alkaline
- Is highly interactive with the surface water, due other unconfined nature of the alluvial aquifer and the presence of high-permeability fine-grained sediments.

6.1.2 Potential impacts

Construction

Pipeline

The Proposal would involve the use of trenchless technology (underbore) and open trenching. Open trenching would be the main methodology used along the proposed pipeline route. Trenchless technology has been selected under the ARTC rail line at Bells Gate Road and Werris Creek Road intersection to limit

the impacts on rail and road operations. A drill pit at each underbore location for the entry and exit points of the drill head would be established, approximately 10 m^2. The total amount of disturbance would be approximately 40$m^{2.}$

The proposed new pipelines would require localised ground disturbance and require a 20m construction corridor. The ground disturbance would total approximately 44.8 ha. This would include the following components of the works:

- Vegetation removal, clearing, and grubbing
- Stripping and excavation of top soil and sub soil
- Establishment of material lay down sites along the pipeline alignment

Open trenching along Back Werris Creek Road, Bells Gate Road and Lowes Creek Road would result in approximately 30,000m^3 (cubic metres) of spoil being removed (based on a 1m by 1.5m trench dimension). Excavated spoil would be kept to the side during the works, and reinstated following completion of pipe laying of each segment.

Material lay down sites would be established within the 20m corridor for the pipeline works. These would be strategically positioned along the pipeline alignment to minimise the number of laydown areas while ensuring that distances from the work site are optimised.

WTP and associated facilities

The proposed new WTP, RWPS, HLR and realignment of Lowes Creek Road would require localised ground disturbance.

No vegetation removal would be required for the proposed sites, however ground disturbance would include the following components of the works:

- Stripping and excavation of top soil and sub soil near proposed WTP, RWPS and HLR
- Establishment of site compound near WTP
- Establishment of access tracks
- Realignment and resurfacing parts of Lowes Creek Road

The total area of impact from ground disturbance is approximately 8.6 ha (86,300 m^2), as itemised below:

- WTP = 80,000 m^2
- RWPS = 200 m^2
- HLR = 900 m^2
- Compound site (estimated 50m x 100m) = 5000 m^2
- Lowes Creek Road = 200 m^2

Impacts of the Proposal

The total surface area of impact by the Proposal is approximately 53.4 ha (8.6ha and 44.8 ha). The potential impacts to soils and surface water from general construction works could include:

- Erosion resulting from excavation and vegetation removal
- Sedimentation of Quipolly Creek, Box Gully, Black Gully, Little Quipolly Creek and unnamed waterways and drainage lines
- Soil erosion and damage to soil structure due to movements of construction machinery and general construction activities
- Temporary change or interference with the direction of surface water runoff during excavation for pipelines

- Potential spills of hydrocarbons during construction (fuels, oils, lubricants) from the use of equipment, vehicles and machinery
- Dust or leachate from road construction works (asphalt and concrete).

Interception of groundwater, near watercourses during construction of the pipelines has the potential to result in the following impacts:

- Temporary lowering of the water table due to trench dewatering
- Contamination of groundwater during dewatering activities, or following a hazardous spill event

Spills and Leaks

The risk of accidental spills and leaks of hazardous products, such as oils, fuels, lubricants and sanitary wastewater is present. Such negative impacts may occur at the construction site's storage areas or during transportation of hazardous products on and off the site. Inadequate procedures for storing, transferring, and handling may also result in spills to the ground and lead to soil contamination. Additionally, migration of the contaminants to groundwater may occur, with the potential for further spreading of pollutants through the groundwater system dependent on the physical and chemical properties of the contaminants and the interconnectivity of the groundwater system.

Inadequate Waste Management

Construction activities typically generate solid and hazardous waste fractions, as well as hazardous liquid wastes. Although these types of wastes (used oil, machinery lubricants and sludge) represent a small proportion of the total amount of construction waste, the inadequate handling, storage and disposal of these wastes increases the risk of soil contamination at the Proposal footprint.

Cross Contamination of Soil

Transferring contaminated soils from one site to another can exacerbate any existing environmental problems through poor management of contaminated or hazardous materials. Existing soils conditions within the Proposal area are not likely to be contaminated, as such the risk of cross contamination is negligible.

Soil contamination risks from any existing sources and the use and storage of fuels and other chemicals during construction would be managed using best practice storage, use and spill response procedures.

Overall, short term risks to soils and water would be high, but localised. Known (demonstrated to be effective on similar projects) mitigation strategies are considered highly likely to be able to adequately address these risks. Medium to long term impacts would be low provided stabilisation strategies are effectively implemented. Stabilisation and revegetation would act to resist soil erosion and sedimentation to the same extent that existing vegetation now functions.

Areas disturbed by vegetation clearing, excavation pits, access tracks and trenching have potential to continue to be susceptible to erosion until groundcover is restored. These impacts are expected to be minimal, subject to the implementation of appropriate restoration measures, outlined below.

Operation

During operation, there is the potential for breaks in the pipeline, leaking water that may infiltrate the groundwater. The implementation of appropriate mitigation measures and the utilisation of CICL pipes would minimise the risk of leakage.

During operation, the volume and variety of hazardous materials used at the Proposal would be minor and would be stored in purpose-built facilities, in accordance with the Safety Data Sheet (SDS). Nonetheless, the risk for spills is still present, and would result from poor handling, storage and disposal procedures. The potential sources of soil contamination would include:

- Solvents, lubricants and oils used for maintenance activities
- Alkaline and acid chemicals used in the water treatment process
- Sanitary wastewater

Soil contamination risks from the use and storage of hazardous materials would be managed using best practice storage, use and spill response procedures. There would remain a risk of soil contamination in the event of a hydrocarbon spills (fuels, lubricants), although the quantities volumes be minimal and the frequency of maintenance would be low.

6.1.3 Safeguards and mitigation measures

Impact	Safeguards and mitigation measures	Responsibility	Timing
Soil management, erosion and sediment control	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the Construction Environmental Management Plan (CEMP). The SWMP would identify all reasonably foreseeable risks relating to soil erosion, soil disturbance and water pollution and describe how these risks would be addressed during construction. The SWMP shall include the following measures: • An Erosion and Sediment Control Plan (ESCP) and would detail the measures to minimise pollution, soil erosion and sedimentation within surface water and groundwater. • Disturbed areas will be stabilised to minimise further erosion. • The construction footprint will be delineated to ensure that no soil disturbance occurs beyond this. • Sediment barriers, will be installed to prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets. • The amount of material transported from site to surrounding pavement surfaces would be minimised. • Clean water would be diverted around the site (in accordance with the Landcom/Department of Housing *Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book). • The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Prior to commencement of construction

Impact	Safeguards and mitigation measures	Responsibility	Timing
	• Erosion and sedimentation controls are to be checked and maintained weekly and at every rainfall event and records kept. • Erosion and sediment control measures will be implemented until the works are complete or areas are stabilised. • Work areas will be stabilised progressively during the works and documented. • Areas of disturbance would be limited along the pipeline to a small area, by covering the installed pipeline trench with stockpiled material at the end of each work day. • Areas requiring excavation/filling will be clearly demarcated to ensure that the soils are not disturbed outside of the approved disturbance footprint.		
Soil re-use	Excavated material to be assessed and classified as VENM/ENM or other waste classification by suitably qualified geotechnical engineer/NATA accredited laboratory. Reuse on site or elsewhere will be dependent on excavated material classification.	Contractor	Construction
Pollution incidents	Emergency equipment will be provided on-site and located at strategic, accessible locations. All staff must be made aware of the location of the spill kits and trained in their use. Emergency equipment will include: • Fire response measures, including fire extinguishers, fire blankets and accessible water • Spill kits • First aid kits • External showers.	Contractor	Detailed design/ Pre-construction/ Construction
	Site layout plan showing location of equipment will be provided to Council and kept at the site office and included within the SWMP.	Contractor	Pre-construction/ Construction
	Spill kits will be made available at the site at all times	Contractor	Pre-construction/ construction
	Site layout plan showing location of spill kits will be provided to Council and kept at the site office and including within the SWMP.	Contractor	Pre-construction/ construction
	All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills	Contractor	Pre-construction/ construction
Pollution /contamination	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks	Contractor	Detailed design Pre-construction

Impact	Safeguards and mitigation measures	Responsibility	Timing
	of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with Council and/or EPA.		
	Contractor to provide a document outlining contamination control measures and notification procedure to Council prior to commencement of site works.	Contractor	Pre-construction
	All fuels, chemicals and other hazardous materials shall be stored in a roofed, fire-protected and impervious bunded area at least 20 m from waterways, drainage lines, basins, flood-affected areas or slopes above 10%. Bunding design shall comply with relevant Australian Standards, and generally be in accordance with guidelines provided in the EPA Authorised Officers Manual. Appropriate on-site signage shall be provided to identify the materials stored and emergency contacts.	Contractor	Pre-construction/ construction
	Refuelling of plant and machinery on-site will be undertaken over a sealed and impervious service, and at least 20m away from drainage lines and water bodies. Appropriate equipment to avoid spills and leaks during the refuelling process shall be used, to be outlined in the SWMP. If and when feasible, it is preferable that refuelling is undertaken off site within a bunded impervious area.	Contractor	Construction
	Cleaning of equipment and vehicles will only occur in areas where water pollution will not occur. Wash-down or wash-out will only occur in bunded areas. Designated cleaning areas to be identified on site plan.	Contractor	Construction
Site Rehabilitation	All areas disturbed during construction, including areas for stockpiles, compound sites, temporary access roads and temporary work areas, would be stabilised and rehabilitated to prevent future erosion, to be checked weekly and as each stage of work is completed. Measures would include removing rubbish, restoring profiles and decompacting soils in the construction areas.	Contractor	Construction
	Perennial grass cover would be established across the WTP, RWPS and compound site as soon as practicable after construction. This would protect	Contractor	Pre-construction

Impact	Safeguards and mitigation measures	Responsibility	Timing
	soils and improve soil stability, structure and landscape function over time.		
	A restoration plan will be prepared and approved by Council prior to undertaking restoration/rehabilitation works, including witness points for restoration works and hold point for completion. This will be updated during construction and checked monthly.	Contractor	Pre-construction/ construction

6.2 BIODIVERSITY

A Biodiversity Assessment was completed by NGH Environmental for the proposed works. This assessment is provided in Appendix C and is summarised below.

6.2.1 Approach

Threatened species evaluation

Database searches (Appendix C of Appendix C of this REF) were undertaken prior to commencement of field surveys to identify threatened species or communities known to, or potentially occurring in the locality based on previous records (Table 6-4). The species identified by database searches were evaluated for their potential to occur in the study area based on habitat assessments undertaken in the field.

Table 6-4 Summary of databases searches

Resource	Target	Search date	Search area
OEH Wildlife Atlas Data (BioNet)	Threatened flora and fauna species, populations and ecological communities listed under the BC Act	25/06/18	10 km radius of Proposal site (Study locality)
EPBC Act Protected Matters Search	Threatened flora and fauna, endangered populations and ecological communities and migratory species	25/06/18	10 km radius of Proposal site
NSW Weed Wise database	Priority weeds declared in the relevant region (North West)	25/06/18	North West Region
NSW Primary Industries threatened and protected fish database	Key fish habitat, species, populations or communities listed under schedules 4 and 5 whose historical geographical distribution extends to the study area	25/06/18	Liverpool Plains LGA
Bureau of Meteorology National Atlas of Groundwater Dependant Ecosystems	Vegetation communities that are likely to rely on groundwater	25/06/18	10 km radius of Proposal site
SEED data portal	Regional and local vegetation mapping	25/06/18	10 km radius of Proposal site (Study locality)

Literature relevant to this study was also reviewed and included:

- Preliminary Planning and Environmental Assessment (PPEA). Regional Water Supply Strategy - Pipeline Construction (GHD, 2014);
- Safety and Capacity Upgrade of Quipolly Dam. Review of Environmental Factors (GHD, 2011);
- OEH Threatened Species Profiles;
- Department of Environment and Energy (DOEE) EPBC Act Species Profiles and Threats Database (SPRAT) (DOEE, 2018);
- Existing vegetation mapping for the Proposal site and locality, namely State Vegetation Type Map: Border Rivers Gwydir / Namoi Region (Version 2.0. VIS_ID 4467) (OEH, 2015); and
- White Box Yellow Box Blakely's Red Gum Woodland – Endangered Ecological Community Listing. NSW Scientific Committee – Final Determination (NSWSC, 2002).

Site Inspection

A site assessment of the study area was undertaken between 27 and 29 July 2018 by two (2) NGH Environmental ecologists. Criteria recorded during the site inspection included:

- Native flora species and vegetation communities present
- Plots according to the Biodiversity Assessment Method (BAM) were undertaken at 6 locations as marked on maps 1 to 12 in Appendix A of Appendix C of this REF (Biodiversity Assessment)
- Targeted searches for threatened species identified during background searches, if suitable habitat was present
- Opportunistic fauna sightings
- Weed species present and their abundance.

6.2.2 Existing environment

The Proposal site is located within the Liverpool Plains Shire LGA. Surrounding the Proposal site is agricultural land predominantly used for cattle grazing, along with associated residences and agricultural infrastructure. Much of the original vegetation has been cleared for these purposes.

Flora

A total of 42 flora species were recorded within the study area (Appendix B of Appendix C of this REF). The vegetation in the study area is highly modified, having been historically impacted by agricultural practices as well as roadside edge effects. Outside of small, disjunct woodland and forest patches, extensive cleared areas are present that comprise a combination of derived native grassland and exotic grassland.

Seven native Plant Community Types (PCTs) were identified within the study area. These are summarised in Table 6-5 and illustrated in Appendix A of the Biodiversity Assessment (Appendix C).

Table 6-5 Summary of identified PCTs

Vegetation community	PCT	Threatened ecological community?	Area (ha) in study area
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	84	No	0.66

Vegetation community	PCT	Threatened ecological community?	Area (ha) in study area
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.90
Rough-barked Apple - White Cypress Pine - Blakely's Red Gum riparian open forest / woodland of the Nandewar Bioregion and New England Tableland Bioregion	544	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.32
Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion	592	No	4.99
Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	599	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.90
Derived Wire Grass grassland of the NSW Brigalow Belt South Bioregion and Nandewar Bioregion	619	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	62.91
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion	1383	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	3.57

Threatened Ecological Communities

Searches of the OEH BioNet and EPBC Act protected matters search tool revealed 13 Threatened Ecological Communities (TECs) with the potential to occur within 10 km of the Proposal site. One of these TECs, *White Box Yellow Box Blakely's Red Gum Woodland* (Box Gum Woodland Endangered Ecological Community (EEC)), has a known association with five of the PCTs identified within the study area (Table 6-5). Box Gum Woodland EEC is listed under the BC Act and within the study area occurs primarily as highly modified areas of derived grasslands, though small woodland patches are also present. The total area cover in the Biodiversity Assessment study area by this EEC is approximately 68.6 ha, as illustrated in Appendix A of the Biodiversity Assessment (Appendix C).

Flora of environmental significance

OEH BioNet database searches for threatened species listed under the BC Act revealed two threatened flora species with records within the study locality. The EPBC Act protected matters search tool suggests a further six threatened flora species have the potential to occur within 10 km of the Proposal site. Of these eight species, two are considered as having a high likelihood and one a medium likelihood of occurring within the study area based on the habitat assessment (Appendix D of Appendix C of this REF). These species are:

- Native Milkwort *Polygala linariifolia* (BC Act – Endangered (E))
- Bluegrass *Dichanthium setosum* (BV – Vulnerable (V) and EPBC Act – V)

- Finger Panic Grass *Digitaria porrecta* (BC – E)

To assess impacts to these species, Tests of Significance have been prepared for those species listed under the BC Act. Assessments of Significance have been prepared for those species also listed under the EPBC Act (Appendix D of Appendix D of this REF).C

No threatened flora species were recorded during the field survey.

Weeds

Of the 42 plant species identified within the study area, three species (7%) were exotic. Within the North West region there are 127 listed priority weeds, none of which were recorded during the field survey. However, as only a small percentage of the Proposal site was surveyed in detail and due to season of the survey, the presence of priority weeds cannot be discounted entirely. Other environmental weeds that were identified within the study area are common within the region and are often encountered along roadsides and disturbed areas.

Fauna

A list of the fauna species recorded opportunistically within the study area is presented in Appendix B of the Biodiversity Assessment (Appendix C). Fifteen species of native fauna were recorded opportunistically during the survey including 13 birds, one reptile and one mammal. All are common within the region. Common birds in particular are likely to utilise the study area and surrounds for forage and breeding. The three exotic species recorded include rural livestock such as cattle *Bos* sp. and sheep *Ovis* sp.

Fauna of environmental significance

OEH BioNet Atlas database searches for threatened species listed under the BC Act identified 24 threatened fauna species known to or have the potential to occur within the study locality. The majority (22 of 24 species) of which are woodland birds and microchiropteran bats (microbats). The EPBC Act protected matters search tool revealed 25 threatened and 10 migratory fauna species with the potential to occur within the study locality. No threatened fauna were observed during the field survey.

Based on the habitat values present within the study area (see below), three threatened fauna species that have been previously recorded close to, or within similar habitat, are considered to have a moderate likelihood of occurring within the study area (Appendix C of Appendix C). These species are:

- Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* (BC Act – V),
- Eastern False Pipistrelle *Falsistrellus tasmaniensis* (BC Act – V), and
- Koala *Phascolarctos cinereus* (BC Act and EPBC Act – V).

To assess impacts to these species, Tests of Significance have been prepared for those species listed under the BC Act, and an Assessment of Significance has been prepared for those species also listed under the EPBC Act (Appendix B of Appendix C).

Threatened fauna habitat

The vast majority of the study area is highly modified by historical agricultural land use and invasion of exotic flora and is therefore unlikely to contain optimal habitat for threatened fauna. Groundcover across the site is largely absent or very disturbed, therefore ground-dwelling species, other than introduced rabbits and foxes, are unlikely to be a common occurrence. The study area contains potential foraging and nesting/roosting habitat for woodland birds, parrots and arboreal mammals in the form of flowering

eucalypts and hollow-bearing trees. Forty-three (43) hollow-bearing trees were recorded evenly distributed across the study area. No nests, dens or other significant roosting features were observed.

The study area does not contain suitable habitat for species which prefer complex habitat features and good connectivity.

Aquatic Habitat

The Proposal would intersect several ephemeral waterways including:

- Box Gully in the south of the Bells Gate Road alignment
- Little Quipolly Creek, north of Box Gully along the Bells Gate Road alignment
- Black Gully in the north of the Back Werris Creek Road alignment
- Quipolly Creek three times, at the intersection of Bells Gate Road and Lowes Creek Road, at the eastern end of Lowes's Creek Road.

Quipolly Creek appears to be an ephemeral waterbody as the current assessment and related PPEA (GHD 2014c) for the Proposal found Quipolly Creek to be dry. In dry times Quipolly Creek would provide habitat for burrowing species and a crossing corridor for terrestrial fauna.

All of the other waterways listed above were dry at the time of the survey. Riparian habitat was absent at the proposed pipeline crossing, and no logs, branches or other vegetation debris was observed in these sections of the creeks. All of these creeks also ran through cattle paddocks, and given the absence of riparian corridors, shallow slopes and low bank profile, the creeks would be heavily impacted by cattle trampling. As such, potential habitat for fish and herpetofauna during flow events would be absent or of poor value. The water quality of the creeks (during flow events) would be poor and likely impacted by high nutrient input from manure, and sedimentation from bank erosion.

No threatened species, populations or communities listed under schedules 4 and 5 of the FM Act are known to the study area.

6.2.3 Potential impacts

In order to determine the potential impact of the Proposal on threatened flora and fauna, a habitat assessment table was completed, identifying the relevant species, their likelihood of occurrence and potential impact of the proposed works (refer to Appendix D of Appendix C of this REF). Of these, eight species/communities were identified as potentially impacted, requiring further assessment. Tests of significance (ToS) under the BC Act and Assessments of Significance (AoS) under the EPBC Act, hereby referred to as 'the assessments', were prepared for each of these including:

- Box Gum Woodland (BC Act and EPBC Act)
- Native Vegetation on Cracking Clay Soils of the Liverpool Plains (BC Act and EPBC Act)
- Native Milkwort *Polygala linariifolia* (BC Act – E)
- Bluegrass *Dichanthium setosum* (BV – V and EPBC Act – V)
- Finger Panic Grass *Digitaria porrecta* (BC – E)
- Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* (BC Act – V),
- Eastern False Pipistrelle *Falsistrellus tasmaniensis* (BC Act – V), and
- Koala *Phascolarctos cinereus* (BC Act and EPBC Act – V).

Further details are provided below.

Loss of vegetation

The Proposal would result in the loss of approximately 44.8 ha of vegetation, predominantly along the pipeline corridor, comprised of:

Vegetation community	PCT	Threatened ecological community?	Area (ha) in study area	Area (ha) of loss of vegetation
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	84	No	0.66	0.08
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.90	0.04
Rough-barked Apple - White Cypress Pine - Blakely's Red Gum riparian open forest / woodland of the Nandewar Bioregion and New England Tableland Bioregion	544	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.32	0.32
Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion	592	No	4.99	4.76
Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	599	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	0.90	0.00
Derived Wire Grass grassland of the NSW Brigalow Belt South Bioregion and Nandewar Bioregion	619	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	62.91	20.07
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion	1383	**Yes,** White Box Yellow Box Blakely's Red Gum Woodland (BC Act) and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)	3.57	0.45
Exotic vegetation	-	-	91.44	19.07

Threatened Ecological Communities

The study area has been deemed to contain 68.6 ha of the BC Act listed Box Gum Woodland EEC in both woodland and derived native grassland forms. The Proposal would reduce the extent of Box Gum Woodland EEC by 20.88 ha.

Of the extent of Box Gum Woodland EEC within the study area, 0.9 ha has been determined to conform to the EPBC Act listed Box Gum Woodland Critically Endangered Ecological Community (CEEC) in woodland form. The Proposal would not reduce the extent of this CEEC as the proposed pipeline alignment has been sited to avoid it.

Impacts to the woodland form of Box Gum Woodland EEC has been limited as much as possible via avoidance, however residual impacts to this EEC remain including the removal of mature trees potentially containing hollows. Due to residual impacts a Test of Significance (ToS) under the BC Act was undertaken and concluded that while these impacts are long lasting, they are considered negligible when viewed in the context of the vegetation adjacent to the study area, of which most is expected to contain Box Gum Woodland EEC.

The impacts to the grassland form of Box Gum Woodland EEC from the construction of the pipeline are likely to be temporary in nature as natural regeneration of groundcover species would be expected post-construction. Hygiene protocols (for both weeds and pathogens) would be put in place to ensure disturbed areas aren't colonised by exotic species, thus preventing long-term impacts.

The assessments contained within Appendix E of Appendix C of this REF concluded that both Box Gum Woodland EEC and Box Gum Woodland CEEC are unlikely to be significantly impacted to the degree that they would no longer remain viable within the Proposal site or locality.

To assess impacts to *Native Vegetation on Cracking Clay Soils of the Liverpool Plain*, an assumed potential area of occupancy has been utilised. This includes all derived native grassland areas (PCT 619), resulting in a potential area of occupancy of 62.91 ha. The Proposal would remove 20.07 ha of this area. As discussed above, impacts would be largely temporary in nature as regeneration of native species would be expected post-construction. The Test of Significance contained within Appendix E of Appendix C concluded that the Proposal would not have a significant impact to this EEC should it exist within the Proposal site.

In accordance with the above findings, a Species Impact Statement (SIS) or voluntary entry into the Biodiversity Offsets Scheme is not required for the Proposal. Similarly, an EPBC Act referral is not warranted.

Threatened flora

No threatened flora were recorded during the field survey, nor are any known to occur within the study area. However, the Proposal has the potential to impact three threatened flora species due to the removal of suitable habitat. The Tests of Significance contained within Appendix E of Appendix C of this REF, concluded that the Proposal would not have a significant impact to any of these species listed under the BC Act and/or EPBC Act.

Fauna habitat Loss

The habitat that would be removed for the Proposals comprises potential foraging and nesting/roosting habitat for woodland birds, parrots and arboreal mammals in the form of flowering eucalypts and hollow-bearing trees. No other specific habitat features such as rock outcroppings would be removed.

Loss of Hollow-bearing Trees and Logs

Of the 43 hollow-bearing trees recorded across the study area, 18 are likely to be impacted by the proposed works. These trees provide an important habitat resource for a range of species in a largely cleared landscape. Coarse woody debris such as logs would also be disturbed by the Proposal though these ground level habitat features were found to be highly limited across the Proposal site.

Threatened and Migratory Fauna

Given the small amount of foraging habitat present within the study area, and the relatively greater presence in the study locality and further afield, the impact of the Proposal to threatened fauna is considered negligible. The Proposal would, however, remove potential breeding habitat for hollow-dependent species likely to occur within the study locality. Tests of Significance were undertaken for Yellow-bellied Sheathtail Bat (BC Act – V) Eastern False Pipistrelle (Bc Act – V), and Koala *Phascolarctos cinereus* (BC Act and EPBC Act – V).

These assessments concluded that the Proposal is unlikely to result in a significant impact to any threatened fauna listed under the BC Act and/or EPBC Act, as summarised below.

The removal of 25.73 ha of sub-optimal foraging habitat in the form of grassy woodland and roosting habitat in the form of 18 trees containing hollows, is not considered likely to generate a significant impact to the Yellow-bellied Sheathtail bat or Eastern False Pipistrelle. Both species are highly mobile and are unlikely to rely on those limited resources available within the Proposal site given areas likely containing significant roost resources exist throughout the locality.

The removal of approximately 25.73 ha of low quality potential habitat, the majority of which is grassland containing sporadic White Box, is not considered likely to generate a significant impact to Koala *Phascolarctos cinereus*. This species was not detected during the field survey, however, it is known to the locality. Significant areas of potential habitat are expected to occur within the locality and are contiguous with that present within the Proposal site. The small reduction in this total area of potential habitat required for the Proposal would not place a potentially occurring viable population of this species at risk of extinction.

Aquatic habitat

All the aquatic features within the study area were found to be without water including Quipolly Creek. Given the ephemeral nature of these waterways, they provide poor quality and intermittent habitat for aquatic and amphibious fauna. The proposed pipeline would intersect a narrow section of each creek (maximum 20m construction buffer) that would also be located within the road reserve. Given the degraded creek habitat, creek slopes and creek bed profile in these locations the Proposal is not considered to impact aquatic and herpetofauna species.

Impacts to flora and fauna would be minimised through the implementation of the safeguards and mitigation measures outlined below.

6.2.4 Safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing
Vegetation removal	• Avoid, wherever possible, the removal of any wooded vegetation – construct all compounds, trenches and access tracks within cleared areas or areas of exotic vegetation where possible.	Contractor	Pre-construction and Construction

Impact	Environmental safeguards	Responsibility	Timing
	• Construction areas would be stabilised as soon as practicable (progressively where possible) • Physically delineate areas to be cleared from areas to be retained • Contractor to submit clearing plan to Council for written approval before commencing clearing work		
Hollow-bearing tree removal	• Avoid, wherever possible, the removal of any hollow-bearing trees (HBTs) • Contractor to identify HBTs proposed to be removed and submit plan to Council prior to pre-clearing inspection • Hollow-bearing trees, that would removed, should be identified and inspected by a qualified ecologist 24 hours prior to the hollow-bearing tree being felled • All habitat clearing activities shall be carried out in a staged process, prior to the construction activities starting in that location, to provide opportunity for fauna species to relocate naturally to the surrounding habitats • A suitable qualified and experience Ecologist will be present when hollow-bearing trees are felled to capture and relocate any fauna that may emerge	Contractor	Pre-construction and Construction
Weed and pathogen management	• The requirements of the Biosecurity Act would be implemented • A qualified botanist would conduct a pre-clearing survey to identify any weed infestations and submit to Council for approval • Machinery would be inspected and cleaned prior to entering and leaving the site to ensure that weed seeds and propagules are not imported to the site or spread to unaffected areas	Contractor	Pre-construction and Construction
Water quality risks	• Identify construction methods and use plant and equipment that would minimise removal or disturbance of any riparian habitat within the construction buffer • ESCP would be prepared and submitted to Council for approval and the controls put in place prior to construction to minimise potential water quality impacts during construction • Measures to prevent and contain spillage of potential contaminants would be implemented in accordance with the requirements of the ESCP • All debris created by the demolition work to be fully contained and disposed of appropriately • Contractor will submit a spill management procedure to Council for approval prior to undertaking any works as part of the CEMP • In the event of a spill or contamination of Quipolly Creek: o Works would cease and the spill management procedure implemented immediately	Contractor	Pre-construction and Construction

Impact	Environmental safeguards	Responsibility	Timing
	o A Council Environmental Officer would be contacted in accordance with incident reporting requirements of the site's CEMP o Any pollution of the ephemeral creeks in the proposal site would be reported to the EPA in accordance with the notification requirements of the *Protection of the Environment Operations Act 1997* (POEO Act). • Should any fish kills occur during construction, all works would stop and DPI (Fisheries) would be contacted immediately • Removal of instream habitat structures such as boulders, vegetation and large woody debris, shall be avoided where possible. Such features to be relocated in preference to removal. Relocation of large woody debris shall be undertaken in consultation with NSW DPI (Fisheries).		

6.3 NOISE AND VIBRATION

6.3.1 Approach

The Proposal has the potential to affect the community due to noise and vibration during construction and operation. Specialist noise modelling for operation impacts, and a qualitative assessment for construction impact, was conducted by RAPT Consulting (RAPT 2018), in accordance with Australian Standard / NZS ISO 9001 and is included in Appendix D.

The methodology implemented to assess the impacts included:

- Identification of appropriate Rating Background Level (RBL)
- Identification of the Noise Management Level (NML)
- Identification of type of sensitive receivers
- Identification of the noise and vibration impacts
- Identification of feasible and reasonable additional mitigation measure

Common receivers were grouped into noise catchment areas (NCA) for construction noise assessment. NCA combines the receivers affected by the same works to assist with assessment, consultation or notification. NCAs are the areas that are affected by the same works and located at similar distances from the noise generating activity. The nearest sensitive receiver is located at the top of the hill, south of the southwest corner of the proposal, identified as R1 in Figure 6-1. The output of the assessment can be found in the sections below and Appendix D.

6.3.2 Existing environment

As no significant development has occurred recently in the project area that would substantially increase the ambient noise environment, noise data from a recent report "Safety and Capacity Upgrade of Quipolly Dam" (GHD, 2009) has been used for this study. The unattended noise monitoring was undertaken from

16 to 23 November 2009 at two residential properties closest to the Quipolly Dam wall. The cumulative Background Levels (LA90) and Ambient Levels (LAeq) are provided in Table 6-6.

Table 6-6 Background and ambient noise levels (GHD, 2009)

	Day 7 am to 6 pm	Evening 6 pm to 10 pm	Night 10 pm to 7 am
LA90(Period)	28	26	24
LAeq(Period)	42	37	38
RBL	35	30	30

6.3.3 Criteria

Construction noise

Construction noise is assessed with consideration to DECCW Interim Construction Noise Guidelines (ICNG) (July 2009). The INCG is a non-mandatory guideline that is usually referred to by local councils and other NSW government entities when construction / demolition works require development approval. The ICNG provides NMLs for construction noise at residential and other potentially sensitive receivers. These management levels are calculated based on the adopted RBL at nearby locations.

As such, based on the existing background noise levels provided in Table 6-6, the following NMLs would apply to the Proposal, as shown in Table 6-7.

Table 6-7 Proposal NMLs

Period	NML
Day (standard hours): 35 + 10	45B(A)
Day (outside standard hours): 35 + 5	40dB(A)
Evening (outside standard hours): 30 + 5	35dB(A)
Night (outside standard hours): 30 + 5	35dB(A)

The *highly noise affected level* represents the point above which there may be strong community reaction to noise and is set at 75 dB(A).

The following table sets out the ICNG noise management levels for other types of noise sensitive receiver locations.

Table 6-8 Noise Management Levels at Other Noise Sensitive Land Uses

Land Use	Assessment Location	Noise Management Level $L_{Aeq\ (15\ min)}$
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)
Commercial premises	External noise level	70 dB(A)
Active recreation areas	External noise level	65 dB(A)

NB: Noise Management Levels only apply when premises are in use

Construction vibration

Vibration during construction is expected to primarily originate from trucks and machinery during installation stages of construction activities. Blasting and heavy ground impact activities is not expected to occur during the construction works. Operational vibration is not expected to be an issue.

Vibration goals were sourced from the DECCW's *Assessing Vibration: a technical guideline*, which is based on guidelines contained in British Standard (BS) 6472–1992, *Evaluation of human exposure to vibration in buildings (1–80 Hz)*.

Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent'.

Table 6-9 Acceptable Vibration Dose Values for Intermittent Vibration (m/s)

Location	Daytime		Night time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

NB: Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

Potential structural damage of buildings as a result of vibration is typically managed by ensuring vibration induced into the structure does not exceed certain limits and standards, such as British Standard 7385 Part 2 (Table 6-10) and German Standard DIN4150-3 (Table 6-11). Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy.

Table 6-10 BS 7385 Structural Damage Criteria

Group	Type of Structure	Damage Level	Peak Component Particle Velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial building	Cosmetic	50		
		Minor	100		
		Major	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor	30 to 40	40 to 100	100
		Major	60 to 80	80 to 200	200

Notes:
1. Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.
2. Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

Table 6-11 DIN 4150-3 Structural Damage Criteria

Group	Type of Structure	Velocity, mm/s			
		At Foundation at Frequency of			Plane of Floor Uppermost Storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. buildings under a preservation order)	3	3 to 8	8 to 10	8

Operation

The New South Wales Noise Policy for Industry (NPfI) provides guidance on the assessment of operational noise impacts. The guidelines include both intrusive and amenity criteria that are designed to protect receivers from noise significantly louder than the background level.

- Intrusive criteria are 5 decibels above the measured (or adopted) background level with a minimum of 40 dB(A) for daytime and 35 dB(A) for evening and night time.
- Amenity criteria are determined based on the overall acoustic characteristics of the receiver area and the existing level of noise excluding other noises such as traffic and insects. The Proposal Amenity Noise Levels (ANL) are the ANL (Table 2.1 of the NPfI) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

The Proposal noise trigger level is the lower value between the intrusive and the amenity noise levels. The NPfI noise criteria are planning levels and are not mandatory limits required by legislation. However, the noise criteria assist the regulatory authorities to establish licensing conditions.

Table 6-12 Proposal specific noise levels

	Day 7 am to 6 pm	Evening 6 pm to 10 pm	Night 10 pm to 7 am
Rating Background Level LA90(Period)	35	30	30
Intrusiveness Criteria, LAeq(15min)	40	35	35
Amenity Criteria (Rural), LAeq(Period)	50	45	40
Project Amenity Noise Level LAeq(15min)	48	43	38
Project Specific Level Residential LAeq(15min)	40	35	35
Commercial Premises (When in use)	65	65	65

6.3.4 Potential impacts

Construction noise levels have been predicted based on the potential construction noise levels provided in Table 6-13. These noise levels represent different equipment noise levels and give an idea how noise levels may change across the Proposal area with different activities being undertaken. The different scenarios would occur from site establishment to refinishing works

The magnitude of off-site noise impact associated with construction would be dependent upon several factors:

- The intensity of construction activities
- The location of construction activities
- The type of equipment used
- Intervening terrain
- The prevailing weather conditions.

In addition, construction machinery would likely move about the study area, variously altering the directivity of the noise source with respect to individual receivers. During any given period, the machinery items to be used in the study area would operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time.

The approximate location and distance of the nearest receivers on Lowes Creek Road to the pipeline are provided in Figure 6-4.

In the unlikely event of a worst-case scenario occurring, there is the possibility for receivers within 50 metres of the pipeline construction on Lowes Creek Road, Back Werris Creek Road and Bells Gate Road to exceed the highly affected noise level of 75 dB(A) (refer section 6.3.3). Additionally, when dozer and rock breaking activities are taking place there is the potential for daytime construction goals to be exceeded at distances of up to 1600 metres.

Receivers along the pipeline route would be subject to short-term elevated noise levels during pipeline trenching and rock breaking. Short-term construction work is generally easier to manage. The ICNG defines short term works as, ‘Short-term means that the works are not likely to affect an individual or sensitive

land use for more than three weeks in total.' Average pipeline trenching productions rates applicable to rock (and other) ground conditions are generally 40 to 50 m/day. With these pipeline trenching rates, sensitive receivers would be impacted for less than three weeks, and receivers would only experience noise levels over the 75 dB(A) for one day (if located within 50 m of rock breaking activities). Since trenching is considered short-term work, a quantitative assessment is not required with consideration to the ICNG and the construction noise management levels do not apply, assuming receivers are not impacted by noise from the project for more than 3 weeks in total

Based on information regarding the indicative location of the WTP, the closest residential receiver (R1) is located approximately 250 away. Rock breaking activities are not anticipated, and other intensive construction noise are not expected. However, there is still the potential for daytime noise levels to be exceeded at this distance. Construction noise for the WTP would be managed through implementation of a Construction Noise Management Plan (CNMP).

Table 6-13 Predicted Construction noise levels

Plant and Equipment	Typical Sound Power Level dB(A)	LAeq @10 m	LAeq @50 m	LAeq @100	LAeq @200	LAeq @400	LAeq @800	LAeq @1600	NML $L_{Aeq(15min)}$
Pneumatic Jackhammer	113	85	71	65	59	53	47	41	45 (Day) 35 (Evening & Night)
Trucks	112	84	70	64	58	52	46	40	
Front End Loader	111	83	69	63	57	51	45	39	
Dozer	115	87	73	67	61	55	49	43	
Grader	110	82	68	62	56	50	44	38	
Pad foot Roller	109	81	67	61	55	49	43	37	
Concrete Delivery Trucks	109	81	67	61	55	49	43	37	
Rock Breaker	116	88	74	68	62	56	50	44	
Tip Trucks	108	80	66	60	54	48	42	36	
Light Vehicles	106	78	64	58	52	46	40	34	
Excavator 20t	105	77	63	57	51	45	39	33	
Chainsaw	105	77	63	57	51	45	39	33	
Crane	98	70	56	50	44	38	32	26	

Figure 6-4 Location of nearest receivers

Construction vibration

Due to the nature of the works the vibration risk is low. However, it is possible that local sensitive receivers may perceive construction vibration at times. The level of annoyance, however, would depend on individuals.

Table 6-14 outlines typical vibration levels for different plant activities sourced from the NSW RTA Publication *Environmental Noise Management Manual*.

Table 6-14 Typical Vibration Levels - Construction Equipment (Source: NSW RTA Publication *Environmental Noise Management Manual*)

Item	Peak Particle Velocity at 10m (mm/s)
Pile Boring	12- 30
15 Tonne Compactor	7-8
7 Tonne Compactor	5-7
Roller	5-6
Dozer	2.5-4
Backhoe	1
Jackhammer	0.5

Vibration goals may have the potential to be exceeded for buildings within 10 metres from potential pile boring impacts. As there are no residential receivers within 10 metres of the project area, impacts to residential receiver are expected to comply. While the nature of the works indicates the risk is low, it is important that this risk is captured and managed in the Project CNVMP.

Operation

Acoustic modelling was undertaken using Bruel and Kjaer's "Predictor" to predict the effects of site noise during operation. Predictor is a computer program for the calculation, assessment and prognosis of noise propagation. Predictor calculates environmental noise propagation according to ISO 9613-2, "*Acoustics – Attenuation of sound during propagation outdoors*". Terrain topography, ground absorption, atmospheric absorption and relevant shielding objects are considered in the calculations.

The primary noise sources would be the pumps drawing raw water from Quipolly Dam and pumps to pump treated water from the WTP to Quirindi and Werris Creek. Both pump stations would be in masonry buildings. The raw water pump station was assumed to be 100mm lightweight brick 100kg/m^2, with a roof assumed to be 1mm metal 8kg/m^2, while the treated water pump station was assumed to be 120mm stretching bond brickwork 240 kg/m2 with an insulated plasterboard roof 25 kg/m^2 due to the proximity of this plant to the nearest receivers.

A hypothetical scenario where all of the above are operating simultaneously were modelled to simulate a worst-case scenario. Day, evening and night time situations were modelled identically to represent a worst-case scenario including an F class atmospheric stability and a 2 m/s source to receiver wind speed.

The result at the nearest residential receiver (R1) is identical for day evening and night as the inputs into the model were the same to simulate a worst-case scenario. Based on the results of this assessment compliance can be expected for operation of the Proposal at all receivers with no additional noise mitigation required, provided the pump stations are properly constructed with a minimum of the building materials utilised above.

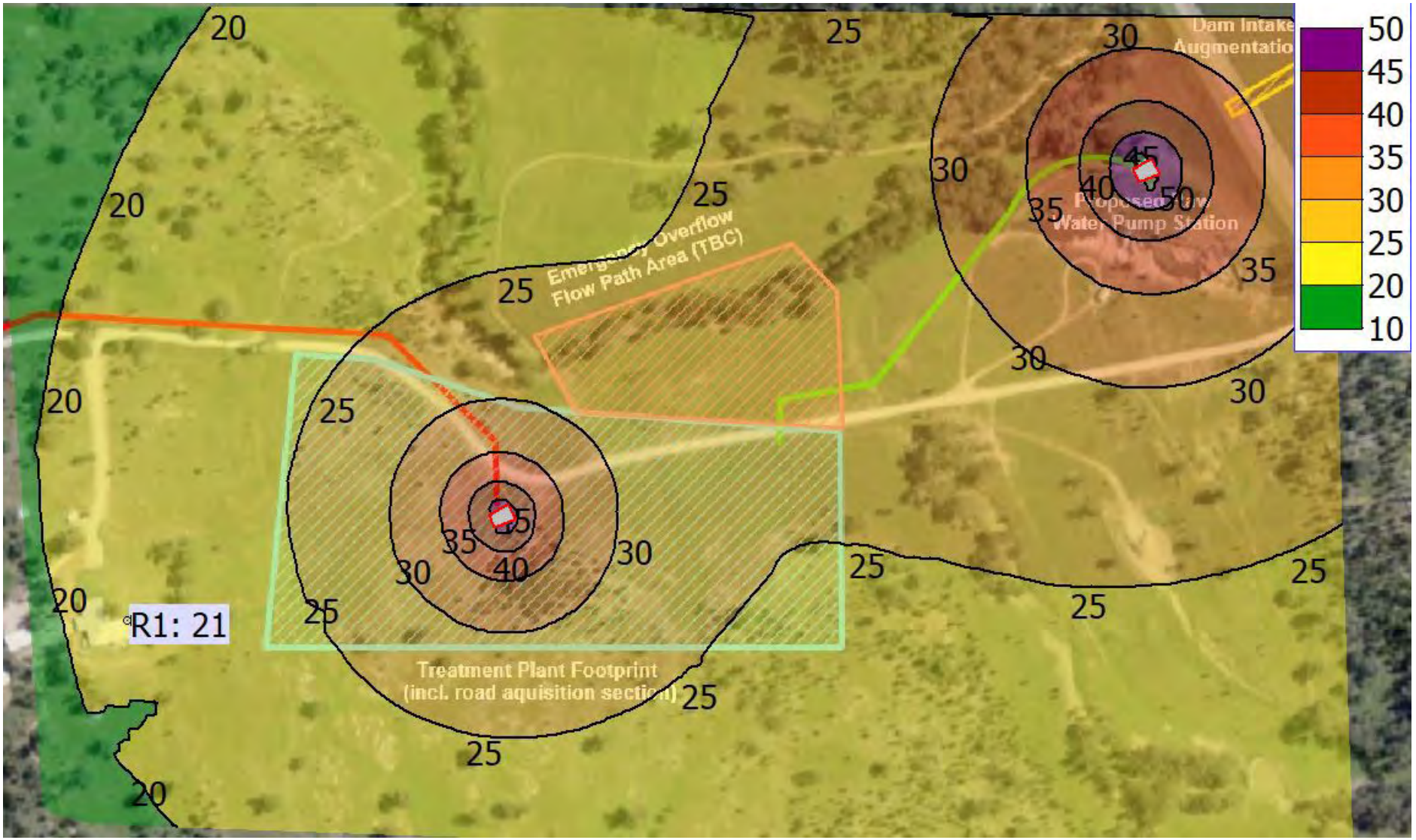

Figure 6-5 Modelled results (RAPT, 2018)

6.3.5 Safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing
Noise and vibration	A Construction Environmental Management Plan (CEMP) could be prepared prior to the commencement of works and implemented through all phases of the proposed construction works. The CEMP would provide the framework for the management of all potential noise impacts resulting from the construction works and would detail the environmental mitigation measures to be implemented throughout the construction works.	Contractor	Detailed design / pre-construction
Notification before and during construction	Notify affected neighbours to the construction works in advance of the proposed construction period at least 2 weeks prior to the commencement of works.	Contractor/Council	Detailed design / pre-construction
	Consultation and communication between the site(s) and neighbours to the site(s) would assist in minimising uncertainty, misconceptions and adverse reactions to noise.	Contractor	Pre-construction
	All site workers (including subcontractors and temporary workforce) shall be familiar with the potential for noise impacts upon residents and encouraged to take all practical and reasonable measures to minimise noise during their activities, including undertaking works only in approved construction hours.	Contractor	Pre-construction
	The contractor or site supervisor (as appropriate) shall provide a community liaison phone number and permanent site contact so that the noise related complaints, if any, can be received and addressed in a timely manner.	Contractor	Pre-construction/ construction
	Contractor to maintain a list of complaints and resolution status, which will be reported at monthly contractor meetings with Council.	Contractor	Construction
	Complaints that are escalated to Council to be reviewed and discussed within one (1) week of escalation if outstanding.	Contractor	Construction
	The contractor (as appropriate) should establish contact with the residents and communicate, particularly when noisy activities are planned.	Contractor	Pre-construction/ construction
Utilising best practice measures when operating on construction site	Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions.	Contractor	Pre-construction/ construction

Impact	Environmental safeguards	Responsibility	Timing
	Ensure that all construction works scheduled for standard construction hours comply with the start and finish time.	Contractor	Pre-construction/ construction
	Where practical, simultaneous operation of dominant noise generating plant shall be managed to reduce noise impacts, such as operating at contrasting times or increase the distance between plant and the nearest identified receiver.	Contractor	Construction
	High noise generating activities such as jack hammering should only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block.	Contractor	Construction
	Where possible, reversing beepers on mobile equipment shall be replaced with low-pitch tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers.	Contractor	Construction
	Equipment which is used intermittently shall be shut down when not in use.	Contractor	Construction
	All engine covers shall be kept closed while equipment is operating.	Contractor	Construction
	The construction site will be arranged to minimise noise impacts by locating potentially noisy activities away from the nearest receivers wherever possible.	Contractor	Construction
	Material dumps shall be located as far as possible from the nearest receivers.	Contractor	Construction
	Wherever possible, loading and unloading areas shall be located as far as possible from the nearest receivers.	Contactor	Construction
	Where possible, trucks associated with the work area should not be left standing with their engine operating in a street adjacent to a residential area.	Contractor	Construction
	All vehicular movements to and from the site shall comply with the appropriate regulatory authority requirement for such activities.	Contractor	Construction
Complaints handling	Noise and vibration monitoring shall be undertaken upon receipt of a complaint to identify and quantify the issue and determine options to minimise impacts.	Contractor	Construction
	If valid noise/vibration data for an activity is available for the complainant property, from works of a similar severity and location, it is not expected that monitoring will be repeated upon receipt of repeated complaints for these activities, except where vibration levels are believed to be potentially damaging to the building.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Any noise and vibration monitoring shall be undertaken by a qualified professional and with consideration to the relevant standards and guidelines. Attended noise and vibration monitoring shall be undertaken in the following circumstances: • Upon receipt of a noise and/or vibration complaint. Monitoring shall be undertaken and reported within a timely manner (say 3 to 5 working days). If exceedance is detected, the situation will be reviewed to identify means to reduce the impact to acceptable levels.	Contractor	Construction

6.4 SOCIO-ECONOMIC

6.4.1 Existing environment Ready for review.

The Proposal site is located in the townships of Quipolly, Quirindi and Werris Creek in the Liverpool Plains Shire Local Government Area (LGA). Liverpool Plains LGA is located south of Gunnedah, west of Tamworth and north of the Upper Hunter LGA. The townships of Quirindi and Werris Creek are considered population centres which support the smaller villages including Quipolly, Currabubula, Spring Ridge, Premer, Wallabadah and Willow Tree.

As of 2016, about 177 people lived in the suburb of Quipolly, 3,444 people lived in Quirindi and 1,572 people lived in Werris Creek (Australian Bureau of Statistics, 2016). This represents about 68 per cent of the 7,687 people that live in the Liverpool Plans LGA.

Employment statistics for Quirindi and Werris Creek have been obtained from the ABS 2016 census survey and are summarised in Table 6-15.

Table 6-15 Australian Bureau of Statistics 2016 census, Quick Stats for Quirindi and Werris Creek

Subject	Quirindi (Code SSC13301)	Werris Creek (Code SSC14238)
Employment	1,459 people reported being in the labour force: • 58.3% were employed full time • 28.9% were employed part-time 7.5% were unemployed	523 people reported being in the labour force: • 48.6% were employed full time • 32.5% were employed part-time • 11.1% were unemployed.
Occupation	• Professionals 14.8%, • Managers 13.9%, • Technicians and Trades Workers 12.9%, • Machinery Operators and Drivers 12.9% • Labourers 12.8%	• Machinery Operators and Drivers 16.7% • Labourers 16.3%, • Community and Personal Service Workers 13.9%, • Technicians and Trades Workers 13.7%, • Professionals 10.3%.
Industry of Employment	• 5.7% worked in Local Government Administration. • Other major industries of employment included • Hospitals (except Psychiatric Hospitals) 4.1%, • Aged Care Residential Services 3.8%,	• 6.7% worked in Rail Freight Transport. • Other major industries of employment included • Hospitals (except Psychiatric Hospitals) 5.1%, • Aged Care Residential Services 5.1%, • Supermarket and Grocery Stores 4.1% • Primary Education 3.4%.

Subject	Quirindi (Code SSC13301)	Werris Creek (Code SSC14238)
	• Secondary Education 3.5% • Primary Education 3.4%.	

The proposed works is on land zoned RU1 (Primary Production) and surrounding properties consist of cultivated lands with fenced paddocks and feed lots. The area is predominantly used for grazing.

There are a number of rural residential receivers near the Proposal site. These include residences along Back Werris Creek Road, Lowes Creek Road and Bells Gate Road. Open trench construction would occur along the proposed pipeline alignment where these residences are nearby.

6.4.2 Potential impacts

Construction

Rural residential properties along Back Werris Creek Road, Lowes Creek Road and Bells Gate Road would temporarily be impacted during construction. Access to properties would be cut off for a few hours during the trenching of the pipeline to allow initial works and then again for installation and rehabilitation. There would also be additional trucks using the road and this may cause traffic disruption, these impacts are discussed in Section 6.5 (Traffic and access). Impact to land accessibility may impact productivity and farm working schedules. However, these impacts are temporary and short term and of minor significance.

Back Werris Creek Road is also used as a Travelling Stock Route (TRS). The pipeline would be built within the road reserve of the TRS. At any given time during the construction period, a section of the TRS, on one side of the road would be inaccessible for grazing. The open trenching works along Back Werris Creek Road would work in a in progression, as each section of pipeline (approximately 450 m) is installed and completed, the trench is refilled and the soils are compacted and rehabilitated. This construction sequence ensures that only small sections of the TRS are not accessible at any given time of the Proposal's construction program. The impact is therefore temporary and short term, and the significance of the impact is minor.

Water supply would not be interrupted as all existing infrastructure would remain in place and be operational throughout the Proposal construction program.

Housing for full time staff during construction

During construction, approximately 50 full time staff would need housing around the Proposal. Some staff would be hired locally with others needing housing nearby. Some of these workers would rent long term accommodation, others would use temporary accommodation, depending on skill level and duration on site. The contractor may elect to Fly-in fly out the skilled staff and have them work in fortnightly shifts.

Both Quirindi and Werris Creek offer long term rental and short stay accommodation. Rental availability on Domain.com.au, in August 2018, shows 19 properties available for rent between both townships. The use of short-term accommodation for staff during the 24-month construction period could have a negative impact on locals and local tourism. This impact is temporary and can be managed with the contractor consulting with the accommodation providers in the two towns, on a regular basis, the construction program in order to alleviate the pressure on short term accommodation.

Boost in economy from full time employment during construction

During the initial construction period, there is a positive financial benefit. This is attributed to the draw of construction workers during the construction period of the project. Assuming these construction workers earn $120,000 per year and invest approximately 50% back into the local economy through purchasing general goods and services and taxes, the total investment (in 2016 dollars) into the local economy was estimated to be $3 m per year (for the 18 months of construction) (Source LPSC June 2017). This is assuming 50 full time staff on average are employed during construction.

Boost in economy from mining (Source LPSC June 2017)

Mining is one of the pillars of the economy for LPSC. The region is currently experiencing a mining boom, providing some diversification from the existing strong dependence on agriculture.

Whitehaven Coal operates an open cut mine in Werris Creek. Further growth in the region in mining was marked by the approved Development Application (DA) submitted by CIVEO Pty Ltd in September 2013. This development application was for the construction for a residential accommodation facility for up to 1,512 studio units across 10 stages. This DA also had provision for the construction of a sewerage treatment plant and augmentation of existing service facilities where required.

The proposed site is located at the northern fringe of Werris Creek township and would enable future occupants of the site to frequent the town and provide significant economic and social benefits to the township. The expected injection from the procurement phase of the project is anticipated to be in excess of $50 Million (MAC Statement of Environment Effects, 2013).

Ongoing injection to the local economy is anticipated to be in excess of $10 Million annually, primarily through increased demand to essential services such as food, fuel and gas. This has been updated to 2016 rates using a CPI value of 4%. Further, this has been conservatively accounted for in the Net Present Value (NPV) analysis with the assumption that 15% of this growth can be attributable to the Liverpool Plains Regional Water Supply Strategy (LPRWSS).

Operation

Boost in economy from ongoing employment

There is also a financial benefit attributable to the ongoing operation of the new water supply assets. Beyond the end of the mining financial boom (predicted to occur beyond 2040), these assets would continue to provide additional capacity to LPSC. This capacity would not only be utilised in assisting the short term population growth (as a result of mining), but would also assist in providing sustainable growth as private businesses and other business (industrial or other) sectors utilise the capacity of the region.

The new processes would deliver better quality and assure continuous supply of treated water to residents of Werris Creek and Quipolly.

The NPV analysis does not quantify other benefits from the works including:

- Restoration of confidence in the region's municipal water supply.
- Increase in supply security and reliability
- Attraction of Liverpool Plains (Quirindi and Werris Creek) for residential and economic growth.
- The full utilisation and capitalisation on existing water infrastructure works including the Dam upgrades (undertaken in 2012) and Willow Tree water supply network upgrades (in 2015).

6.4.3 Safeguards and mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected businesses and residents, including scope of the works, changed traffic and access conditions • Contact name and number for complaints	Contractor	Construction
Complaints	A project information board will be displayed at the site compound. A contact phone number for complaints and enquiries would be on display.	Contractor	Construction
Communications	The following will be undertaken to manage complaints from the community and stakeholders: • Regular review of complaints and enquiries received to identify emerging trends and unresolved issues. • Review of initial response time to complaints and timing of response letter/email/phone call/visit to assess compliance • Regular review of all communication materials • A weekly "look ahead" of activities along the project timeline to be shared with the construction manager to plan engagement activities • Complaints with resolution to be reported by Contractor at monthly contractor meetings with Council • Escalated complaints will be reported to Council no more than one week if outstanding • Records/logs of complaints and resolution will be made available for review by Council at any time • Reviewing timing of notifications • Monitoring of the media (traditional and social)	Contractor Council	Construction
	Contractor will liaise with Council and nearby towns on an accommodation management strategy that would ensure availability of short term and long term accommodation for locals and tourists.	Contractor	Pre-construction/ construction

6.5 TRAFFIC AND ACCESS

6.5.1 Existing environment

The proposed pipeline route is to be located predominantly within the road reserves of Lowes Creek Road, Back Werris Creek Road and Bells Gate Road. These roads are subject to relatively low traffic volumes and a number of residential dwellings are located along these roads. To access Lowes Creek Road, Back Werris

Creek Road and Bells Gate Road, traffic uses Kamilaroi Highway (B51), Werris Creek Road and Werris Creek Caroona Road.

No bus services, cycle paths or pedestrian footpaths are provided on Lowes Creek Road, Back Werris Creek Road and Bells Gate Road. All three roads are unsealed, dual lane and managed by Council:

- Back Werris Creek Road is also used as a Travelling Stock Route
- Lowes Creek Road connects to Werris Creek Road heading west and Borah Creek Road heading east
- Bells Gate Road intersects with Werris Creek Road about 4km north of Quirindi.

6.5.2 Potential impacts

Construction

Pipeline and WTP

Construction activities with the potential to impact traffic flow include:

- Earthworks for pipe installation
- Vegetation removal
- Construction vehicles accessing the work areas along the pipeline alignment
- Realignment of Lowes Creek Road adjacent to the WTP site
- Trenchless boring at the ARTC railway line at Bells Gate Road and Werris Creek Road
- Construction employees commuting from nearest towns to construction site

Construction materials would be transported from Tamworth along Werris Creek Road, to Payne Road which becomes Lowes Creek Road. Workers would commute from Quirindi, Werris Creek and Tamworth along the Proposal's pipeline roads, as shown in Figure 6-6.

The construction activities would lead to additional traffic on the local roads from workers going to and from the site, deliveries of materials, removal of waste, and moving plant and equipment along the three roads. Construction workers, in particular specialised trades, would likely carpool to site, given the proximity of the nearest towns; as such an average of around 40 vehicle movements per day would be expected. Materials delivery would require approximately five vehicle movements per day, however numbers would occasionally increase for concrete pours, pipe delivery and steel delivery. Lane closures at Lowes Creek Road would be intermittently required to facilitate movement of large trucks at the WTP site.

The impact to traffic would be localised and temporary. Given that these roads are infrequently used the significance of impact is minor with the implementation of the mitigation measures outlined below.

ARTC Rail crossing

Trenchless boring methodology would be implemented for the ARTC Rail crossing at Bells Gate Road to avoid impacts to rail operations. The timing of works surrounding the rail corridor would coincide with rail maintenance activities to further minimise all impact to rail operations. As discussed in Section 5.2.1, consultation was undertaken with ARTC regarding works around the rail corridor. Construction of the pipeline would occur during a planned rail possession or as approved by ARTC.

Figure 6-6: Material transport and Workers commute routes

Operation

Operation of the WTP would require less than 10 personnel. Delivery of chemicals and parts for equipment maintenance would be on an as need basis. Typically, deliveries may generate two additional vehicle movements per month. Given the rural setting of the Proposal, low population density and low level of use of Lowes Creek Road, the operation of the Proposal would not negatively impact traffic and transport on local roads.

6.5.3 Safeguards and mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Traffic and access	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will include: • Confirmation of haulage routes • Measures to maintain access to properties and parking • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites/storage area including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic	Contractor	Construction
Traffic and access	Consultation will be undertaken with Council seeking approval regarding the proposed traffic arrangements.	Contractor	Construction
	Once approval from Council regarding proposed traffic arrangements is granted, consultation will be undertaken with potentially affected residences prior to the commencement of and during works.	Contractor	Construction
	Road users and local Communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction
	Private property access would be maintained either through management	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	of existing accesses or through temporary access in consultation with the property owner.		

6.6 VISUAL AMENITY

6.6.1 Approach

The potential landscape character and visual impact of the Proposal has been assessed in relation to the key viewpoints. The assessment considered the magnitude of visual change and the distance from the viewer, as well as the sensitivity. The sensitivity refers to the quality of the view and how sensitive it is to the proposed change. The categories of magnitude and sensitivity of visibility are defined in Table 6-16.

The combination of sensitivity and magnitude then provides an overall landscape character and visual impact rating based on the grading matrix shown in Table 6-17.

Table 6-16 Magnitude and sensitivity of visibility (Source: RMS, 2009)

Rank	Description
Negligible	Very minor loss or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that are consistent with the existing visual character.
Low	Minor loss of or alteration to one or more key elements/feature/characteristics of the baseline visual character and/or introduction of elements that are consistent with the existing visual character.
Moderate	Partial loss of or alteration to one or more key elements/features/characteristics of the baseline visual character and/or introduction of elements that may be prominent but not considered to be substantially uncharacteristic.
High	Substantial to total loss of key elements/features/characteristics of the baseline visual character and/or introduction of elements considered to be totally uncharacteristic.

Table 6-17 Landscape character and visual impact grading matrix (RMS, 2009)

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High Impact	High-Moderate Impact	Moderate Impact	Negligible Impact
	Moderate	High-Moderate Impact	Moderate Impact	Moderate-Low Impact	Negligible Impact
	Low	Moderate Impact	Moderate-Low Impact	Low Impact	Negligible Impact
	Negligible	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

6.6.2 Existing environment

Photographs of the site, taken during the site survey are provided in Appendix G. The existing visual environment in the vicinity of the Proposal can be summarised as follows:

- The majority of the pipeline is located in a rural landscape where the visual landscape is dominated by open clear-cut pasture, scattered trees and a dirt road.
- The proposed reservoir at Werris Creek is located on a hill adjacent to an existing reservoir of similar size and appearance to that proposed.
- The proposed pumping station at Quipolly Dam is located in a highly modified environment that is visually dominated by the Dam wall and existing pumping station.
- The proposed pumping station in Quirindi is located on the outskirts of Quirindi, on land that is visually dominated by residential and industrial buildings.
- The proposed WTP is located on rocky, grassy and steeply sloped land. A residential receiver sits at the top of the hill with clear views looking east to the proposed WTP.
- The proposed residual lagoons are located on rocky, grassy gently sloping land. A cluster of cypress trees is located on the proposed block of land between the WTP and lagoons. These trees would provide visual screening of the residual lagoons from the residential receiver at the hill top.

The following series of figures show the locations of the WTP, residual lagoons and reservoirs with the respective key sensitive receivers.

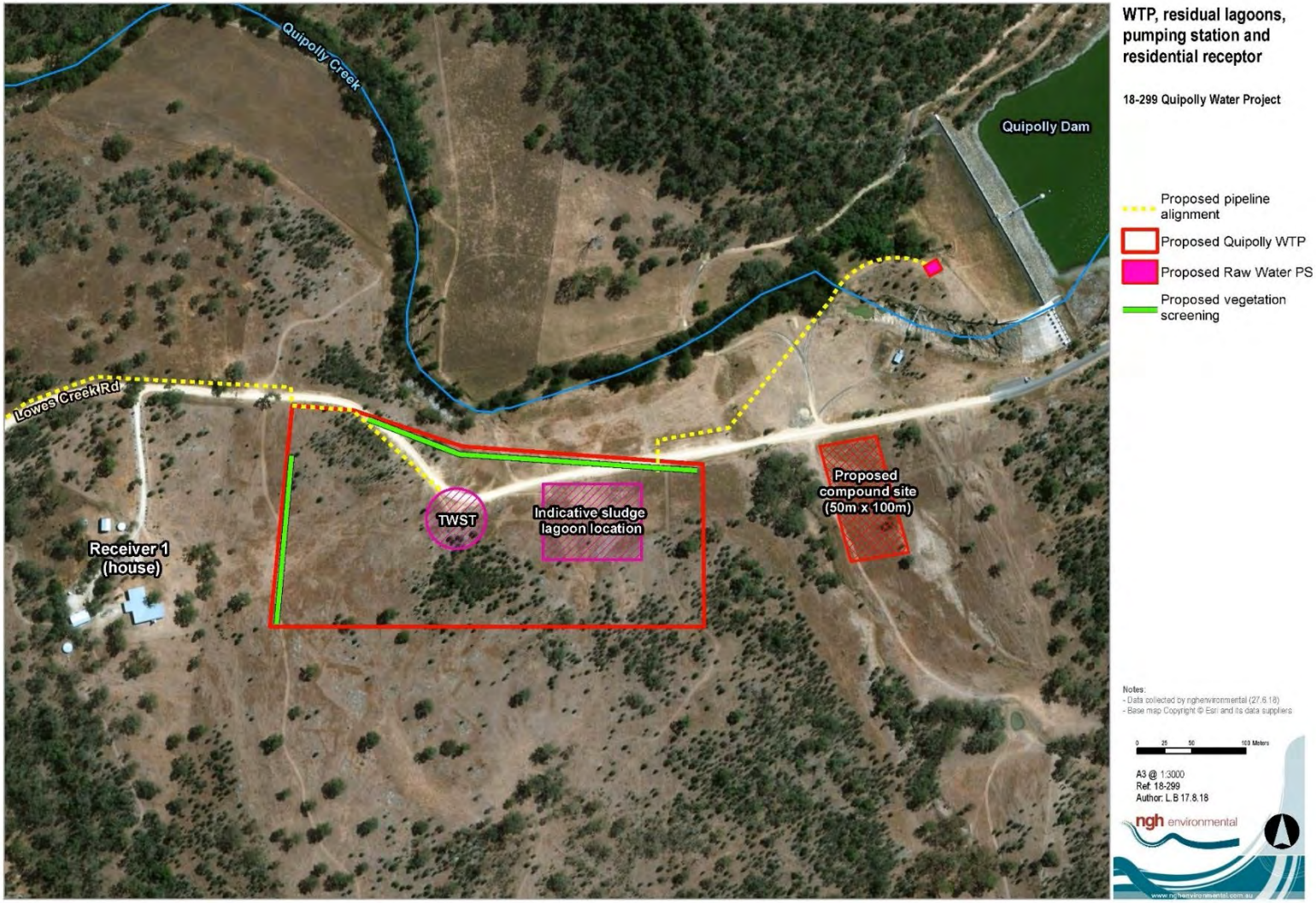

Figure 6-7 WTP, residual lagoons, pumping station and residential receiver

Figure 6-8 Werris Creek Reservoir

Figure 6-9 Proximity of sensitive receivers around the Proposal

6.6.3 Potential impacts

The assessment of impact is based on the identification of key viewpoint sensitive receivers, which were determined from site investigations, and are listed below:

- View from closest residential receiver of the new reservoir at Werris Creek
- View from closest residential receiver of WTP
- View from road of the WTP and residual lagoons
- View from road of aboveground pipeline
- View from road of changed landscape due to removal of trees

The following proposed work would have an impact on the landscape character and visual amenity of the area:

- The establishment of the construction compound on Lowes Creek Road
- The establishment of a work areas along the alignment of the pipeline (Back Werris Creek Road and Bells Gate Road)
- The removal of trees along the pipeline alignment
- The grading of land to accommodate the WTP
- Light spill from security lighting at the WTP during operation.

Table 6-18 Landscape character and visual impact of WTP, residual lagoons and tree removal

Viewpoint	Visual sensitivity	Magnitude	Overall impact	Comments
View from closest residential receiver of the new reservoir at Werris Creek	Moderate	Low	**Moderate Low Impact**	The new reservoir would duplicate the existing reservoir currently at Werris Creek. The new reservoir would be positioned east of the existing one, so that it is not visible to the majority of viewers. The addition of the reservoir would not change the landscape character of the site, and the reservoir would be positioned to limit its visibility from the town. The overall impact is moderate to low.
View from closest residential receiver of WTP	High	Moderate	**Moderate Impact**	The existing landscape is rural, comprising of open hilly terrain, with dense stands of trees and one or two other homesteads. The WTP would introduce an industrial element to the landscape, with several tall structures of steel and concrete construction, a chain link security fence along the perimeter and night time security lighting. Minor grading of the WTP site would be required to ensure that certain structures are on level land and to facilitate road access by large vehicles. However, some elevation would be maintained to take advantage of the gravity feed for the water supply to the reservoirs. The minor change in topography, would lead to an immediate change in the landscape character.

Viewpoint	Visual sensitivity	Magnitude	Overall impact	Comments
				The closest residential receiver sits on the high point of the hill, looking down at the WTP and associated facilities. Views of the residual lagoons would be blocked from the residential receiver by an existing stand of cypress trees which would not be removed. During operation the addition of light and widespread use of lighting across the WTP and residual lagoons would result in a night-time light haze being emitted above the WTP site and visible to sensitive receivers. Upon completion of construction activities at the WTP site, trees would be planted along the west boundary of the WTP to screen the built structures from the residential receiver. The change in landscape character is permanent, the operation and construction impact is moderate for the residential receiver.
View from road of the WTP and residual lagoons	Moderate	Moderate	**Moderate Impact**	The visual amenity of road users would only be impacted when approaching the compound site and WTP site. The structures of WTP would change the rural landscape views from the road to an industrial landscape. This change in view would be limited to the construction footprint of the WTP and lagoons. No other changes would be noticeable by passing traffic. Trees would be planted along the roadside fence line of the WTP to limit views of the WTP from the road once operational. The change in landscape is permanent, and with the use of vegetation screening the impact is moderate to road users.
View from road of aboveground pipeline	Low	Low	**Low Impact**	Above ground pipeline would only be used along limited sections of Werris Creek Road. The pipeline diameter would range from 250 to 375 DN, and would be constructed of Ductile Iron Cement Lined (DICL), which is non reflective material. The pipe would sit no more than 1.5m above ground. As such visibility of the pipeline by road users would be limited. The change in landscape is permanent, but limited to few locations. As such the visual impact is low to road users.
View from road of changed landscape due to removal of trees	Low	Negligible	**Negligible Impact**	The chosen pipeline alignment would aim to limit the total number of trees removed, and would avoid removal of whole stands of trees. The change in landscape character would not be noticeable, as much of the land has already been cleared with scattered

Viewpoint	Visual sensitivity	Magnitude	Overall impact	Comments
				remnants of tree stands or single trees in the landscape. Work areas would have a small footprint, would be temporary and would move with the stages of the pipeline construction. Work areas would be reinstated to their pre-construction condition. The magnitude of change in landscape character is negligible and the overall impact to road users is negligible.

6.6.4 Safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing
Minimise visual and landscape impact during construction	Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impact. A site arrangement plant showing at minimum the following: • Storage areas for equipment and materials • Sufficient parking areas are available at the work sites • Waste storage areas, and ensure waste is sorted and recycled	Contractor	Construction
	When not in use, construction plant shall be lowered and stationed in designated area, so they are at their minimum height and do not protrude unnecessarily within the views of receivers.	Contractor	Construction
	Contractor to provide Council notification 4 weeks prior to any changes in working hours and activities.	Contractor	Construction
	Notices and letters shall be provided to residents, informing them of working hours and any activities with four weeks notice of the proposed works.	Council	Construction
Light spill	Any lights required will be directed onto the site, with a maximum position angle of 30º from vertical, and back spill shields, therefore minimising any unwanted light spill and impacts at night. Lighting should not cause reflected glare.	Contractor	Detailed Design Construction Post Construction
Visual amenity	Implement a vegetation screening program along Lowes Creek Road and between the closest sensitive receiver to the WTP, to screen views for road users and the residents. Plant mature trees, of native species and appropriate for the landscape and habitat at the planting site. Heights and density of the tree planting should consider the immediate screening potential of the planting program.	LPSC Contractor	Post Construction

Impact	Environmental safeguards	Responsibility	Timing
	Plant components will be painted to better integrate with the landscape and match the surroundings, substantially decreasing their visibility and contrast.	LPSC and Contractor	Detailed design Post Construction

6.7 INDIGENOUS HERITAGE

6.7.1 Approach

An Aboriginal Heritage Information Management System (AHIMS) search was completed on 18 July 2018. The search indicated no Aboriginal places recorded in or near the Proposal pipeline, and eight sites identified within a 2km radius of the Proposal area, but not within the proposed construction footprint. A copy of the extensive AHIMS database search is attached in Appendix A.

6.7.2 Existing environment

Everick Heritage Consultants (Everick) undertook a cultural heritage assessment of the area of proposed works in 2014, prior to works commencing (Everick Heritage Consultants Pty Ltd, 2014).

A search of the AHIMS database (Client service number 358572) identified eight Aboriginal cultural heritage sites located within a 2km radius of the proposed pipeline route, but not within the proposed construction footprint. Further searches of other State and National heritage registers did not locate any Indigenous places within the route.

A site assessment of the proposed pipeline route was conducted as part of the assessment, with no Aboriginal objects or places identified. Everick (2014) has described the proposed route being characterised as disturbed (within the meaning of the Due Diligence Code).

Everick has highlighted that there is currently a pending Native Title claim lodged by the Gomeroi people which covers all of the Crown land within the proposed pipeline route (filed 20.12.2011). The claim is active, having passed the test for registration. However, the application is yet to be determined, pending anthropological evidence. Currently, the Gomeroi people are not Native Title holders.

The Gomeroi people were not consulted as part of the Everick's cultural heritage assessment as there is no requirement to do so. The Nungaroo Local Aboriginal Land Council (LALC) is still the primary body responsible for cultural heritage in the area until such time as a Native Title Claim has been successfully determined.

The Native Title claim provides a right to negotiate over certain activities (Future Acts) on lands where Native Title has not been extinguished. This includes the majority of Crown lands and non-perpetual leases etc. Negotiations usually take the form of negotiations over compensation but can include ongoing access and cultural heritage. It is common to enter into an Indigenous Land Use Agreement in such instances.

Due to the level of existing disturbance of the area and lack of sites identified during Everick's site inspection, a further, more detailed heritage assessment is not warranted for the pipeline.

6.7.3 Potential impacts

Everick's 2014 desktop review of the Proposal area identified a low- moderate potential for archaeological materials to be within the Proposal area prior to European settlement. It is anticipated that should heritage be located within the Proposal area, it is likely to be limited to single artefacts and/or scatters of stone

artefacts, scarred or modified trees. Due to the extensive ground disturbance following European settlement, it was considered that there was a generally low potential for evidence of scientifically significant Aboriginal sites to remain within the Proposal area. It was presumed that evidence of Aboriginal occupation would largely be limited to a 'background scatter' of Aboriginal stone tools, as would be expected given the results of archaeological and cultural heritage assessments throughout the region.

Everick Heritage Consultants did not locate any Aboriginal heritage sites during their 2014 survey of the Proposal area. Though no Aboriginal objects were located during the survey, they identified that there is still a low potential for Aboriginal objects to be uncovered during construction works within the proposed pipeline alignment. It is recommended that the Proponent approach the construction of the pipeline alignment with caution.

6.7.4 Safeguards and mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Unexpected finds	In the highly unlikely event that potential human skeletal material is identified over the course of the proposed works, the following procedure shall be followed in accordance with the *Policy Directive - Exhumation of Human Remains* (NSW Department of Health 2008), *Skeletal Remains - Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997): • As soon as remains are exposed, work in the vicinity of the remains is to halt immediately to allow assessment and management; • The Contractor's Manager will be notified to cease works. The Contractor's Manager will then contact Council to notify relevant authorities including; a suitable Archaeologist , local police, and OEH; • If the remains are suspected to be human, a physical or forensic anthropologist should inspect the remains in situ, and make a determination of whether the remains are human and if so, the likely ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic); • If the remains are identified as forensic the area is deemed as crime scene; • If the remains are identified as Aboriginal, the site is to be secured and OEH and all registered Aboriginal parties are to be notified in writing; or • If the remains are non-Aboriginal (historical) remains, the site is to be secured and OEH is to be contacted; and • This process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (NSW Police Force, forensic anthropologist, OEH, registered Aboriginal parties	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	etc) and in accordance with the *Public Health Act* 1991.		
	• If suspected Aboriginal human remains are uncovered within the Proposal area, all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Nungaroo LALC and the OEH Regional Office are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the OEH shall be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.	Contractor	Construction
	• If Aboriginal cultural materials are uncovered as a result of development activities within the Proposal area, they are to be registered as Sites in the AHIMS managed by the OEH. Any management outcomes for the site will be included in the information provided to the AHIMS.	Contractor	Construction

6.8 NON-INDIGENOUS HERITAGE

6.8.1 Approach

The following database searches were completed on 19 July 2018:

- National Heritage List
- Commonwealth Heritage List
- NSW State Heritage Register
- State Heritage Inventory
- Liverpool Plains LEP 2011

A copy of the heritage database searches is attached in Appendix A.

6.8.2 Existing environment

No heritage listed items are located along the length of the pipeline from Quipolly Dam to Werris Creek Reservoir and North Quirindi Reservoir.

The Liverpool Plains LEP (2011) identifies a number of locally listed heritage items within Werris Creek and Quirindi, however there is no perceived impact to the heritage significance of any identified item, as the proposed works are not within the immediate vicinity of any listed item.

6.8.3 Potential impacts

The proposed pipeline is not within the immediate vicinity of any listed heritage item and would therefore not impact on the non-Indigenous heritage values of the location.

6.8.4 Safeguards and mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Unexpected finds	• Contractor will notify Council before commencing any work. • Staff working at the site during construction will be instructed to stop work immediately on identification of any suspected heritage artefact.	Contractor	Construction
	• If any unexpected archaeological remains are discovered during construction, work will stop immediately in the vicinity of the material/find and specialist advice from a suitably qualified heritage consultant will be sought.	Contractor	Construction

6.9 RISKS AND HAZARDS

6.9.1 Summary of risks and hazards

Work health and safety

All requirements of the *Work Health and Safety Act 2011* and *Work Health and Safety Regulation 2011* must be fulfilled during the works. Public access to construction sites would be prohibited.

Hot work and fires

Construction techniques that involve hot work, such as the welding of pipes (which can generate sparks), are considered to have some, albeit low, potential to generate a fire or increase the existing frequency of fires in the area (particularly during the fire danger period). Any potential risk would be reduced by:

- Flammable material would be removed from work site
- Staff training in proper use of equipment and fire fighting techniques would be required
- Operations would be continually monitored, especially during high risk activities;
- Personal Protective Equipment (PPE) would be used
- Appropriate equipment to quickly extinguish any sparks generated on site

The CEMP would incorporate contractor requirements to restrict the use of combustible fuels, particularly cigarette smoking, on the construction site, as well as being aware of potential ignition risk when conducting hot work (such as welding) in or near bushland/vegetated areas, fallen timber or other potential ignition sources.

Hazardous materials

The Work Safety Plan for construction of the Proposal would include measures for minimising the risk of direct human contact with hazardous materials, such as asbestos. As a minimum, a Work Safety Plan for the Proposal would include a contingency or response plan in the event that site staff encounter hazardous materials.

Flooding

Flooding models indicate that the 1 in 100 Average Recurrence Interval Event flooding level is around RL 404 m AHD. This would only pond around the northern embankments of the residuals lagoons.

The location of the WTP is outside the Council's flood planning area and therefore the operation of the WTP is unlikely to be impacted by flooding.

Hazardous Waste

If during construction it is determined that there is a significant risk of harm to the environment or human health from potentially hazardous waste, this risk would be reported immediately to the construction Project Manager and the appropriate regulatory authority. Appropriate Personal Protective Equipment would be used in relation to sampling, extraction and disposal of hazardous material.

Operational Chemical Storage

Operational chemical storage, handling and management (including deliveries) would be undertaken in accordance with the relevant Safety Data Sheets (SDS) and the HAZOP procedures of the WTP, including bunding. Dangerous goods (such as chlorine gas) would be required to be transported to site. These would be transported in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* which outlines requirements to manage risks associated with transport of dangerous goods.

Public Health

Construction

Construction of the pipeline would involve pressure testing. The contractor would be required to implement appropriate measures and install functioning backflow prevention devices that would ensure that raw or recycled water is not discharged to the potable water supply.

Operation

Water quality targets have been reviewed and outlined in the Concept Design report. To ensure that water quality parameters are being met prior to delivery of treated water to the townships it would be continuously monitored for the following:

- pH
- Residual chlorine (before and after the CCT)
- Turbidity

Alarms/interlocks would be incorporated to protect operators and plant equipment and to minimise potential adverse effects in the treatment process and a comprehensive suite of alarm priorities would be incorporated to warn of current or potential problems such as parameters being outside of normal operating ranges (and resultant system interlocks).

6.9.2 Safeguards and mitigation measures

Impact	Environmental safeguard	Responsibility	Timing
Spills accidents and natural events	An Incident Management Plan (IMP) would be developed as part of the CEMP. The IMP would contain procedures dealing with spills and accidents or natural events that may have environmental and health and safety risks.	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	The IMP would contain appropriate procedures for protection of people, machinery, materials and the environment in the event of such incidents.		
Hazardous material handling	If during construction it is determined that there is a significant risk of harm to the environment or human health from potentially hazardous waste, this risk would be reported immediately to Council's construction Project Manager and the appropriate regulatory authority. Appropriate personal protective equipment would be used in relation to sampling, extraction and disposal of hazardous material.	Contractor	Construction
Hazardous material handling	Operational chemical storage, handling and management (including deliveries) would be undertaken in accordance with the relevant Safety Data Sheets and the HAZOP procedures of the WTP, including bunding. Dangerous goods (such as chlorine gas) would be required to be transported to site. These would be transported in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* which outlines requirements to manage risks associated with transport of dangerous goods.	Contractor	Operation
Public health	The contractor would be required to implement appropriate measures and install functioning backflow prevention devices that would ensure that raw or recycled water is not discharged to the potable water supply.	Contractor	Detailed design Construction Operation

6.10 GREENHOUSE GAS EMISSIONS AND ENERGY USE

6.10.1 Potential impacts

Construction activities for the Proposal would generate greenhouse gas (GHG) emissions. The major sources of expected emissions include the operation of plant, machinery, and the transportation of materials to and from site resulting from diesel and petrol combustion.

Operation of the new WTP would create emissions through the consumption of electricity. However, the WTP would take advantage of gravity flows through the main treatment processes of the plant, minimising energy use and operational costs with re-lift pumping. Night pumping would be proposed during low seasonal demand periods to benefit from off-peak tariffs.

Other GHG emissions would be generated from associated WTP operational activities such as chemical use (and reactions) and transport (operator travel, waste disposal, maintenance and deliveries). The emissions generated from these associated activities have not been estimated.

Using NSW's emission factor of 0.82 kg CO2-e/kWh for the calculations, the following estimations were made for the operation of the WTP:

- Energy use of 1,376 kWh/day
- Carbon dioxide equivalent 232 t/yr

6.10.2 Safeguards and mitigation measures

Construction phase

The following mitigation measures to minimise GHG emissions during construction would be undertaken to reduce the production of GHG emissions. With these safeguards in place there would be no significant level of GHG as a result of the construction of the Proposal.

Impact	Environmental safeguard	Responsibility	Timing
Power consumption	• Use well-maintained plant and equipment to minimise fuel consumption. • Proper fitting and maintenance of vehicle exhausts systems to ensure emissions comply with the POEO Act. • Only start up vehicles when required and limit idling time when not in use. • Minimise haulage vehicle movements by filling to maximum allowable limits.	Contractor	Construction

Operation phase

No measures are required.

6.11 OTHER IMPACTS

6.11.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impact
Air quality/ dust	The WTP and pipeline would be located in a rural area. The dominant land use is cattle grazing and farming. Population density is very low and the alignment of the pipeline follows unsealed roads mainly used by the farmers and residents living and working directly off these roads. No industrial facilities are located within the air shed, however, a quarry is located over 2km west of Back Werris Road. Air quality impacts from the quarry would be predominantly dust. Given the limited sources of emissions in the Proposal area, the air quality in the Proposal area is unlikely to be impacted by air pollutants.	Potential air quality impacts during construction would result from the following emissions: • Dust generation from exposed areas of soil, soil excavation and soil stockpiles, rock crushing, vehicles travelling on unsealed roads, concrete cutting or other similar construction activities • Exhaust emissions from construction traffic and machinery • Use and handling of chemicals Airborne particulates generated from these activities would be temporary and would be unlikely to affect any sensitive receivers given their distance from the site, as these impacts attenuate with distance. Dust generation would be limited to the construction phase of the project. It is considered that air quality impacts during construction would be highly manageable and temporary. No air quality impacts are expected to be generated during the operation phase as a result of the Proposal.
Waste	LPSC is committed to the responsible management of unavoidable waste and promotes the reuse of such waste in accordance with the resource management hierarchy principles outlined in the *Waste Avoidance and Resource Recovery Act 2001*. These resource management hierarchy principles, in order of priority are: • Avoidance of unnecessary resource consumption. • Resource recovery (including reuse, reprocessing, recycling and energy recovery).	Construction of the Proposal would involve activities that generate solid and hazardous waste, as well as liquid wastes. Hazardous construction waste including oil and machinery lubricants would represent a very small proportion of the total amount of construction waste. The majority of the waste by volume/bulk would be generated by the installation of the pipeline and site preparation. Cut material, rocks and top soil would be generated from excavation activities and ground levelling. Vegetation waste would be generated by clearing at the WTP site, lagoons site and pipeline alignment.

Environmental factor	Existing environment	Potential impact
	• Disposal. By adopting the above principles, LPSC aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in accordance with the principles of ecologically sustainable development (ESD).	The excavated subsoil material would be stockpiled (separately to the topsoil), and used for infilling of the pit excavations and backfilling of trenches, any remaining spoil would be classified in accordance with the waste guidelines, reused on site where possible, with the remainder disposed of off-site in accordance with the waste classification. Under the POEO Act, it is an offence to 'without lawful authority, wilfully or negligently dispose of waste in a manner which harms or is likely to harm the environment'. The requirements of the POEO Act would be met during the proposed works. The operation of the WTP would generate domestics wastes (putrescible, solid and liquid). The volumes of these would be small and manageable under the facilities general waste management guidelines. The treatment process would generate under 6ML/day of liquid waste which would be sent to the residual lagoons. The majority of the liquid would be recycled in the WTP, some loss of water is expected through evaporation. The Quipolly WTP would not include a routine off-site discharge. The solids in the lagoons would be collected by a licensed waste service supplier and disposed at a state licensed waste facility. Approximately 61 tonnes/annum would be collected.

6.11.2 Safeguards and mitigation measures

Impact	Mitigation measure	Responsibility	Timing
Air quality/ dust	• Potential dust sources (soil stockpiles, access tracks) shall be regularly watered (if water restrictions are not in place) when required, particularly on hot, dry and windy days • If stockpiles are to remain for longer than a 10-day period, cover or stabilise with quick growing, sterile grasses as soon as possible • The location and number of dust sources (i.e. bare surfaces including stockpiles) will be kept to a minimum • Visual surveillance for dust generation would occur at all times. Work must cease when high levels of airborne dust cannot be controlled • Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in a suitable manner (e.g. watering and/or vegetation establishment) and inspected weekly.	Contractor	Construction

Impact	Mitigation measure	Responsibility	Timing
Air Quality **Emissions**	• Vehicle exhaust systems shall be properly maintained so that exhaust emissions comply with the Clean Air Regulation issued under the *Protection of the Environment Operations Act 1997* • Plant and machinery to be turned off when not in use.	Contractor	Construction
Air Quality **Other pollutants**	• Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation. • Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust in the response to an air quality complaint. • Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely. • Vegetation or other materials are not to be burnt on site.	Contractor	Construction
Waste	Resource management hierarchy principles are to be followed: • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the Waste Avoidance & Resource Recovery Act 2001).	Contractor	Construction
	Waste is not to be burnt on site.	Contractor	Construction
	Waste material, other than vegetation and tree mulch that complies with the EPA resource recovery exemption, is not to be left on site once the works have been completed.	Contractor	Construction
	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day. No hazardous material will be stockpiled. Minimise the size and height of the stockpile as far as possible.	Contractor	Construction
	Wherever possible, reduce the quantity of chemicals and fuel stored on site to minimum practical level. Infrequently used chemicals will be ordered before they are needed	Contractor	Construction
	Green waste as result of vegetation clearing will be mulched and reused on site or disposed of at an appropriate facility	Contractor	Construction
	The handling and disposal of priority weeds, will be undertaken in accordance with local control plans and/or the weed's classification as per the *Biosecurity Act 2015*.	Contractor	Construction

6.12 CUMULATIVE IMPACTS

6.12.1 Existing environment

The Proposal is part of the Liverpool Plains Regional Water Supply Scheme (RWSS). The first stage of this work, the pipeline from Quirindi to Willow Tree, has now been constructed.

Whitehaven Coal operates an open cut mine in Werris Creek. Further growth in the region in mining was marked by the approved Development Application (DA) submitted by CIVEO Pty Ltd in September 2013. This development application was for the construction for a residential accommodation facility for up to 1,512 studio units across 10 stages. This DA also has provision for the construction of a sewerage treatment plant and augmentation of existing service facilities where required.

6.12.2 Potential impacts

Environmental factor	Construction	Operation
Noise	Construction of these Proposals are in distinctly separate locations. There would be no overlap in sensitive receivers between the Proposals. No cumulative impact is likely.	Neither Proposals would result in significant noise impact from operational activities on nearby sensitive receivers.
Traffic	Should there be overlap in the construction programs between these projects, the significance of impact on traffic congestion between major town centres for material supply would increase. If they follow each other resulting with an overall longer construction program then the duration of the impact would increase, but the significance of impact would not change.	A moderate increase in traffic would result from the increased worker population brought by the mine. The operation of the WTP would employ less than 10 permanent staff.
Socio-economic	Residents in Quirindi and Werris Creek are likely to experience construction fatigue as a result of construction impact from multiple projects occurring in the same period or consecutively. Undersupply of accommodation may impact affordability for locals in the short term. Increased influx of population would boost trade for local businesses.	Secure and reliable supply of good quality water would support continued economic growth in the area, attract more businesses and sustain local trades.

6.12.3 Safeguards and mitigation measures

The safeguards identified in Sections 6.3, 6.4, and 6.5 would ensure that cumulative impacts in the form of noise, socio-economic, and traffic and access are minimised.

7 SUMMARY OF SAFEGUARDS

Table 7-1 Key environmental safeguards

Impact	Environmental safeguard	Responsibility	Timing
Biodiversity	• Avoid, wherever possible, the removal of any wooded vegetation – construct all compounds, trenches and access tracks within cleared areas or areas of exotic vegetation where possible. • Construction areas would be stabilised as soon as practicable (progressively where possible) • Physically delineate areas to be cleared from areas to be retained • Contractor to submit clearing plan to Council for written approval before commencing clearing work	Contractor	Pre-construction and Construction
	• Avoid, wherever possible, the removal of any hollow-bearing trees (HBTs) • Contractor to identify HBTs proposed to be removed and submit plan to Council prior to pre-clearing inspection • Hollow-bearing trees, that would removed, should be identified and inspected by a qualified ecologist 24 hours prior to the hollow-bearing tree being felled • All habitat clearing activities shall be carried out in a staged process, prior to the construction activities starting in that location, to provide opportunity for fauna species to relocate naturally to the surrounding habitats • A suitable qualified and experience Ecologist will be present when hollow-bearing trees are felled to capture and relocate any fauna that may emerge	Contractor	Pre-construction and Construction
	• The requirements of the Biosecurity Act would be implemented • A qualified botanist would conduct a pre-clearing survey to identify any weed infestations and submit to Council for approval • Machinery would be inspected and cleaned prior to entering and leaving the site to ensure that weed seeds and propagules are not imported to the site or spread to unaffected areas	Contractor	Pre-construction and Construction
	• Identify construction methods and use plant and equipment that would minimise removal or disturbance of any riparian habitat within the construction buffer • ESCP would be prepared and submitted to Council for approval and the controls put in place prior to construction to minimise potential water quality impacts during construction • Measures to prevent and contain spillage of potential contaminants would be implemented in accordance with the requirements of the ESCP	Contractor	Pre-construction and Construction

Impact	Environmental safeguard	Responsibility	Timing
	• All debris created by the demolition work to be fully contained and disposed of appropriately • Contractor will submit a spill management procedure to Council for approval prior to undertaking any works as part of the CEMP • In the event of a spill or contamination of Quipolly Creek: o Works would cease and the spill management procedure implemented immediately o A Council Environmental Officer would be contacted in accordance with incident reporting requirements of the site's CEMP o Any pollution of the ephemeral creeks in the proposal site would be reported to the EPA in accordance with the notification requirements of the *Protection of the Environment Operations Act 1997* (POEO Act). • Should any fish kills occur during construction, all works would stop and DPI (Fisheries) would be contacted immediately • Removal of instream habitat structures such as boulders, vegetation and large woody debris, shall be avoided where possible. Such features to be relocated in preference to removal. Relocation of large woody debris shall be undertaken in consultation with NSW DPI (Fisheries).		
Noise and vibration	A Construction Environmental Management Plan (CEMP) could be prepared prior to the commencement of works and implemented through all phases of the proposed construction works. The CEMP would provide the framework for the management of all potential noise impacts resulting from the construction works and would detail the environmental mitigation measures to be implemented throughout the construction works.	Contractor	Detailed design / pre-construction
	Notify affected neighbours to the construction works in advance of the proposed construction period at least 2 weeks prior to the commencement of works.	Contractor/Council	Detailed design / pre-construction
	Consultation and communication between the site(s) and neighbours to the site(s) would assist in minimising uncertainty, misconceptions and adverse reactions to noise.	Contractor	Pre-construction
	All site workers (including subcontractors and temporary workforce) shall be familiar with the potential for noise impacts upon residents and encouraged to take all practical and reasonable measures to minimise noise during their activities, including undertaking works only in approved construction hours.	Contractor	Pre-construction
	The contractor or site supervisor (as appropriate) shall provide a community liaison phone number and permanent site contact so that the noise	Contractor	Pre-construction/ construction

Impact	Environmental safeguard	Responsibility	Timing
	related complaints, if any, can be received and addressed in a timely manner.		
	Contractor to maintain a list of complaints and resolution status, which will be reported at monthly contractor meetings with Council.	Contractor	Construction
	Complaints that are escalated to Council to be reviewed and discussed within one (1) week of escalation if outstanding.	Contractor	Construction
	The contractor (as appropriate) should establish contact with the residents and communicate, particularly when noisy activities are planned.	Contractor	Pre-construction/ construction
	Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions.	Contractor	Pre-construction/ construction
	Ensure that all construction works scheduled for standard construction hours comply with the start and finish time.	Contractor	Pre-construction/ construction
	Where practical, simultaneous operation of dominant noise generating plant shall be managed to reduce noise impacts, such as operating at contrasting times or increase the distance between plant and the nearest identified receiver.	Contractor	Construction
	High noise generating activities such as jack hammering should only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block.	Contractor	Construction
	Where possible, reversing beepers on mobile equipment shall be replaced with low-pitch tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers.	Contractor	Construction
	Equipment which is used intermittently shall be shut down when not in use.	Contractor	Construction
	The construction site will be arranged to minimise noise impacts by locating potentially noisy activities away from the nearest receivers wherever possible.	Contractor	Construction
	Material dumps shall be located as far as possible from the nearest receivers.	Contractor	Construction
	Wherever possible, loading and unloading areas shall be located as far as possible from the nearest receivers.	Contactor	Construction
	Where possible, trucks associated with the work area should not be left standing with their engine operating in a street adjacent to a residential area.	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	All vehicular movements to and from the site shall comply with the appropriate regulatory authority requirement for such activities.	Contractor	Construction
	Noise and vibration monitoring shall be undertaken upon receipt of a complaint to identify and quantify the issue and determine options to minimise impacts.	Contractor	Construction
	If valid noise/vibration data for an activity is available for the complainant property, from works of a similar severity and location, it is not expected that monitoring will be repeated upon receipt of repeated complaints for these activities, except where vibration levels are believed to be potentially damaging to the building.	Contractor	Construction
	Any noise and vibration monitoring shall be undertaken by a qualified professional and with consideration to the relevant standards and guidelines. Attended noise and vibration monitoring shall be undertaken in the following circumstances: • Upon receipt of a noise and/or vibration complaint. Monitoring shall be undertaken and reported within a timely manner (say 3 to 5 working days). If exceedance is detected, the situation will be reviewed to identify means to reduce the impact to acceptable levels.	Contractor	Construction
Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected businesses and residents, including scope of the works, changed traffic and access conditions • Contact name and number for complaints	Contractor	Construction
	A project information board will be displayed at the site compound. A contact phone number for complaints and enquiries would be on display.	Contractor	Construction
	The following will be undertaken to manage complaints from the community and stakeholders: • Regular review of complaints and enquiries received to identify emerging trends and unresolved issues. • Review of initial response time to complaints and timing of response letter/email/phone call/visit to assess compliance • Regular review of all communication materials • A weekly “look ahead” of activities along the project timeline to be shared with the construction manager to plan engagement activities • Complaints with resolution to be reported by Contractor at monthly contractor meetings with Council	Contractor Council	Construction

Impact	Environmental safeguard	Responsibility	Timing
	• Escalated complaints will be reported to Council no more than one week if outstanding • Records/logs of complaints and resolution will be made available for review by Council at any time • Reviewing timing of notifications • Monitoring of the media (traditional and social)		
	Contractor will liaise with Council and nearby towns on an accommodation management strategy that would ensure availability of short term and long term accommodation for locals and tourists.	Contractor	Pre-construction/ construction
Traffic and access	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will include: • Confirmation of haulage routes • Measures to maintain access to properties and parking • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites/storage area including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic	Contractor	Construction
	Consultation will be undertaken with Council seeking approval regarding the proposed traffic arrangements.	Contractor	Construction
	Once approval from Council regarding proposed traffic arrangements is granted, consultation will be undertaken with potentially affected residences prior to the commencement of and during works.	Contractor	Construction
	Road users and local Communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Contractor	Construction
	Private property access would be maintained either through management of existing accesses or through temporary access in consultation with the property owner.	Contractor	Construction
Visual amenity	Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impact. A site arrangement plant showing at minimum the following:	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	• Storage areas for equipment and materials • Sufficient parking areas are available at the work sites • Waste storage areas, and ensure waste is sorted and recycled		
	When not in use, construction plant shall be lowered and stationed in designated area, so they are at their minimum height and do not protrude unnecessarily within the views of receivers.	Contractor	Construction
	Contractor to provide Council notification 4 weeks prior to any changes in working hours and activities.	Contractor	Construction
	Notices and letters shall be provided to residents, informing them of working hours and any activities with four weeks notice of the proposed works.	Council	Construction
	Any lights required will be directed onto the site, with a maximum position angle of 30º from vertical, and back spill shields, therefore minimising any unwanted light spill and impacts at night. Lighting should not cause reflected glare.	Contractor	Detailed Design Construction Post Construction
	Implement a vegetation screening program along Lowes Creek Road and between the closest sensitive receiver to the WTP, to screen views for road users and the residents.	LPSC Contractor	Post Construction
	Plant mature trees, of native species and appropriate for the landscape and habitat at the planting site. Heights and density of the tree planting should consider the immediate screening potential of the planting program.	LPSC Contractor	Post Construction
	Plant components will be painted to better integrate with the landscape and match the surroundings, substantially decreasing their visibility and contrast.	LPSC and Contractor	Detailed design Post Construction
Indigenous heritage	In the highly unlikely event that potential human skeletal material is identified over the course of the proposed works, the following procedure shall be followed in accordance with the *Policy Directive - Exhumation of Human Remains* (NSW Department of Health 2008), *Skeletal Remains - Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997): • As soon as remains are exposed, work in the vicinity of the remains is to halt immediately to allow assessment and management; • The Contractor's Manager will be notified to cease works. The Contractor's Manager will then contact Council to notify relevant authorities including; a suitable Archaeologist , local police, and OEH; • If the remains are suspected to be human, a physical or forensic anthropologist should inspect the remains in situ, and make a determination of	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	whether the remains are human and if so, the likely ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic); • If the remains are identified as forensic the area is deemed as crime scene; • If the remains are identified as Aboriginal, the site is to be secured and OEH and all registered Aboriginal parties are to be notified in writing; or • If the remains are non-Aboriginal (historical) remains, the site is to be secured and OEH is to be contacted; and • This process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with the appropriate stakeholders (NSW Police Force, forensic anthropologist, OEH, registered Aboriginal parties etc) and in accordance with the *Public Health Act* 1991.		
	If suspected Aboriginal human remains are uncovered within the Proposal area, all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station, the Nungaroo LALC and the OEH Regional Office are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the OEH shall be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.	Contractor	Construction
	If Aboriginal cultural materials are uncovered as a result of development activities within the Proposal area, they are to be registered as Sites in the AHIMS managed by the OEH. Any management outcomes for the site will be included in the information provided to the AHIMS.	Contractor	Construction
Non-indigenous heritage	• Contractor will notify Council before commencing any work. • Staff working at the site during construction will be instructed to stop work immediately on identification of any suspected heritage artefact.	Contractor	Construction
	• If any unexpected archaeological remains are discovered during construction, work will stop immediately in the vicinity of the material/find and specialist advice from a suitably qualified heritage consultant will be sought.	Contractor	Construction
Risks and hazards	An Incident Management Plan (IMP) would be developed as part of the CEMP. The IMP would contain procedures dealing with spills and accidents	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	or natural events that may have environmental and health and safety risks. The IMP would contain appropriate procedures for protection of people, machinery, materials and the environment in the event of such incidents.		
	If during construction it is determined that there is a significant risk of harm to the environment or human health from potentially hazardous waste, this risk would be reported immediately to Council's construction Project Manager and the appropriate regulatory authority. Appropriate personal protective equipment would be used in relation to sampling, extraction and disposal of hazardous material.	Contractor	Construction
	Operational chemical storage, handling and management (including deliveries) would be undertaken in accordance with the relevant Safety Data Sheets and the HAZOP procedures of the WTP, including bunding. Dangerous goods (such as chlorine gas) would be required to be transported to site. These would be transported in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* which outlines requirements to manage risks associated with transport of dangerous goods.	Contractor	Operation
	The contractor would be required to implement appropriate measures and install functioning backflow prevention devices that would ensure that raw or recycled water is not discharged to the potable water supply.	Contractor	Detailed design Construction Operation
Greenhouse gas emissions and energy use	• Use well-maintained plant and equipment to minimise fuel consumption. • Proper fitting and maintenance of vehicle exhausts systems to ensure emissions comply with the POEO Act. • Only start up vehicles when required and limit idling time when not in use. • Minimise haulage vehicle movements by filling to maximum allowable limits.	Contractor	Construction
Air quality/ dust	• Potential dust sources (soil stockpiles, access tracks) shall be regularly watered (if water restrictions are not in place) when required, particularly on hot, dry and windy days • If stockpiles are to remain for longer than a 10-day period, cover or stabilise with quick growing, sterile grasses as soon as possible • The location and number of dust sources (i.e. bare surfaces including stockpiles) will be kept to a minimum • Visual surveillance for dust generation would occur at all times. Work must cease when high levels of airborne dust cannot be controlled • Stockpiles or areas that may generate dust are to be managed to suppress dust emissions in a	Contractor	Construction

Impact	Environmental safeguard	Responsibility	Timing
	suitable manner (e.g. watering and/or vegetation establishment) and inspected weekly.		
Air quality/ emissions	• Vehicle exhaust systems shall be properly maintained so that exhaust emissions comply with the Clean Air Regulation issued under the *Protection of the Environment Operations Act 1997* • Plant and machinery to be turned off when not in use.	Contractor	Construction
Air quality/ other pollutants	• Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation. • Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust in the response to an air quality complaint. • Works (including the spraying of paint and other materials) are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely. • Vegetation or other materials are not to be burnt on site.	Contractor	Construction
Waste	Resource management hierarchy principles are to be followed: • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the Waste Avoidance & Resource Recovery Act 2001).	Contractor	Construction
	Waste is not to be burnt on site.	Contractor	Construction
	Waste material, other than vegetation and tree mulch that complies with the EPA resource recovery exemption, is not to be left on site once the works have been completed.	Contractor	Construction
	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day	Contractor	Construction
	No hazardous material will be stockpiled	Contractor	Construction
	Minimise the size and height of the stockpile as far as possible	Contractor	Construction
	Wherever possible, reduce the quantity of chemicals and fuel stored on site to minimum practical level. Infrequently used chemicals will be ordered before they are needed	Contractor	Construction
	Green waste as result of vegetation clearing will be mulched and reused on site or disposed of at an appropriate facility	Contractor	Construction
	The handling and disposal of priority weeds, will be undertaken in accordance with local control plans and/or the weed's classification as per the *Biosecurity Act 2015*.	Contractor	Construction

8 SUMMARY OF LICENSES AND APPROVALS

The following licences and approvals would be required:

Table 8-1 Summary of licenses and approvals required

Legal Instrument	License or Approval
LPSC	• Determination under Division 5.1 of the Environmental Planning and Assessment Act 1979.
Water Act 1912 **NSW Office of Water**	• Section 60 approval under the *Local Government Act 1993* to construct a WTP. • A licence for the interception of groundwater during construction is required under the *Water Act 1912* or the *Water Management Act 2000*, if more than 3ML of groundwater is required to be dewatered. This is not expected to be required.
Roads and Maritime Service	• 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, or dig up or disturb the surface of a public road, otherwise than with the consent of the appropriate roads authority. Road occupancy under s138 of the *Roads Act 1993* for underboring RMS roads. The pipeline would require the crossing of Werris Creek Road, part of the RMS Tamworth-Yetman State Road. Werris Creek Road would be crossed and therefore would require road occupancy consent from RMS. • *Roads Act 1993*, Section 138(1) • Road Occupancy Licence (ROL)
DPI (Fisheries)	• Part 7 Fisheries Management Act Permit required for in-river works under S200 of the FM Act and obstruction of fish passage. Approval is required for instream works and dredging in the river.
Minister for Primary Industries	• Prior to construction of the WTP, approval would be sought from the Minister for Primary Industries under section 60 of the *Local Government Act 1993*.
WorkCover Authority of NSW	• If any dangerous goods are stored and handled above statutory defined quantities, then WorkCover needs to be notified under the *Work Health and Safety Regulation 2011.*

9 CONCLUSION

9.1 ENVIRONMENTAL IMPACT

The proposed Quipolly Water Project is subject to assessment under Part 5.1 of the EP&A Act. This REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

The Proposal was found to have the potential to cause minor short term biodiversity, noise, and traffic and access, impacts. These negative impacts would be limited to the construction phase of the Proposal only.

This assessment found that once operational, the Proposal would deliver positive outcomes for the locality, including securing reliable water supply to the growing townships of Quirindi and Werris Creek.

The works were not found to result in any impacts to threatened species, populations or ecological communities listed on the NSW *Biodiversity Conservation Act 2016*, or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

9.2 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

9.2.1 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.

This REF has been prepared utilising the precautionary principle. That is, if threats are perceived as possibly leading to serious or irreversible environmental damage, then either the Proposal would not go-ahead, or the development would be modified to ensure that such threats do not exist. The potential risks associated with the proposed works assessed in this REF are considered to be adequately manageable.

9.2.2 Inter-generational equity

Intergenerational and intra-generational equity requires that the present generation would ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.

There would be some environmental impacts associated with the Proposal, although these would be short term during construction and would be managed through implementation of mitigation measures during construction.

Vegetation constituting the highest ecological constraints such as forming components of Endangered Ecological Communities and threatened flora and fauna habitat were avoided as far as practical, with the net outcome being a permanent impact of up to 25.73 hectares of predominantly low condition native vegetation. This includes 20.88 ha of the BC Act listed EEC *White Box Yellow Box Blakely's Red Gum Woodland* across grassland and woodland forms. The corresponding EPBC Act TEC, *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, is also present within the study area covering approximately 0.9 ha but would not be directly impacted by the Proposal.

The Tests of Significance and Assessments of Significance concluded that construction and operation of the Proposal is unlikely to significantly impact on the EEC. Habitat for hollow-dependent bats and birds is also

likely to be affected, however, this is not expected to adversely affect nesting/roosting resources for these highly mobile and far-ranging species.

The Proposal would benefit the community by providing a more efficient and reliable water supply with upgraded treatment processes to address water quality issues. The upgrade would also improve drought security for Werris Creek and Quirindi.

9.2.3 Conservation of biological diversity and ecological integrity

This principle requires the diversity of genes, species, populations and their communities, as well as the ecosystems and habitats they belong to be maintained or improved to ensure their survival.

The Proposal would result in the removal of up to 25.73 hectares of predominantly low condition native vegetation. This includes 20.88 ha of the BC Act listed EEC *White Box Yellow Box Blakely's Red Gum Woodland* across grassland and woodland forms. The corresponding EPBC Act TEC, *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, is also present within the study area covering approximately 0.9 ha but would not be directly impacted by the Proposal. However, it is unlikely to have a significant impact on any native flora or fauna, including threatened species and ecological communities.

9.2.4 Improved valuation of environmental factors

This principle requires that costs to the environment are incorporated or internalised in terms of the overall project costs.

The Proposal has been designed with the objective of avoiding or minimising potential impacts on the surrounding environment, thereby minimising costs to the environment. Environmental factors have been incorporated into the selection of the pipeline route and the location of the WTP.

The environmental consequences of the Proposal have been assessed in this REF and mitigation measures identified for factors with potential for adverse impact. Implementing the mitigation measures would impose an economic cost on Council, increasing both the capital and operating costs of the Proposal. This indicates that environmental resources have been valued.

10 REFERENCES

ABS 2016 Census Quick Stats

CSIRO Land and Water. (July 2018). Australian Soil Resource Information System. Retrieved from http://www.asris.csiro.au/

CSIRO (2007) Water availability in the Namoi, a report to the Australian government from the CSIRO Murray-Darling Basin Sustainable Yields Project. CSIRO, Australia

DECCW. (2008). Waste Classification Guidelines.

DECCW. (2010). Due Diligence Code of Practice for Protection of Aboriginal Objects in NSW.

Department of Environment and Climate Change 2009, Interim construction noise guidelines.

Department of Environment and Conservation 2004, Threatened Biodiversity Survey and Assessment Guidelines.

EPA. (July 2018). EPA contaminated sites records. Retrieved from http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx

GHD (July 2011) Safety and Capacity Upgrade of Quipolly Dam – Review of Environmental Factors. Prepared for LPSC.

GHD (July 2014a) Regional Water Supply Strategy. Water Network Concept Design report. Prepared for LPSC.

GHD (July 2014b) Liverpool Plains Water Supply Scheme. Water Treatment Plant Concept Design report. Prepared for LPSC.

GHD (June 2014c) Regional Water Supply Strategy – Pipeline Construction. Preliminary Planning and Environmental Assessment. Repapered for LPSC.

Hunter H2O. (2018). Quipolly Water Treatment Plant – Briefing for REF

LPSC Water Supply Scheme (June 2017). NSW Safe and Secure Water Program

LPSC Regional Water Supply Strategy (accessed July 2018) pdf presentation from website https://www.lgnsw.org.au/files/imce-uploads/48/4.Rod_Batterham_Mark_Gebhard.pdf

LPSC Quipolly Water Project (accessed July 2018) Information from website https://www.lpscwater.com.au/

MDBA (2012) The proposed groundwater baseline and sustainable diversion limits: methods report, MDBA publication no. 16/12. Murray–Darling Basin Authority, Canberra.

NSW, DEE, 2018, Species Profile and Threats Database. Accessed online July 2018

NSW Office of Environment and Heritage. (2018). eSPADE V2.0. Retrieved from espade.environment.nsw.gov.au

OEH. (2010). Aboriginal cultural heritage consultation requirements for proponents 2010 (ACHCRP).

OEH. (2010). Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales.

OEH. (2011). Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW.

RAPT Consulting (July 2018) Noise Assessment – Quipolly Water Project.

Welsh W, Hodgkinson J, Strand J, Northey J, Aryal S, O'Grady A, Slatter E, Herron N, Pinetown K, Carey H, Yates G, Raisbeck-Brown N and Lewis S (2014) Context statement for the Namoi subregion. Product 1.1 from the Northern Inland Catchments Bioregional Assessment. Department of the Environment, Bureau of Meteorology, CSIRO and Geoscience Australia, Australia.