Phoenix Pumped Hydro Energy Storage (Yarrabin)

EIS Scoping Report

ACEN Phoenix Pty Ltd

June 2023

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Executive Summary

Introduction

ACEN Phoenix Pty Ltd (ACEN) proposes to develop the Phoenix Pumped Hydro Energy Storage (Yarrabin) project with a generating capacity of 810 megawatts (MW) for a nominal duration of 12 hours (the Project). The majority of the Project site is located within the Dubbo Regional Council local government area (LGA), with a small portion in the Mid-Western Regional Council LGA. The site is in the Central-West Orana Renewable Energy Zone (CWO REZ) of New South Wales (NSW) on lands of the Wiradjuri people, about 35 kms southwest of Mudgee. The location is a greenfield site in the catchment of Lake Burrendong. It would have purpose built upper and lower storage reservoirs, with an average elevation difference of about 330 m between the two reservoirs. The reservoirs are proposed to be connected by a tunneled waterway to a surface silo powerhouse containing three pump-turbine units. The Project will operate as firming capacity for variable renewable energy (VRE) plants in the region.

The PHES would store water in the upper reservoir during periods of surplus electricity generation in the electricity network, and then flow the water through the turbines to the lower reservoir to generate electricity during periods of high demand. Environmental approvals would be sought in 2024, with a proposed construction period from 2025 to 2029, subject to approvals.

Project overview

The proposed PHES project has a generating capacity of about 810 MW, and 12 hours target storage, with total energy storage of 9,600-9,720 MWh. The Project is the largest to date to be supported by EnergyCo's Pumped Hydro Recoverable Grants program and will play a critical part in decarbonising NSW.

The Project includes upper and lower water storage reservoirs constructed off-stream on land east of Lake Burrendong, to be connected by a 2.85 km long, 8.3 m diameter excavated vertical shaft and tunnel, to a surface silo powerhouse containing three pump-turbine units. The northern portion of the site is located on privately owned land, while the southern portion of the site near Lake Burrendong is owned by WaterNSW.

Water is proposed to be purchased from the Project's partners at WaterNSW (Lake Burrendong) and pumped for first filling of the reservoirs (about 16.2 gigalitres (GL)), and for ongoing minor replenishments to replace evaporative losses. Water for first filling of 16.2 GL constitutes about 2.6% of the 632 GL annual general security entitlement for the Macquarie River. Water is proposed to be pumped from Lake Burrendong via temporary pumps and suction lines to the reservoirs.

The Project will operate by storing variable renewable energy (VRE) generated within the CWO REZ when grid energy demand is low by using the turbines in pump mode to store water in the upper reservoir. When grid energy demand is high, the Project would generate hydroelectricity by releasing water from the upper reservoir to the lower reservoir, passing through the vertical shaft and tunnel and powering turbines in the powerhouse. The Project is a closed loop system with water recycled through the upper and lower reservoirs, and minor replenishments from Lake Burrendong to replace evaporative losses.

The Project connects into the existing electricity transmission network via a new 330 kV transmission line connecting to a new switching station located along the 330 kV Wellington to Mount Piper Transmission Line, about 15 kms south-west of the site. The Project includes road upgrades for

construction traffic access. Geotechnical investigations for the Project do not form part of this application.

Strategic context

For many decades, energy generation in NSW has been powered by large coal-fired power stations, providing reliable and abundant energy distributed across NSW. Four of the States' five existing coal fired power stations are expected to close within the next fifteen years, starting with the Liddell Power Station in 2023. These power stations currently provide around three quarters of NSW's electricity supply and two thirds of the capacity required to meet peak energy demand.

The NSW Government has announced renewable energy zones (REZs) and additional transmission infrastructure to generate and transmit renewable electricity to meet the forecast energy shortfall. The Project site is located within the CWO REZ and will firm VRE in the region. Locating this large energy storage near proposed wind and solar projects in the region will reduce requirements for additional transmission lines, reduce energy losses and improve grid stability in the CWO REZ. The Project will also provide energy storage that will help to 'smooth out' energy peaks and troughs created by variable energy (e.g. solar and wind).

Assessment of impacts

The identification of issues to be addressed in the EIS has been undertaken through a risk-based approach in accordance with the *State significant development guidelines – preparing a scoping report* (DPE 2022a).

The following key environmental matters identified during the risk assessment would require assessment in the EIS:

– Biodiversity
– Aboriginal cultural heritage
– Access and traffic
– Social impacts
– Water (surface and groundwater flows and quality)
– Visual amenity.

Other matters that would require consideration include historic heritage, noise and vibration, air quality, hazards and risks and land (soils, landform and topography). For each environmental matter, the potential impacts associated with the construction, operation, and decommissioning and rehabilitation of the Project would be identified in the EIS. Mitigation measures would be provided in the EIS to eliminate or reduce potential impacts associated with the Project.

Engagement undertaken to date

ACEN has commenced early engagement for the Project following the public announcement of grant funding to progress feasibility studies in December 2022. ACEN has established a project website portal which provides information on the Project, including progress to date and the next steps: **Phoenix Pumped Hydro | ACEN Australia (acenrenewables.com.au)**.

A community information session was held in Mudgee in March 2023, to inform the community of the Project and provide the opportunity for early comment. In addition, a mailout was sent to dwellings within 2 kms of the Project site, and dwellings within proximity to the proposed construction access route. This mailout was sent to 63 dwellings outlining Project information and an invitation to attend a community drop in session.

Purpose of this Scoping Report

This Scoping Report has been prepared in accordance with the form and content requirements of the *State Significant Development Guidelines – preparing a scoping report* (DPE 2022a). This Scoping Report provides:

– A description of the Project;
– An analysis of feasible alternatives considered having regard to the objectives of the development, and identifies the alternatives that will be investigated further in the EIS;
– An early indication of community views on the Project and identifies what engagement will be carried out during the preparation of the EIS; and
– A summary of the key matters requiring further assessment in the EIS and the proposed approach to assessing each of these matters having regard to any relevant Government legislation, plans, policies or guidelines.

This Scoping Report seeks to obtain the Secretary's Environmental Assessment Requirements (SEARs) for the Project.

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Abbreviations and glossary of terms

Term	Definition
ACEN	ACEN Phoenix Pty Ltd
Adit	A horizontal or nearly horizontal tunnel providing access to further underground infrastructure.
AEMO	Australian Energy Market Operator Public company that manages the National Electricity Market.
AHD	Australian Height Datum Australia's national height reference system.
BC Act	*Biodiversity Conservation Act 2016*
BFMC	Bushfire Management Committee
BoM	Bureau of Meteorology
C	Celsius
CIV	Capital Investment Value
CLM Act	*Contaminated Land Management Act 1997*
CWO REZ	The Central-West Orana Renewable Energy Zone
Dubbo Regional LEP	*Dubbo Regional Local Environmental Plan 2022*
EIS	environmental impact statement
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
FER	Functional Economic Region
GW	giga watt one billion watts
GWh	giga watt hour one billion watt hours
ISP	Integrated System Plan The Australian Energy Market Operator's whole-of-system plan for the efficient development of the National Electricity Market power system that achieves power system needs for a planning horizon of at least 20 years for the long-term interests of the consumers of electricity.
km	kilometre
kms	kilometres
km/h	kilometres per hour
kV	kilovolt one thousand volts
LEP	Local Environmental Plan
LGA	local government area
m	metre
ML	mega litre one million litres
MW	mega watt one million watts
MWh	megawatt hour

Term	Definition
	one million watt hours
NEM	National Electricity Market The connected electricity transmission grid of Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania and South Australia.
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
PEA	Preliminary Environmental Assessment
PHES	Pumped Hydro Energy Storage The use of water reservoirs to store energy. Energy can be generated by releasing water from an upper reservoir through a hydroelectric turbine into a lower reservoir.
Planning Systems SEPP	*State Environmental Planning Policy (Planning Systems) 2021*
PM10	Particulate matter 10 micrometres or less in diameter
PM2.5	Particulate matter 2.5 micrometres or less in diameter
the Project	Construction and operation of Phoenix Pumped Hydro Energy Storage (Yarrabin)
the Regulation	Environmental Planning and Assessment Regulation 2021
REZ	Renewable Energy Zone Renewable Energy Zones (REZs) are the equivalent of modern-day power stations. They combine new renewable energy infrastructure, including generators (such as solar and wind farms) with storage (such as batteries and pumped hydro) and high-voltage transmission infrastructure.
the Roadmap	NSW Electricity Infrastructure Roadmap
Shaft	A vertical entry passage used for access or to haul goods into or out of an underground structure.
SSD	State Significant Development
Tailrace	A channel that carries water away from a hydroelectric plant, containing tail water that has already been used to generate electricity.
TEC	Threatened Ecological Community listed under the *Environment Protection and Biodiversity Conservation Act 1999*
T+I SEPP	*State Environmental Planning Policy (Transport and Infrastructure) 2021*
Transgrid	The manager and operator of the high voltage electricity transmission network in New South Wales and the Australian Capital Territory.
Tunnel	An underground passageway.
turkeys-nest reservoir	A reservoir built by excavating earth from the centre of the reservoir and moving it to the edge to help form a continuous embankment.
VRE	variable renewable energy Some renewable energy sources, such as wind and solar, have variable supply. Electricity generators using variable renewable energy (VRE) sources can only produce electricity when weather conditions are right (i.e. when the wind is blowing or the sun is shining).

1 Introduction

1.1 Overview

ACEN Phoenix Pty Ltd (ACEN) proposes to develop the Phoenix Pumped Hydro Energy Storage (Yarrabin) project with a generating capacity of about 810 megawatts (MW) for a nominal duration of 12 hours (the Project). The Project would be located in the Central-West Orana Renewable Energy Zone (CWO REZ) in New South Wales (NSW) on a greenfield site in the catchment of Lake Burrendong, about 35 kms southwest of Mudgee, NSW. It would have purpose built upper and lower storage reservoirs, with an elevation difference of about 330 m between the two reservoirs. The reservoirs would be connected by a tunneled waterway to a surface silo powerhouse containing three pump-turbine units. The Project will operate as firming capacity for variable renewable energy (VRE) plants in the region.

The preferred site was selected following a significant scoping effort to identify a suitable site for a pumped hydro Project in NSW that would minimise environmental impacts as far as practicable (refer to sections 2.4 and 3.6 for detailed discussion on site selection and alternatives).

1.2 Project background

Traditionally, energy generation in NSW has been powered by large coal-fired power stations. Four of the five NSW coal fired power stations are expected to close by 2033, starting with the Liddell Power Station in 2023. These power stations currently provide around three quarters of NSW's electricity supply and two thirds of the capacity required to meet peak energy demand.

The NSW Government has announced renewable energy zones (REZs) and additional transmission infrastructure to generate and transmit renewable electricity to meet the forecast energy shortfall. The Project site is located within the CWO REZ and will firm VRE in the region. Locating this large energy storage near proposed wind and solar projects in the region will reduce requirements for additional transmission lines, reduce energy losses and improve grid stability in the CWO REZ. The Project will also provide energy storage that will help to 'smooth out' energy peaks and troughs created by variable energy (e.g. solar and wind).

1.3 The proponent

The Proponent is ACEN Australia Pty Ltd (ACEN). ACEN's renewable energy assets in Australia includes solar, wind, battery, pumped hydro and energy storage, and electricity transmission projects across Australia in development and construction. ACEN is the listed energy platform of the Ayala Group, which has about 3,800 MW of capacity in the Philippines, Vietnam, Laos, Indonesia, India, and Australia.

ACEN aims to provide low cost, clean renewable electricity in a socially and environmentally responsible way, using innovative technology solutions, and aspires to be the largest listed renewables platform in Southeast Asia, with a goal of reaching 5,000 MW of renewables capacity by 2025.

ACEN is a signatory to the Clean Energy Council Best Practice Charter for Renewable Developments (CEC, 2021), and as such is committed to:

– Engaging respectfully with the communities in which it plans and operates projects.
– Being sensitive to the environment and cultural values in developing projects.
– Making positive contributions to the local and broader communities and regions in which ACEN operates.

1.4 Purpose and structure of this report

This report has been prepared to support an application to the NSW Department of Planning and Environment (DPE) to request SEARs, and has been developed in accordance with the *State significant development guidelines – preparing a scoping report* (DPE 2022a). It includes an outline of the strategic context, description of the Project, the statutory context, stakeholder engagement completed to date and proposed ongoing engagement, preliminary identification of relevant environmental matters, potential impacts and the proposed scope of the assessment to be undertaken in the EIS.

The EIS would be prepared in accordance with the requirements of the SEARs, the *Environmental Planning and Assessment Act 1979, the Environment Protection and Biodiversity Conservation Act 1999* and the *Environmental Planning and Assessment Regulation 2021*.

2 Strategic context

The NSW energy sector is undergoing a major decarbonisation transformation away from fossil fuel generation towards renewable generators (mainly wind and solar). With this transition to renewable energy, and with the variable nature of wind and solar generation, there is a need for investment in energy storage systems (such as pumped hydro) which are deemed critically important for the energy security and stability of the National Electricity Market (NEM).

2.1 National policies

The Australian Energy Market Operator (AEMO) published the most recent version of their Integrated System Plan (ISP) in June 2022. The ISP is a whole-of-system plan that provides a coordinated generation and transmission investment plan to transition the NEM over the next 30 years.

Under the 'Step Change' scenario, identified in the 2022 ISP as the most likely scenario, the NEM will need to cater for significant investment in generation capacity, storage, firming generation and transmission augmentation, as coal-fired generation ceases.

The 2022 ISP predicts under the Step Change scenario that 23 gigawatts (GW) of coal-fired generation will cease (14 GW by 2030), and 45 GW/620 gigawatt hours (GWh) of new battery and hydro storage (distributed and utility-scale), able to respond to a dispatch signal, will be required to help firm the renewable energy sources entering the market. There will also be an increased need for the network to shift electricity from where it is produced to where it is needed to maximise the value of geographic diversity and efficiently share resources across the NEM.

2.2 NSW policies

The NSW Electricity Infrastructure Roadmap (DPIE 2020) (the Roadmap) is the NSW Government's plan to transition the electricity sector and deliver the major infrastructure needed to modernise our electricity system and power the economy. Under the roadmap, consumers will benefit from low cost, clean electricity generation backed up by 24-hour power sources.

The Roadmap is a coordinated framework to modernise the electricity system and deliver new generation, transmission, long duration storage and firming that will also deliver on the ambition of net zero emissions by 2050.

The modernisation of the electricity system will be built on five pillars:

1. Driving investment in regional NSW
2. Delivering energy storage infrastructure
3. Delivering Renewable Energy Zones
4. Keeping the grid secure and reliable
5. Harnessing opportunities for industry.

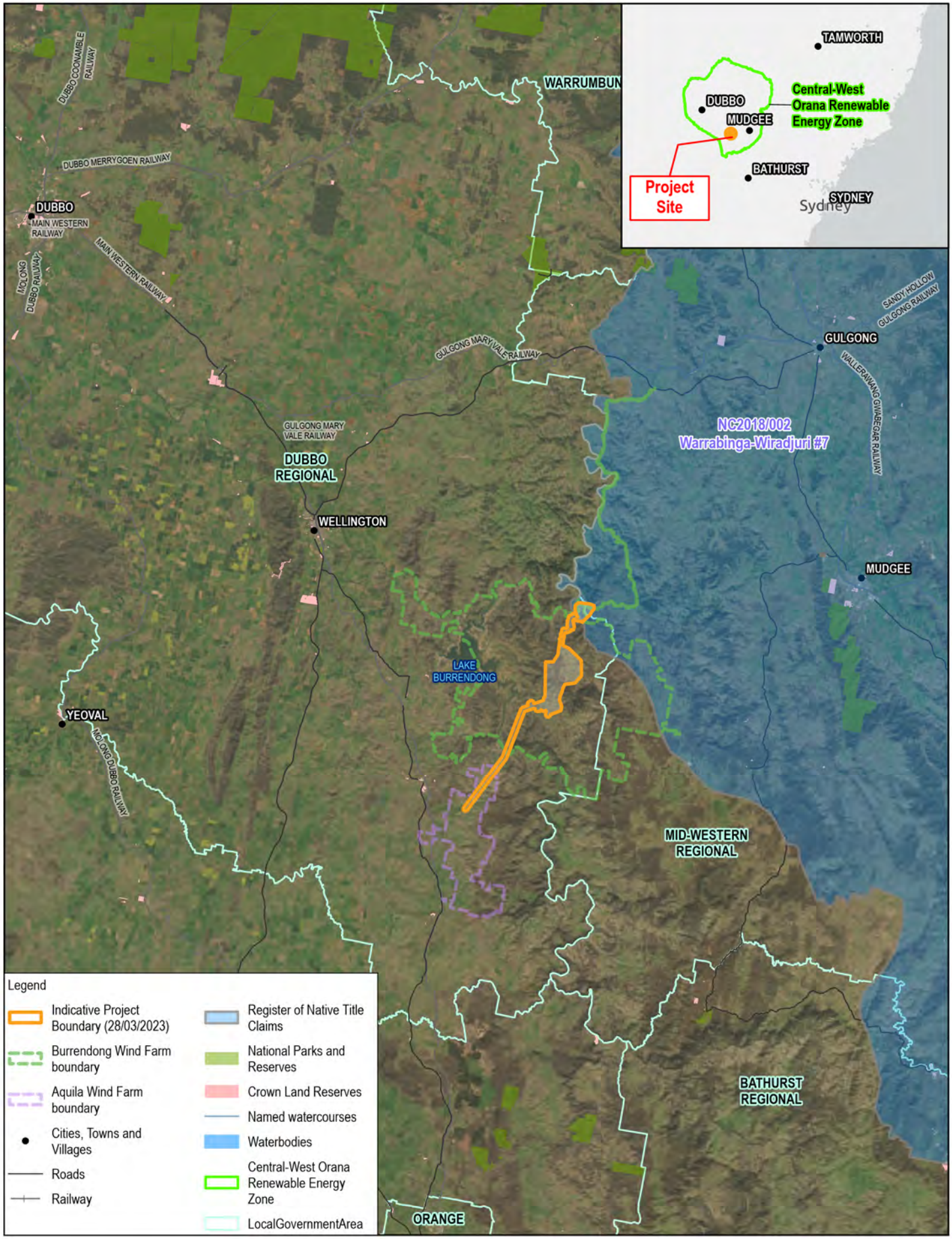
As the electricity market moves towards more generation that relies on variable conditions, like weather, generators need to be backed up by long duration storage to ensure power is available at all times when it is needed. Energy storage infrastructure—such as batteries and pumped hydro—allows renewable energy to be stored and then released on demand when it is needed, creating stability and reliability in the electricity system. The Roadmap identifies pumped hydro as the current primary form of long duration storage, being able to provide long injections of stored power (from hours to days).

The Roadmap also notes that AEMO's ISP finds that by the mid-2030's, NSW could need about 2.3 GW of energy storage with four to twelve hours of duration to maintain system reliability and security under most scenarios. This is in addition to the Commonwealth developing the Snowy 2.0 scheme.

2.3 Site setting

The site is located in the Central-West and Orana region of NSW, east of Lake Burrendong. The core components of the Project (i.e. reservoirs and connecting water conveyance tunnel) are located on land identified as Nos. 589 and 1195 Endacott Road, Yarrabin (SIX Maps 2022). The site is located about 30 kms south-east of Wellington and about 35 kms south-west of Mudgee, and is located within the Dubbo Regional Council Local Government Area (LGA). Access to the site is via sealed and unsealed roads from Mudgee, via the Castlereagh Highway, Hill End Road, Yarrabin Road and Burrendong Dam Road.

The Project location and regional context is shown in Figure 2.1 and the Project site is shown in Figure 2.2. These figures identify the Project site (the site), proposed access road study area and proposed transmission connection route. The access road study area extends north of the site past the Cudgegong River Holiday Park, while the transmission connection route extends west to the existing 330 kV Wellington to Mount Piper transmission line.



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Project No. **12532827**
Revision No. **D**
Date **02/05/2023**

Regional context

FIGURE 2.1

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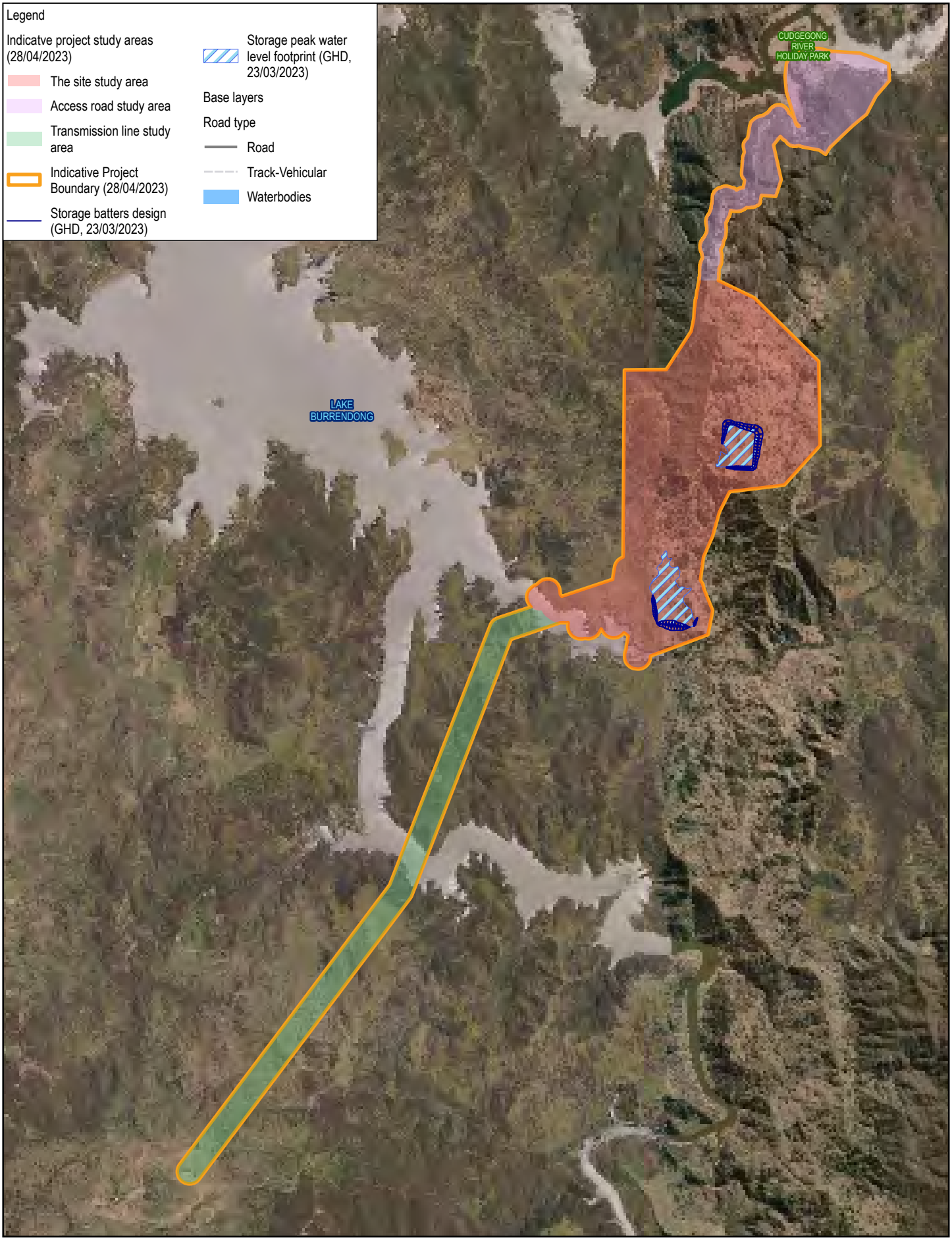

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Project site

Project No. **12532827**
Revision No. **D**
Date **21/06/2023**

FIGURE 2.2

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2.3.1 Property

The Project is located on lands of the Wiradjuri people. A search of the Native Title Claims register undertaken in November 2022 identified claim NC2018/002 - Warrabinga-Wiradjuri #7, which covers a small portion of the site near the Cudgegong River Holiday Park and extends from this holiday park in the west to Wollemi National Park in the east, and from Dunedoo in the north to Lithgow in the south (refer to Figure 2.1).

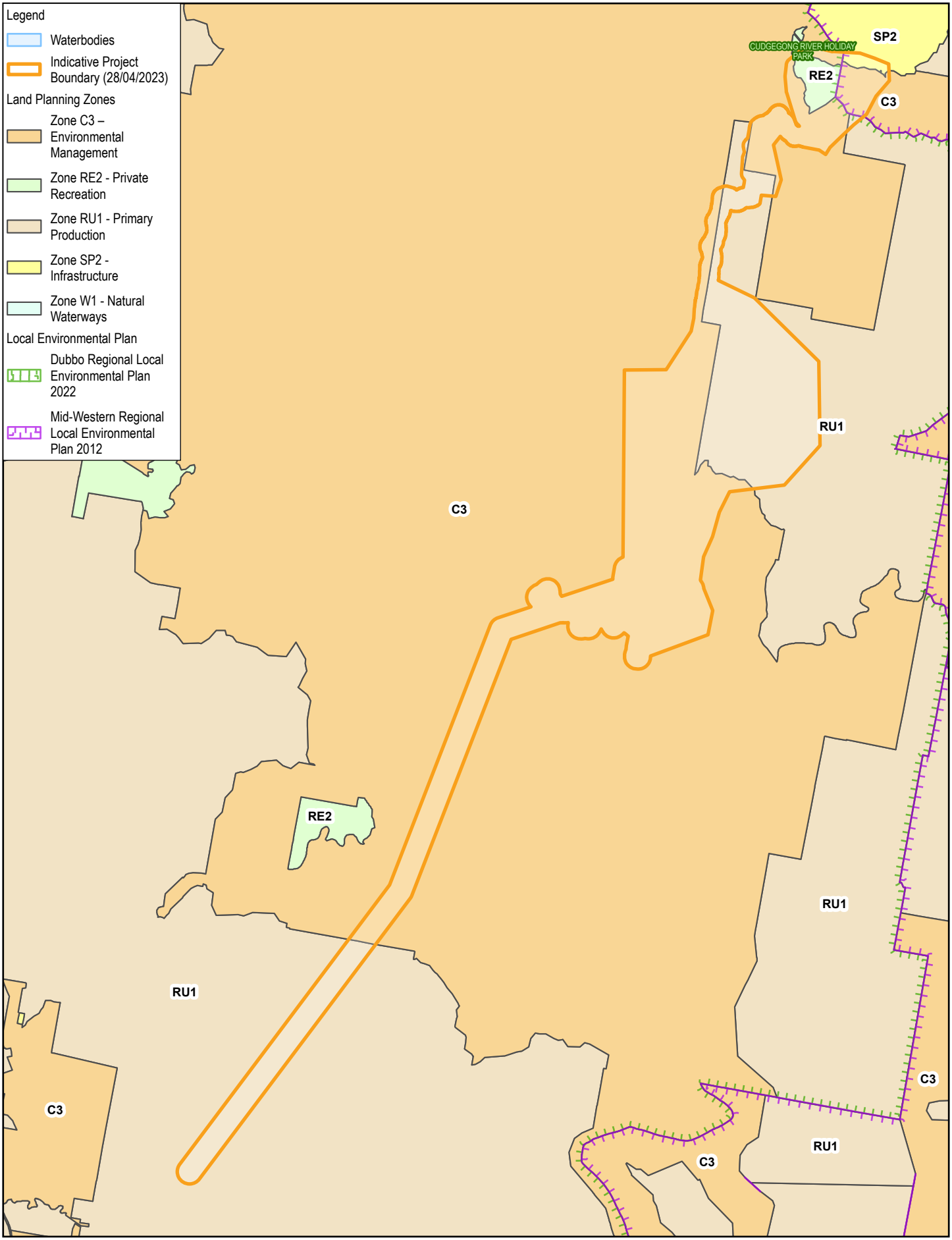
The Project comprises the upper and lower reservoirs, water conveyance shaft and tunnel, surface silo powerhouse, 330 kV transmission line and ancillary components. Table 2.1 outlines the key site identifiers and information.

Table 2.1 Key site information

	Upper reservoir	Lower reservoir	Water conveyance shaft and tunnel	Surface silo powerhouse	330 kV transmission line
Address	589 Endacott Road, Yarrabin	1195 Endacott Road, Yarrabin	1195 Endacott Road, Yarrabin	1195 Endacott Road, Yarrabin	Various – transmission line route covers large area
Lot and DP	Lots 4, 13, 37 and 38 of DP 756872	Lots 5 and 6 of DP 756903	Lots 6 and 17 of DP 756903	Lot 6 of DP 756903	
Ownership and lease areas	Privately owned	WaterNSW	WaterNSW	WaterNSW	
Land use zoning	RU1 Primary Production	C3 Environmental Management	C3 Environmental Management	C3 Environmental Management	

Land use zoning for the site is identified in Figure 2.3.

The Cudgegong River Holiday Park (adjacent to the proposed access route) is part of a Crown Reserve, and is subject to a Crown Licence. Lands south-west of Lake Burrendong, relevant for the proposed transmission line, is also subject to a Crown Reserve, Crown Lease or Crown Licence.



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Revision No. **C**
Date **02/05/2023**

Land Use Zoning

FIGURE 2.3

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2.3.2 Surrounding land uses and sensitive receivers

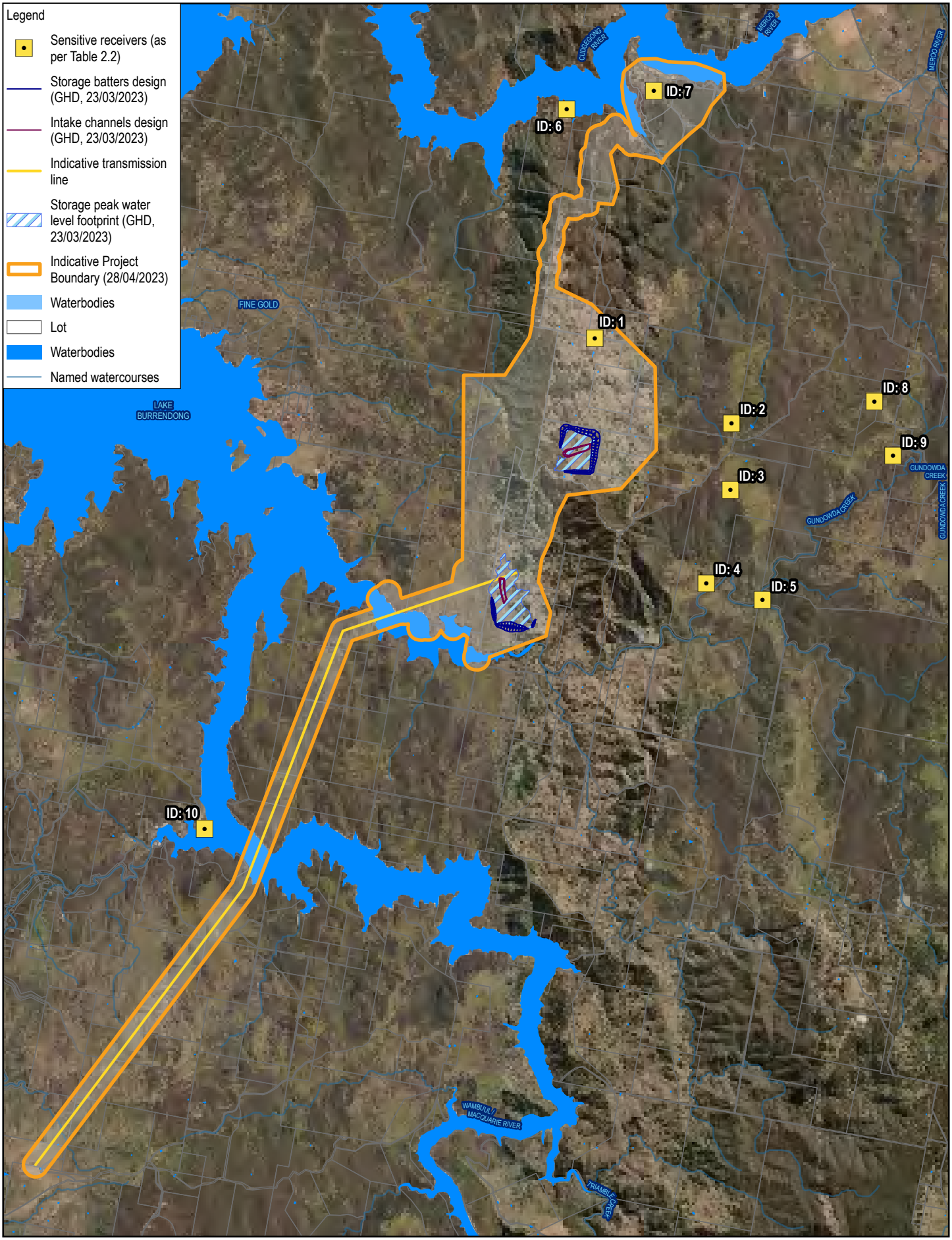
The Project site is used for livestock grazing. Land within the vicinity of the site is either undeveloped or used for agricultural production and recreational land uses, and comprises of landholdings which are generally greater than 200 hectares in size. The broader locality is characterised by agricultural land uses and rural residential properties.

Sensitive receivers are typically regarded as residential properties, schools, childcare centres, aged-care facilities, hospitals and neighbouring businesses. Sensitive receivers have been identified within 5 km of the reservoirs and connecting water conveyance tunnel, within 1 km of proposed access road upgrades, and within 1 km of the proposed transmission line alignment. Aerial imagery indicates up to ten potential residential sensitive receivers within these areas. Potential residential sensitive receivers are presented in Table 2.2.

Table 2.2 Identified structures and potential residential sensitive receivers

ID	Address	Lot/DP	Approximate position of dwelling from Project	Comment
1	589 Endacott Road, Yarrabin	Lot 4 DP 756872	2.3 km northeast of upper reservoir	Dwelling and shed
2	Highland Home Road, Yarrabin	Lot 6 DP 756872	3.4 km east-northeast of upper reservoir	Dwelling
3	Highland Home Road, Yarrabin	Lot 12 DP 756903	3.3 km east of upper reservoir	Dwelling
4	Highland Home Road, Yarrabin	Lot 12 DP 756903	3.8 km east of lower reservoir	Dwelling and shed
5	1390 Black Willow Road, Hargraves	Lot 58 DP 756915	4.7 km southeast of upper reservoir	Dwelling
6	486 Fashions Mount Road, Yarrabin	Lot 54 DP 756872	1 km northwest of access road upgrades near Cudgegong River Holiday Park	Dwelling or shed
7	689 Burrendong Dam Road, Yarrabin	Lot 51 DP 756872	500 m northwest of access road upgrades near Cudgegong River Holiday Park	Cudgegong River Holiday Park
8	1519 Wallawaugh Road, Hargraves	Lot 1 DP 786247	4.5 km east of upper reservoir	Dwelling
9	1511 Wallawaugh Road, Hargraves	Lot 2 DP 786247	4.8 km east of upper reservoir	Dwelling
10	1000 Mookerawa Road, Mookerawa	Lot 215 DP 756871	1 km west of proposed transmission line	Mookerawa Waters Holiday Park

Figure 2.4 indicates the potential sensitive receivers in proximity to the Project as outlined above. These potential sensitive receivers would be confirmed in further detail in the EIS.



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Sensitive receivers

FIGURE 2.4

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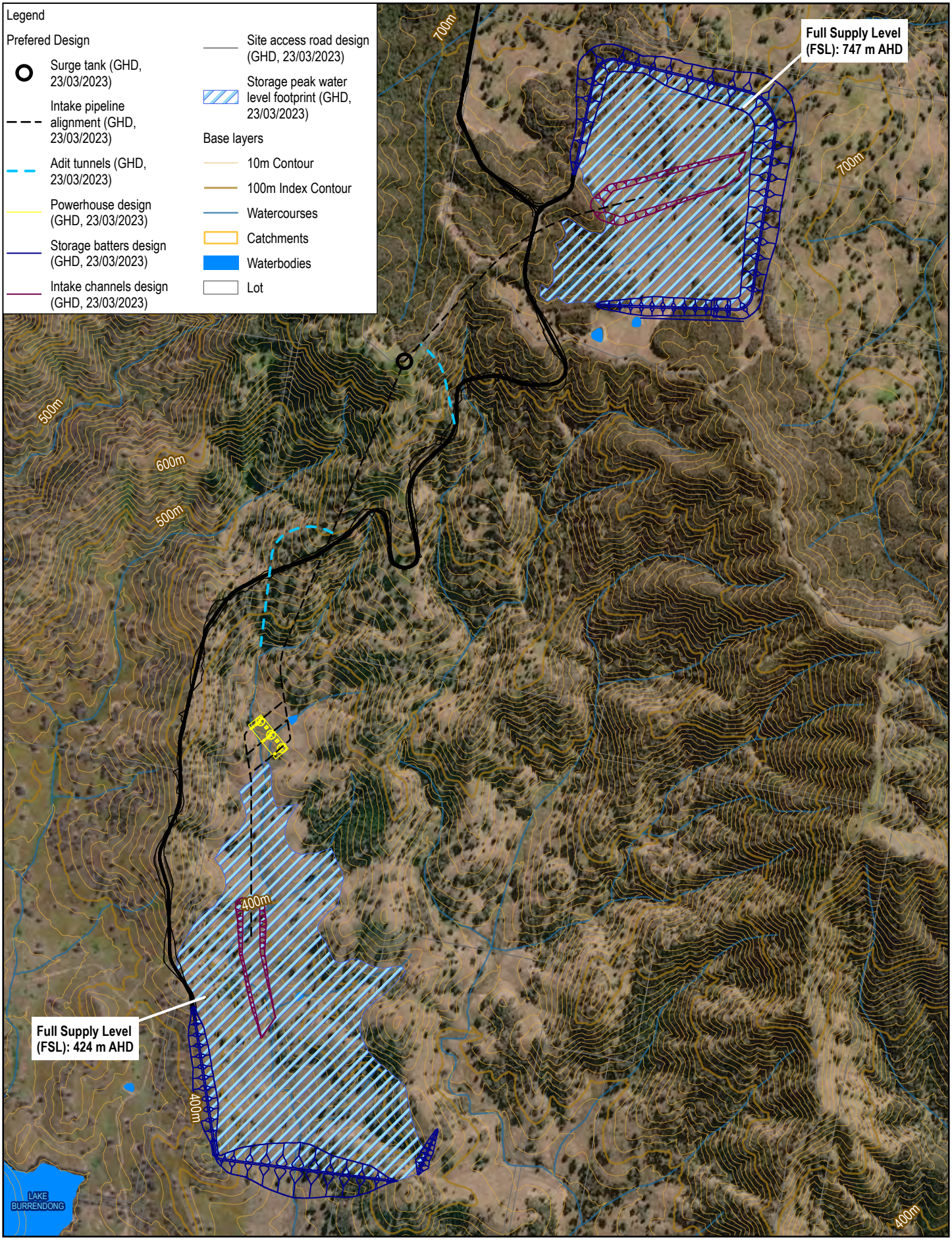
2.3.3 Topography and water resources

Aerial imagery and mapping indicates the topography within and in proximity to the site is variable, with gentle slopes and ridges north of the escarpment, and a steep drop south of the escarpment down to Lake Burrendong. This drop in altitude is about 350 m across a distance of about 2.5 kms, from an elevation of around 750 m AHD at the top of the escarpment near the upper reservoir, to around 400 m AHD at the lower reservoir.

The site is located within the Macquarie River surface water catchment and the Macquarie-Castlereagh Surface Water Resource Plan. The upper reaches of Lake Burrendong are located about 500 m south of the site (at its nearest point). Lake Burrendong was created following the damming of the Macquarie River at Burrendong Dam in 1967 and has a storage capacity of 1,678,000 megalitres (ML) (WaterNSW n.d.). The main purpose of the dam is for flood control and to supply agricultural irrigation, stock and household needs in the Macquarie Valley, and environmental flows to the Macquarie Marshes (WaterNSW 2022).

The proposed upper reservoir is located at the head of an ephemeral stream that flows to the north into Steep Creek, which flows into Lake Burrendong. The proposed lower reservoir is located in a valley between two minor ridgelines; an ephemeral stream traverses this valley, which flows south into Oakey Creek and Lake Burrendong. The site is not identified within a mapped flood prone area as indicated on the *Dubbo Regional Local Environmental Plan 2022* (Dubbo Regional LEP).

The combined catchment of the two proposed reservoirs is about 2.5 km^2, while the catchment of Lake Burrendong is about 13,886 km^2. Therefore, the proposed reservoirs will at most affect about 0.02% of the catchment of Lake Burrendong. The topography of the site and nearby waterways are presented in Figure 2.5.



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Topographic map

FIGURE 2.5

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Data source: National Geographic Style Base: Sources: Esri, USGS
World Imagery: Maxar
World Hillshade: Esri, USGS, © State Government of NSW and Department of Planning and Environment 2022, © State Government of NSW and Spatial Services (DCS) 2022. Created by: lmanasan

2.4 Project justification and alternatives considered

The site of the Project has been selected following a prefeasibility study to identify suitable sites for a pumped hydro energy storage Project in NSW. The site and arrangement for the Project were developed using an initial desktop assessment followed by a range of technical reviews to confirm the suitability of the location. The first step in determining the site involved a detailed review of the potential pumped hydro locations across NSW as identified in the Australian National University (ANU)'s mapping of pumped hydropower opportunities (ANU 2022). Several hundred site options were identified within the NSW Government's REZs. These were screened based on the following criteria:

– Available head (change in water level between hydro intake and discharge) and reservoir storage volumes
– Potential capacity (MW)
– Comparative costs ($ per MW) based on preliminary estimates which considered water conveyance length, dam volumes and powerhouse costs
– Land use to exclude National Parks, Crown Land, and existing infrastructure to reduce the risk of potentially significant environmental and permitting constraints.

This resulted in a short list of about 20 sites in the Central-West Orana REZ and the New England REZ. Transgrid assessed the viability of connecting into the existing grid infrastructure for the potential sites and confirmed that the selected site in the CWO REZ had a range of advantages for the NSW energy system including:

– The site allows for connection to the 330 kV line between Wellington Substation and Mount Piper (about 14 kms west of the site).
– Existing and proposed renewable energy projects are located nearby. The Project would provide significant energy storage and frequency control, balancing these renewable projects and reducing the marginal loss factors in the CWO REZ region.
– The Project provides an alternative to large scale transmission upgrades between Snowy 2.0 and the Central-West region.

In addition to these network benefits, the site also presents the opportunity to purchase water from the nearby Lake Burrendong storage for first filling and ongoing scheme replenishment for the reservoirs of the Project. Water is proposed to be pumped from Lake Burrendong via temporary pumps and suction lines to the reservoirs.

In summary, the site is considered a suitable location for the Project given the elevation change on the site between the escarpment and Lake Burrendong, the relative lack of sensitive receivers within close proximity to the site, the openness of large parts of the site, and the lack of any reserve or National Park constraints. Detailed site layout options are discussed further in section 3.6.

3 Project description

3.1 Overview

ACEN proposes to construct and operate a pumped hydro energy storage (PHES) project, Phoenix Pumped Hydro Energy Storage (Yarrabin) (the Project), located within the CWO REZ. Siting the Project near the existing and proposed wind and solar projects planned within the CWO REZ will reduce requirements for additional transmission lines, reduce energy losses and improve grid stability. With a target net generating capacity of about 810 MW, and 12 hours storage equating to 9,600-9,720 MWh of stored energy, the Project would provide firming capacity to renewables generation in the Central West region and is consistent with the NSW Electricity Infrastructure Roadmap.

The Project would include an upper and lower reservoir constructed off-stream on land east of Lake Burrendong, connected by a 'drill & blast' excavated vertical shaft and tunnel via a siloed surface powerhouse. Water required for the Project will be sourced from Lake Burrendong for first filling of the reservoirs, and for ongoing minor replenishments to replace evaporative losses. Water for first filling of 16.2 GL constitutes about 2.6% of the annual general security entitlement of 632 GL for the Macquarie River.

The indicative operational footprint of the Project (excluding the transmission line) is about 200 hectares. The indicative area impacted by the proposed transmission line is about 100 hectares (a 60 m wide corridor over about 17 km). The indicative area impacted by temporary construction works (e.g. construction camp, borrow pits and laydown areas) is about 100 hectares.

The Project will operate by storing variable renewable energy (VRE) generated within the CWO REZ when electricity demand is low by using the turbines to pump water to the upper reservoir. When solar and wind power generation is less than grid demand, the Project will generate hydroelectricity by releasing water from the upper reservoir to the lower reservoir, passing through the vertical shaft and tunnel thus powering turbines in the powerhouse to generate electricity. Once filled, the Project will operate as a closed loop system, with water recycled through the upper and lower reservoir without any proposed discharges and additional top ups only required for evaporative and seepage losses. The Project is to connect into the existing 330 kV network at a new switching station located along the Wellington to Mount Piper transmission line.

A key benefit of the Project is the offline nature of the infrastructure. Traditional hydropower projects are constructed by damming waterways, causing associated impacts on hydrology, fish passage and aquatic ecology. In contrast, the Project involves the excavation and construction of two new reservoirs on a greenfield site, and underground tunnel connection, with minimal impacts on ephemeral creeks. The Project therefore has very limited impacts on existing waterways compared to a traditional hydropower project. Material won from reservoir excavations and tunnelling would be used to construct the proposed rock walls of the reservoirs, with the aim of achieving net zero cut and fill.

It is noted that there will be opportunities for design optimisation and refinement of the Project to reduce environmental impacts further where possible, for example earthworks cut and fill requirements, location of construction and permanent facilities, and the alignment of road upgrades and transmission lines required. These opportunities will continue to be explored as the design is refined. Geotechnical investigations required for the Project do not form part of this application. WaterNSW will assess and self-determine the proposed geotechnical site investigations as part of a Review of Environmental Factors (REF).

3.1.1 Key Proposal characteristics

The key Proposal characteristics are summarised in Table 3.1.

Table 3.1 Key Project characteristics

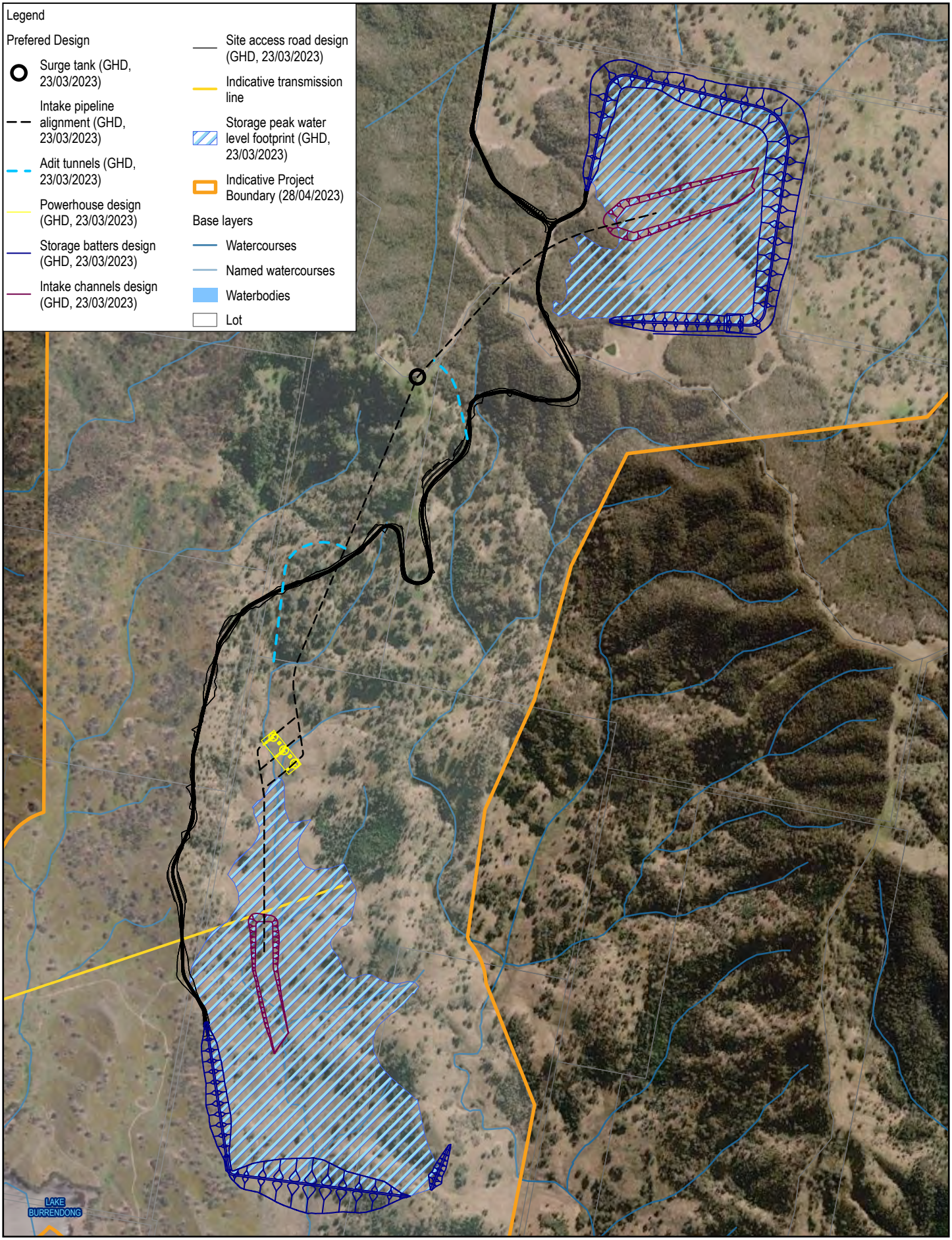
Project element	Description
Operational infrastructure	Upper and lower reservoirs with associated intakes and emergency spillway discharge areas. The lower reservoir is proposed to be constructed as a concrete faced rockfill dam, while the upper reservoir is to be constructed as either a concrete faced rockfill dam or earth core rockfill dam. The upper reservoir will have 13.7 GL total storage volume, 50 m embankment height and 4.0 million m^3 of embankment volume. The lower reservoir will have 13.8 GL total storage volume, 57 m embankment height and 1.7 million m^3 of embankment volume.
	Water conveyance through an excavated vertical shaft and tunnel, with a total length from upper to lower reservoir of about 2.85 kms
	Underground surge tank with potential surface extension
	Silo surface powerhouse and associated workshop/storage facility
	330kV transmission line connection to existing 330kV Wellington to Mount Piper line and a switching station at each end of the transmission line
	Public road upgrades to facilitate site access, and internal site access track construction / upgrades
	Lake Burrendong temporary pump station (for first filling and ongoing scheme replenishment)
Construction infrastructure	Temporary construction worker accommodation camp for up to 500 workers, including site office/facilities, water, sewerage and power supply
	Parking, laydown and stockpile/storage areas
	Adit tunnels and portals to facilitate construction access to underground tunnels
	Quarries and borrow areas, including explosives magazine(s), rock crushers and concrete batching plant(s)
Capacity	Generating capacity of about 810 MW, and 12 hours target storage of 9,600 to 9,720 MWh
Estimated employment	The Project is estimated to create up to 500 full-time jobs at the peak construction phase, and up to 50 operational jobs for 50 years.
Estimated construction earthworks	3,174,000 m^3 of cut and fill for the upper reservoir, 1,567,000 m^3 of cut and 2,025,000 m^3 of fill for the lower reservoir, 267,000 m^3 of cut for tunnels and shafts, and 191,000 m^3 of cut for the powerhouse. A total of 5,199,000 m^3 of cut and fill is estimated.

3.1.2 Capital investment value

The Capital Investment Value (CIV) of the Project is about $1.7 billion. The estimate will continue to be refined during the EIS preparation phase.

3.2 Operational infrastructure

Operational infrastructure required for the Project includes upper and lower reservoirs, connecting water conveyance infrastructure, transmission line connection to the grid, and other associated infrastructure. The indicative operational footprint of the Project (excluding the transmission line) is about 200 hectares. A concept layout of the Project, including upper and lower reservoirs and connecting waterway alignment, is provided in Figure 3.1. These operational elements are described in the following sections.



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Proposal concept layout

FIGURE 3.1

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3.2.1 Upper and lower reservoirs

In order to generate 810 MW for 12 hours, both reservoirs require a minimum of 12 gigalitres (GL) of active water supply. Both the lower and upper reservoir have been sized to provide an additional 1 GL of active storage capacity to store additional water as a drought contingency to maintain supply over several years should water not be available from Lake Burrendong.

The preliminary details of the two reservoirs are summarised in Table 3.2. The lower reservoir is proposed to be constructed as a concrete faced rockfill dam, while the upper reservoir is to be constructed as either a concrete faced rockfill dam or earth core rockfill dam. This will be determined after geotechnical investigations to assess the suitability of the site and availability of clay for earth core construction. Clay excavated on site has a significant advantage in cost and embodied carbon compared with concrete and would be favoured.

Table 3.2 Preliminary details of upper and lower reservoirs

	Upper reservoir	Lower reservoir
Full supply level	747 m AHD	424 m AHD
Minimum operating level	720 m AHD	392.5 m AHD
Total reservoir volume	13.7 GL	13.8 GL
Surface area at full supply level	58 ha	55 ha
Maximum embankment height	50 m	57 m
Embankment volume	3.2 million m^3	2.0 million m^3
Maximum excavation depth within the reservoir	38 m	25 m
Maximum water depth within the reservoir	50 m	57 m

It is proposed that the upper reservoir would be developed as a turkeys-nest reservoir using available topography in the area to minimise embankment volume requirements. The lower reservoir would be located in a normally dry valley downstream of the upper reservoir which would be closed with a main valley dam and right abutment saddle dam. The concept design of the upper and lower reservoirs is provided in Figure 3.2 and Figure 3.3. Note that in these figures, the upper reservoir is fully charged ready for energy generation, while the lower reservoir is at minimum operating level.

Both reservoirs will also include emergency spillways. The design of these spillways is subject to detailed design. The operational intent would be not to spill from the upper reservoir and instead to pass high rainfall events through the water conveyance tunnel and turbines to the lower reservoir. A spillway is provided for emergency releases from the upper reservoir in the very unlikely event of system failure, to avoid overtopping and potential failure of the dam. For the lower reservoir, the emergency spillway would only operate in the event of extreme rainfall in the Project catchment, or due to an operational malfunction. Operations would aim to use the lower spillway to pass any excess water from extreme rainfall back to Lake Burrendong, to avoid spilling from the upper reservoir.

Figure 3.2 *Upper and lower reservoir concept design*

Figure 3.3 Upper and lower reservoir concept design

3.2.2 Water conveyance

Water conveyance for the Project consists of an underground waterway connecting the upper reservoir with a proposed surface silo powerhouse. Water conveyance totals about 2.85 kms between the two reservoirs and comprises the following (from upper to lower reservoir):

– A concrete lined tunnel (about 1 km in length and 8.3 m diameter) with grade limited to 5 to 10 per cent for constructability reasons.
– A 220 m long concrete lined vertical shaft (diameter about 8.3 m). An underground surge tank is proposed above the vertical shaft to provide for up surge and down surge within the water conveyance and powerhouse system. This surge tank may extend about 5 m above ground as a concrete structure and would be backfilled with soil to conceal the tank. A 420 m adit tunnel and associated portal is proposed to provide access to the top of the vertical shaft for construction and maintenance.
– A 1,400 m long tunnel connecting the vertical shaft with the powerhouse. This tunnel is proposed to be an 8.3 m diameter concrete lined pressure tunnel, transitioning to a 5.6 m diameter steel lined pressure tunnel upstream of the silo powerhouse. A 600 m long adit tunnel at nine per cent grade and associated portal is proposed to provide construction access to the pressure tunnel at the transition from concrete to steel lining.
– A silo powerhouse located on the northern end of the lower reservoir (described in further detail in section 3.2.3).
– A 250 m long, 8.5 m diameter low-pressure inclined tailrace tunnel from the powerhouse to the lower reservoir.

A schematic of the Project is provided in Figure 3.4.

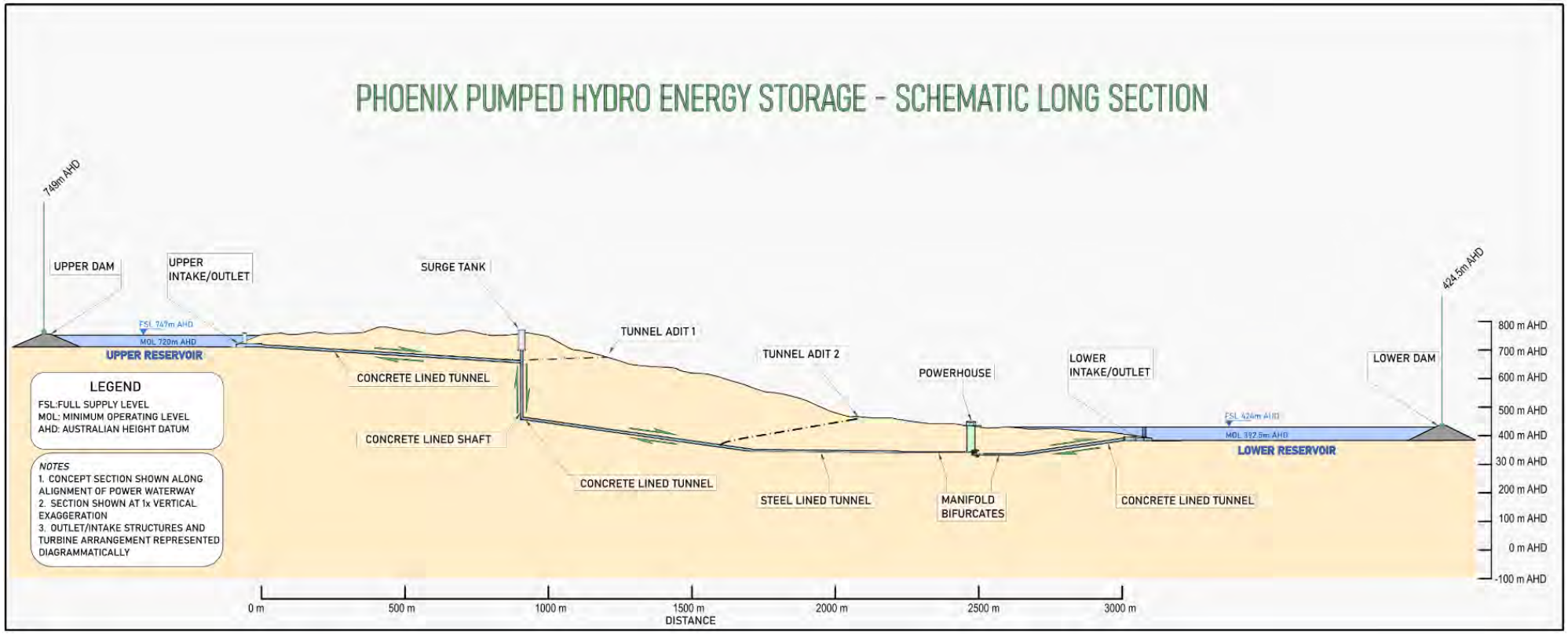


Figure 3.4 Project schematic

3.2.3 Powerhouse

A powerhouse is proposed adjacent to the lower reservoir. Three 270 MW or two 400 MW conventional, reversible Francis pump turbines are proposed to be located within the powerhouse.

The powerhouse is proposed as a surface 'silo' construction. This involves excavating a large cylindrical silo from the ground surface to the required elevation of the pump-turbines, about 80-90 m deep. The walls of the silo are temporarily supported with shotcrete and rock bolts before permanent structural concrete is installed; this process is similar to construction of a basement for a high rise building. The arrangement will depend on geotechnical conditions but is likely to require separate silos for each pump-turbine (i.e. three silos) to minimise the diameter of each silo. These would be connected at surface level with a working floor (the assembly bay) and overhead crane. A sketch of the powerhouse arrangement is shown in Figure 3.5.

The powerhouse will also incorporate the following elements:

– Transformers and switchyard
– Control building
– Ancillary buildings
– Workshops and stores
– Fire and life safety system
– Potable water supply
– Battery system backup power for powerhouse services, potentially with solar generation.

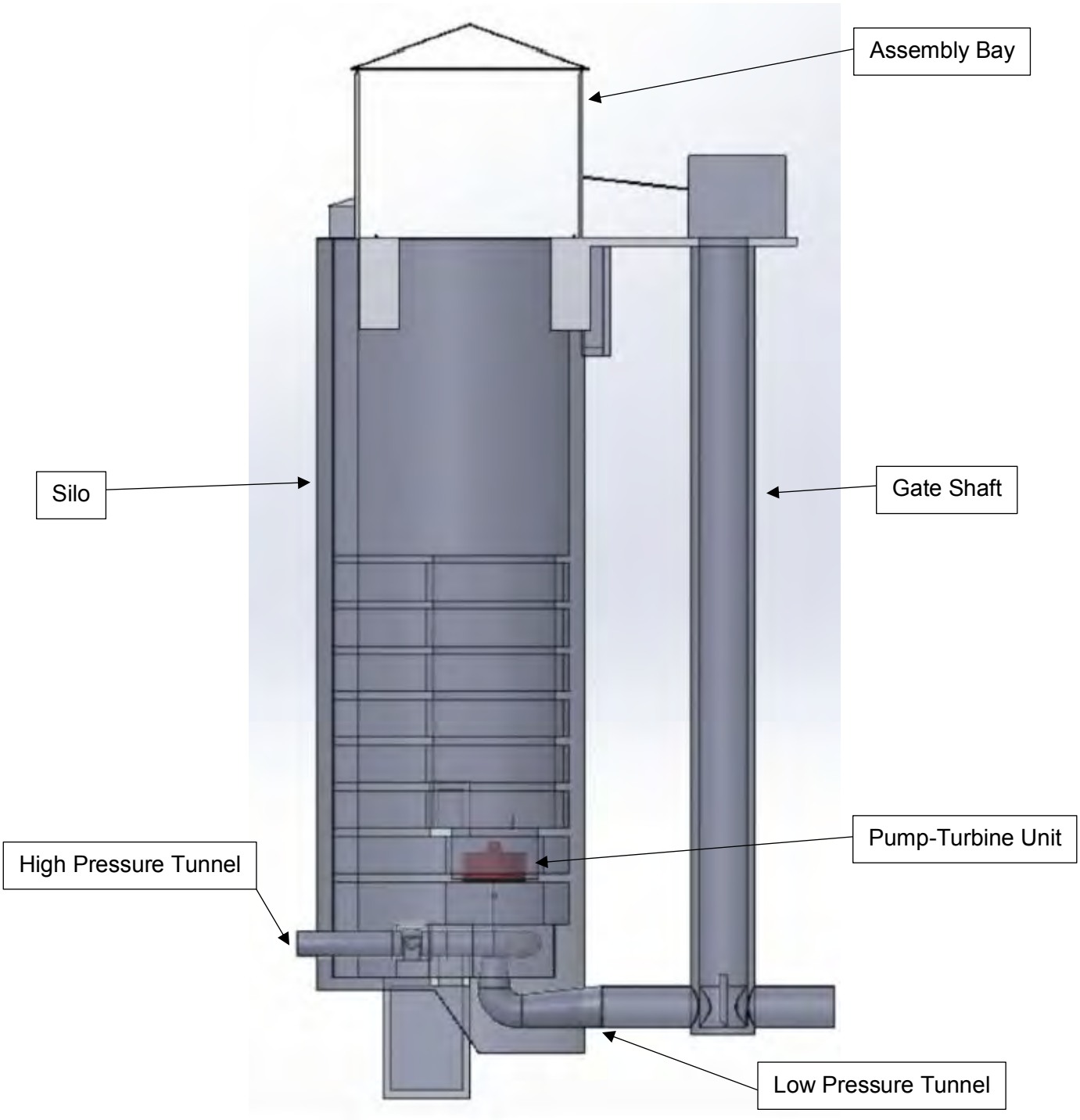
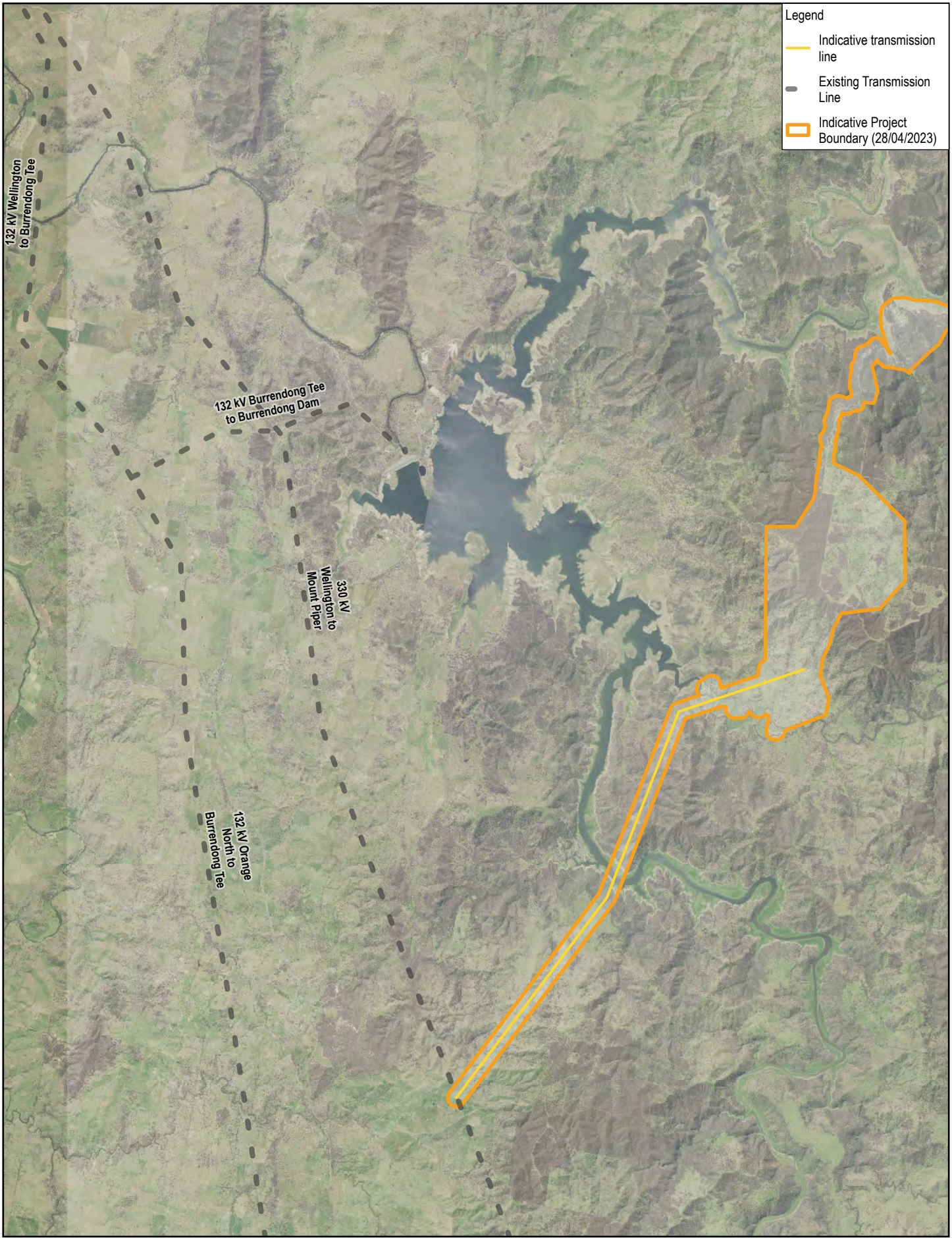


Figure 3.5 Typical cross section of silo powerhouse

3.2.4 Transmission connection

A high voltage transmission line (330 KV) would be required to connect the Project into the existing 330 kV network at a new switching station located along the Wellington to Mount Piper transmission line. The proposed transmission connection route is presented in Figure 3.6. The indicative area impacted by the proposed transmission line is about 100 hectares (a 60 m wide corridor over about 17 km).



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Transmission line alignment

FIGURE 3.6

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3.2.5 Lake Burrendong temporary pump station

A temporary pump station on the Oakey Creek arm of Lake Burrendong is proposed, to provide for the initial filling and ongoing replenishment of the two reservoirs. Four potential pumping locations are being considered; the preferred pumping location would be selected based on the water level in Lake Burrendong at the time pumping is required. Mobile pumps with suction lines into Lake Burrendong would be deployed to operate on a hard stand adjacent to the lake during the pumping period. The pump station would comprise a compacted gravel hard stand with appropriate bunding. Once the pumping period has concluded, the mobile pumps would be stored in a suitable location onsite so they are not inundated by Lake Burrendong if water levels rise. Mobile suction lines will lead to the lower reservoir via existing 4WD tracks that run along the shore of Lake Burrendong. Power supply to the proposed pump station will be via an onsite generator.

3.3 Construction

3.3.1 Construction staging

Detailed construction staging plans would be developed in future phases of the Project and refined by the appointed construction contractor. Early contractor involvement would be a critical component to understand construction duration and staging.

Construction would be scheduled to commence in 2025/2026 subject to regulatory approvals being obtained and would be completed during 2029. The construction duration is expected to be about 43 months. There may also be an opportunity to engage a larger workforce to manage multiple work fronts to allow parallel construction tasks, and to reduce the overall construction program. Construction is expected to comprise of the following typical phases; planning, early works, main works, pre commissioning and commissioning.

3.3.2 Construction methodology

Upper and lower reservoirs

Construction of the reservoirs will involve substantial surface earthworks. The envisaged process would be to:

- Strip and stockpile topsoil and overburden from the dam foundation and quarry areas.
- Establish a quarry for rockfill from within the reservoir area as far as possible. This minimises environmental disturbance and maximises storage volume in the reservoir. It is likely that clay, if used, would be sourced from outside the reservoir areas but within the Project area.
- Blast and haul rockfill from the quarry to the dam site to construct the embankment.
- Sand for the dam construction would either be crushed from an onsite quarry or an external commercial quarry.
- If a concrete faced dam is selected, this would be constructed by slip-forming the upstream face in panels running up the finished upstream face of the embankment.

Water conveyance

Construction of the water conveyance tunnels is proposed using the drill and blast method. This involves remotely operated machines drilling holes into the tunnel face, loading with explosives and blasting to loosen the rock. The tunnel is then supported with temporary rock bolts and shotcrete before lining with concrete or steel. This is likely the most appropriate construction method for the relatively short, hard rock tunnels envisaged to be developed on the project.

Excavation of the vertical shaft required for the surge tank would be undertaken using a mechanised method such as raise boring once the correct location in the upper tunnel is reached. Temporary rock support would be used to stabilise tunnels during excavation.

Adit tunnel portals are required to access parts of the water conveyance tunnels and shaft. These allow construction on multiple work fronts and access to the top and bottom of the vertical shaft to facilitate the raise boring method. These will require clearance/disturbance of an area of about 50 m by 50 m at each tunnel portal, to allow for construction equipment, truck movements etc. Similarly, the construction area for the surge tank will require clearance/disturbance of an area of about 50 m by 100 m above the surge tank to allow for crane operation, and laydown for concrete placement, lining components etc.

Powerhouse

Construction of the powerhouse is described in section 3.2.3 and would involve drill and blast type techniques to advance the excavation from the surface down to the pump-turbine elevation. It is envisaged that the low pressure (tailrace) tunnel would be completed early to allow the rock from powerhouse excavation to be dropped down to the base through a narrow diameter tunnel before 'mucking out' through the tailrace tunnel.

Ancillary activities

A construction camp will likely be established on the site. This is seen as an opportunity to alleviate some of the pressure on accommodation demands in the nearest town, Mudgee, especially for a large workforce of up to 500 people. Further social impact assessment and stakeholder engagement will consider whether it is advantageous to accommodate part or all of the workforce in Mudgee or alternative locations. At this early stage, a potential location for this camp has been identified on the existing cleared and relatively flat area south-west of the upper reservoir. It is proposed that water supply for the construction worker camp would be sourced from Lake Burrendong and pumped to the camp location via temporary overland pipelines. An onsite drinking water treatment facility is proposed to supply potable water to the camp. Wastewater would be collected and directed to an onsite wastewater treatment facility where the effluent would be treated to an acceptable water quality before being discharged to the adjacent agricultural land using a diffuse discharge method. Power supply may be from the existing electricity distribution network, or come from onsite generators. The camp will also include a site office and facilities.

Laydown and storage areas are proposed to be located adjacent to reservoirs and proposed infrastructure. Crushers and concrete batch plant(s) will be located adjacent to the laydown/storage and construction areas to minimise cartage. The indicative area impacted by temporary construction works and ancillary activities is about 100 hectares.

3.3.3 Site clearance, vegetation removal and earthworks

Construction of the Project would involve the removal of some of the existing vegetation that is present on the site. There are six Critically Endangered Ecological Communities (CEEC) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *NSW Biodiversity Conservation Act 2016* (BC Act) mapped in some areas of the site. Vegetation clearance will be further defined at the EIS stage.

Excavation works will result in excess material won from the proposed tunnel, powerhouse and surge tank excavations. It is proposed that this material will be reused on site for the proposed reservoir embankments. It is also expected that some material excavated onsite could potentially be unsuitable for reuse onsite and would therefore need to be appropriately managed or taken off-site. The estimated cut and fill earthwork volumes for reservoirs are indicated in Table 3.3.

Table 3.3 Construction earthworks estimated cut and fill volumes

Item	Excavated cut volume (m^3)	Estimated fill volume (m^3)	Comments
Upper reservoir	3,174,000	3,174,000	Embankment fill sourced from Upper Reservoir quarry/borrow areas
Lower reservoir	1,567,000	2,025,000	Embankment fill sourced from Lower Reservoir quarry, tunnel, shaft and powerhouse excavations
Tunnels and shafts	267,000	-	Excavated material to be used in Lower Reservoir embankment
Powerhouse	191,000	-	Excavated material to be used in Lower Reservoir embankment
Total	**5,199,000**	**5,199,000**	

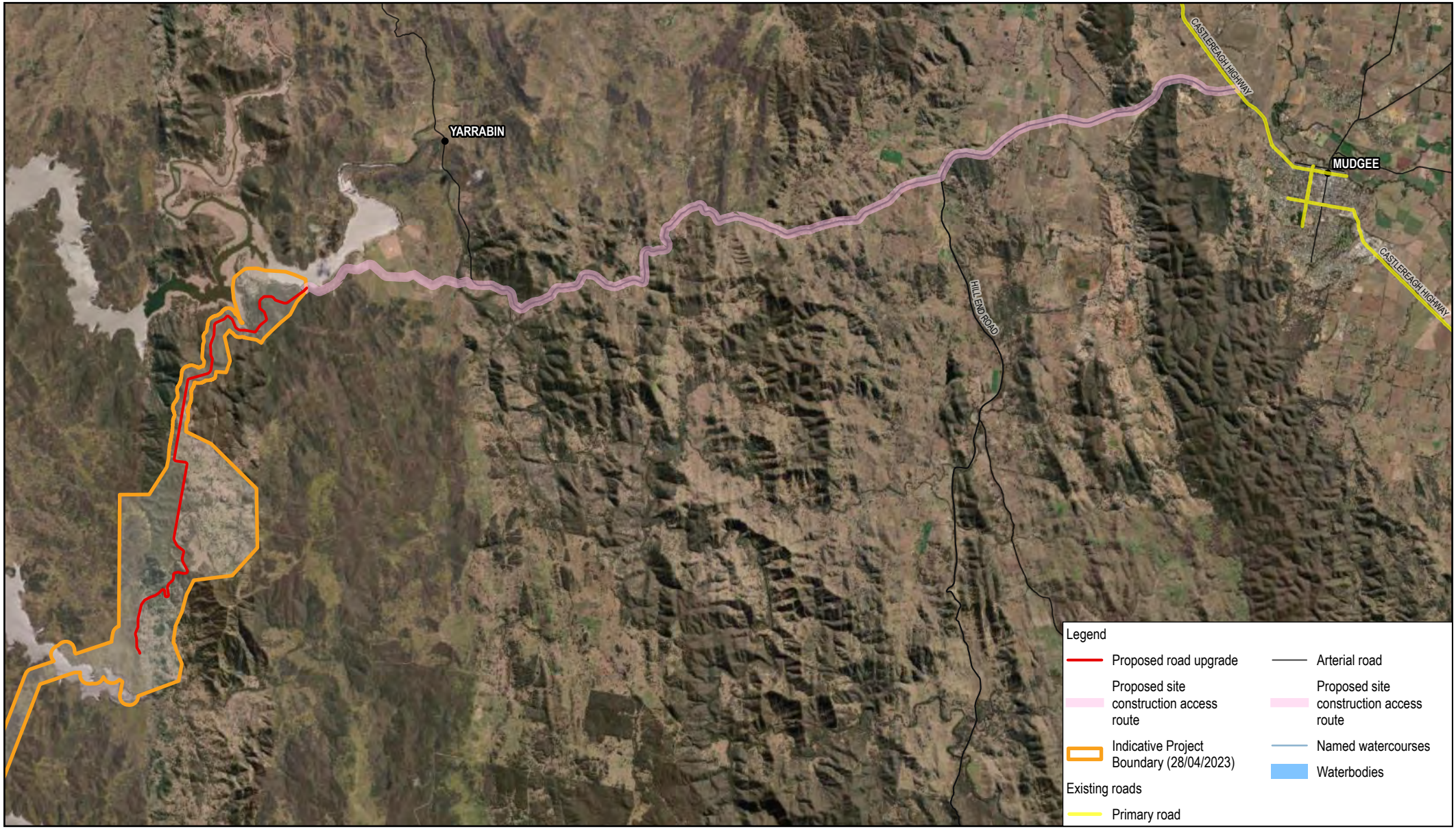
Quarries and borrow areas are required to construct the reservoir embankments. These materials will be preferentially sourced from within the reservoir areas to maximise available reservoir volume. However, these materials are unlikely to be suitable for concrete aggregate. Preference would be to obtain rock for concrete aggregate from an onsite quarry. This avoids the disturbance and cost of hauling rock from an external site and provides a more sustainable outcome. A desktop review has identified potential locations for quarry sites and clay borrow areas. Borrow pits and quarry locations will be developed further following geotechnical investigations and will be confirmed in the EIS. Explosives magazine(s) will be located in a separate location adjacent to the proposed quarry(s).

3.3.4 Access

The proposed construction access to the site is from Mudgee via Hill End Road, Yarrabin Road, Burrendong Dam Road, Endacott Road and a private access road, requiring upgrading of about 20 kms of unsealed roads, and requiring a new section of access road to bypass the Cudgegong River Holiday Park in order to minimize impacts to the holiday park and its users. Proposed access road upgrades would involve the following:

– Clearance of up to 5 m of vegetation on either side of existing access roads (i.e. Burrendong Dam Road west of Meroo River, Endacott Road and the private access road south of Cudgegong River Holiday Park).
– Upgrades to road subgrade to provide for the anticipated plant and equipment.
– Diversion to bypass the Cudgegong River Holiday Park.
– Road realignments where required to achieve a maximum grade of 10-15 per cent to allow for safe transportation of equipment and materials.

The proposed construction access route is identified in Figure 3.7. Discrete sections of access road upgrades may also be required to Yarrabin Road and Hill End Road. Further studies to be undertaken as part of the EIS will identify these potential upgrade requirements.



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Proposed site construction access route

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FIGURE 3.7

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In addition to upgrades to the construction access route to the site, upgrades are also required to internal access routes within the site. Existing access between the upper and lower reservoir sites is via unsealed tracks. Realignment of existing tracks will be required to achieve a reasonable maximum grade (10 to 15 per cent) and width for construction and permanent access between the reservoirs. Upgrading of internal access tracks will be described in more detail in the EIS.

3.3.5 Utilities

Power

A residential power supply connection (Essential Energy) exists at the site. The need for connection of additional power services would be investigated and considered during the EIS. Power supply to the construction site may be from the existing distribution network, or from on-site generators.

Water

There are no known water or sewer connections to the site. The need for connection to these services would be investigated and considered prior to and during the preparation of the EIS. Water is likely to be supplied by pumping from Lake Burrendong, as described in section 3.2.5. Onsite treatment of water pumped from Lake Burrendong is proposed to provide potable water for the onsite workers accommodation camp.

3.4 Operation

The Project would typically operate on a daily energy storage cycle, charging (pumping) and discharging (generating) as required. The Project is for a closed loop system with water retained in the two reservoirs. Operational details of the Project are outlined in Table 3.4.

Table 3.4 Operational details of Project

Aspect	Description
Lifespan of hydro project operations	The design life for the dam civil infrastructure would be 50 years. Mechanical and electrical equipment would require regular maintenance and replacement of some components to match this overall design life.
Hours of operation	24 hours a day, 7 days a week, charging (pumping) and discharging (generating) as required.
Evaporative losses	Annual evaporative losses from the Project are expected to be about 400-500 ML/yr. These losses would be replaced by further purchases of water from Lake Burrendong when water is available. The lower reservoir has been sized to provide reserve water as a contingency if water is not available from Lake Burrendong during drought.

3.5 Decommissioning

Large hydropower assets usually remain high value assets when they approach their design life and tend to be fully refurbished rather than decommissioned. Therefore, the Project could be refurbished when it approaches its design life, rather than being decommissioned.

If closure were to occur, decommissioning would involve removal and recycling of mechanical and electrical equipment. The dams could remain as water reservoirs or be dewatered. The powerhouse would be demolished to ground surface level, backfilled and capped.

3.6 Alternatives considered

3.6.1 Alternative sites

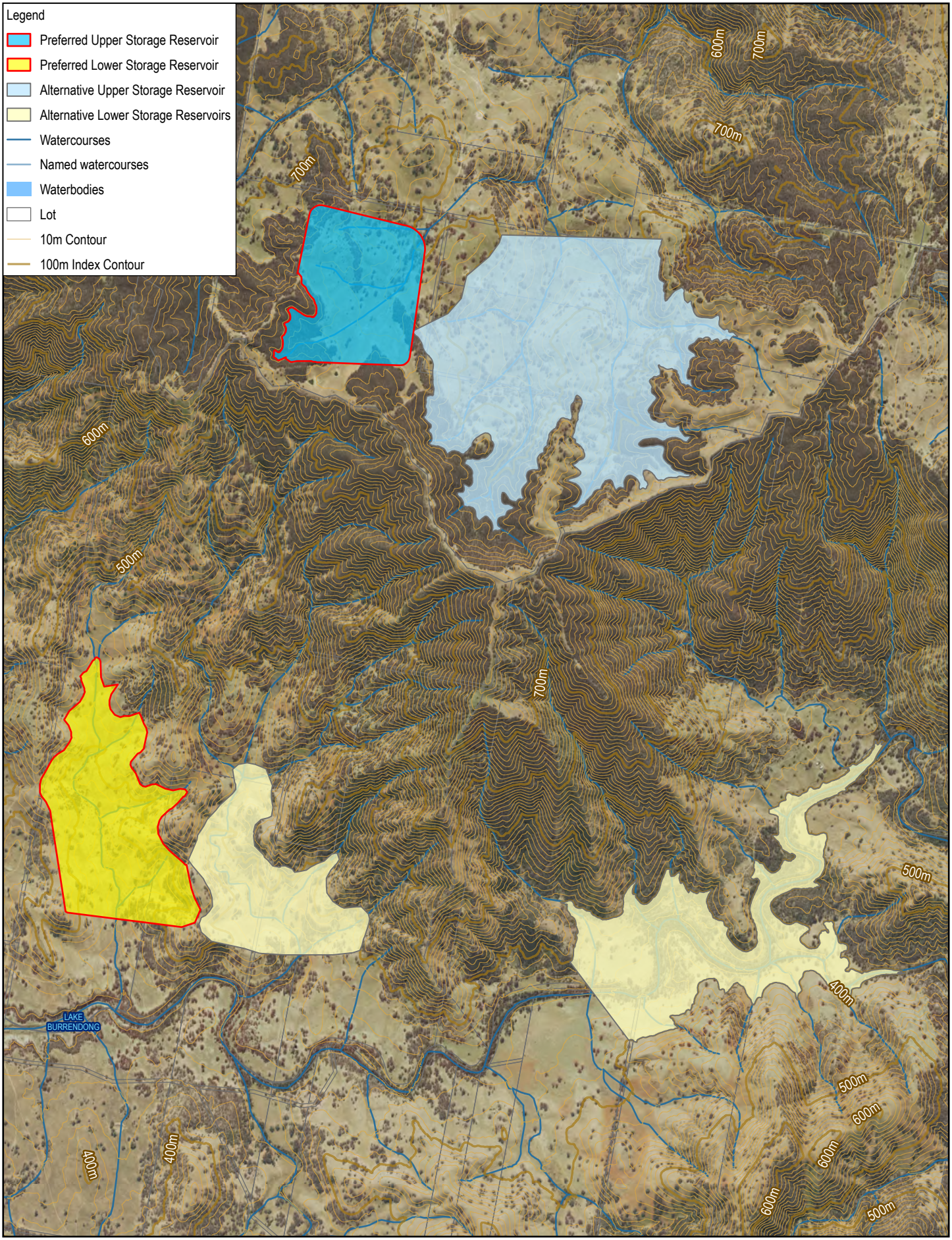
As outlined at section 2.4, the Project site has been selected following an extensive review of suitable sites for pumped hydro in NSW. In summary, this process involved the following steps:

1. A detailed review of the potential pumped hydro locations across New South Wales as identified in the Australian National University (ANU)'s mapping of pumped hydropower opportunities (ANU 2017).
2. Screening of selected sites based on technical factors, development cost, electricity storage capacity and environmental constraints. Screening of environmental constraints aimed to avoid forests and wooded areas, waterways and sensitive aquatic habitats, existing infrastructure and high value land use.
3. Transgrid review of the short list options to determine the option with the greatest advantage for the NSW energy system.

The site is therefore considered a suitable option for electricity storage. Additionally, it is appropriately located within the Central-West Orana Renewable Energy Zone. It will avoid the need for large transmission upgrades from other energy storage projects, stabilise the grid for VRE production and provide an overall benefit for the NSW energy system.

3.6.2 Alternative layouts on selected site

A number of reservoir location options were considered to the east of the preferred option described in section 3.2.1. These options involved a similar arrangement of one reservoir at the top of the escarpment, and one reservoir below closer to Lake Burrendong, and are identified in Figure 3.8. The preferred option was selected as it minimised vegetation removal, and avoided impacts to creeks and ephemeral streams as far as practicable. While the reservoirs will still result in removal of some vegetation, the selected site avoids heavily vegetated areas and utilises disturbed farming land as far as practical. The options considered for reservoirs exhibit similar biodiversity constraints; the selected option minimises impacts on creeks and is therefore considered suitable. The capacity of the reservoirs will be subject to further optimisation in conjunction with the scheme design to further reduce impacts as far as practicable.



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Reservoir options considered

FIGURE 3.8

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Optioneering for the scheme arrangement has primarily focused on the water conveyance and powerhouse options. The following three potential scheme arrangement options have been considered for the options assessment:

1. Surface waterway[1] and surface (silo) powerhouse
2. Tunneled waterway and surface (silo) powerhouse
3. Tunneled waterway and underground (cavern) powerhouse.

Option 1: Surface waterway and surface (silo) powerhouse

Option 1 involves a section of tunnel about 1.3 kms in length south of the upper reservoir to a portal on the escarpment, followed by three surface pipelines along a ridgeline to a surface (silo) powerhouse adjacent to the lower reservoir.

Option 2: Tunneled waterway and surface (silo) powerhouse

Option 2 involves a tunnel from the upper reservoir to the lower reservoir, via a surface (silo) powerhouse.

Option 3: Tunneled waterway and underground (cavern) powerhouse

Option 3 involves an underground cavern powerhouse. Two tunnel conveyance options were considered: a vertical drop shaft directly to the powerhouse, and an inclined tunnel connecting to the powerhouse.

Following a review of these options, a surge tank was also added to designs to provide for a robust hydraulic design. It is also noted that numerous underground alignment options were considered for tunneled water conveyance.

A review of the options developed identified that Option 2 was the preferred option for the following reasons:

– A surface (silo) powerhouse requires less excavation than an underground (cavern) powerhouse. This is both lower cost and produces less carbon emissions and spoil disposal.
– An underground waterway is preferred to a surface waterway as this results in reduced surface disturbance and visual impacts.
– Option 2 was estimated to have a construction duration of about 43 months, whereas Option 3 was estimated to have a construction duration of about 62 months.

3.7 Strategies to avoid or minimise impacts

The key strategy to avoid or minimise potential impacts principally relates to selecting a relatively remote site that has relatively few sensitive receivers, has been disturbed with intensive grazing over many years and which is relatively clear of areas of dense vegetation. The location of the selected site means that amenity impacts such as noise and vibration and landscape and visual impacts will be minimal compared to a site with more sensitive receivers. In addition, the closed nature of the system means the Project will minimise any ongoing impacts upon Lake Burrendong except for occasional topping up of water.

There is an existing access road to the site, therefore the Project largely avoids the needs to construct a new access road. The Project is also located in close proximity (about 14 kms) to the Wellington to Mount Piper 330 kV transmission line, reducing the length of required connecting infrastructure and therefore minimising impacts.

[1] Tunnelling for the upper portion of the upper waterway is necessary due to the site topography.

Additionally, efforts have been made to minimize impacts during the construction phase on the broader region through exploring the winning of earthwork materials on site, thereby alleviating demand on local resources and on the road network, and also through the establishment a workers accommodation camp within the boundary of the Proposal. These measures will be assessed in the EIS with a particular focus on cumulative impacts.

4 Statutory context

The key requirements of the EP&A Act and the *Environmental Planning and Assessment Regulation 2021* (the EP&A Regulation) in relation to the approval and assessment of the project are summarised in Table 4.1.

Table 4.1 Summary of statutory requirements for the Project

Matter	Comment
Power to grant consent	Section 4.36(2) of the EP&A Act provides that a State environmental planning policy may declare any development, or any class or description of development, to be State Significant Development (SSD). The Project is deemed SSD in accordance with section 2.6(1) of State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), since Section 20 of Schedule 1 of the Planning Systems SEPP lists electricity generating works with a CIV of more than $30 million as SSD. In accordance with section 4.5(a) of the EP&A Act, the consent authority for State significant development is the Minister for Planning and Public Spaces or the Independent Planning Commission (pursuant to section 2.7 of the Planning Systems SEPP).
Permissibility	The site is located within the Dubbo LGA and the relevant local environmental plan is the Dubbo Regional LEP 2022. The site is zoned RU1 Primary Production and C3 Environmental Management. Section 2.36(1)(b) of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (T+I SEPP) applies to development for the purpose of electricity generating works and provides that development for this purpose is permissible with consent, if carried out on any land in a prescribed non-residential zone. Clause 2.35 provides the following relevant definition of electricity generating works: ***electricity generating works*** *means a building or place used for the following purposes, but does not include a solar energy system—* *(a) making or generating electricity,* *(b) electricity storage.* Pursuant to Section 2.35 definitions, RU1 is a prescribed non-residential zone. C3 is not defined as a non-residential zone. Therefore, the electricity generating works are permissible in the RU1 Primary Production zone however that part of the Project located within the C3 Environmental Management zone is prohibited. Notwithstanding the above part prohibition, pursuant to the provisions of Section 4.38(3) of the EP&A Act, consent may be granted for State significant development despite the development being partly prohibited by an environmental planning instrument.
Other approvals	**Consistent approvals** Any authorisations under certain legislation, identified in Section 4.42 of the EP&A Act, cannot be refused if it is necessary for carrying out an approved SSD project and is to be substantially consistent with the SSD approval. In relation to the project, these authorisations could include: – An aquaculture permit under section 144 of the *Fisheries Management Act 1994* – An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* – A consent under section 138 of the *Roads Act 1993* – A licence under the *Pipelines Act 1967*. **Approvals not required** An authorisation under certain other legislation, identified in Section 4.41 of the EP&A Act, is not required for approved State significant development. In relation to the project, these authorisations could include: – A permit under Section 201, 205 or 219 of the *Fisheries Management Act 1994* – An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*

Matter	Comment
	– An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974* – A bush fire safety authority under Section 100B of the *Rural Fires Act 1997* – a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the *Water Management Act 2000*. **EPBC Act approval** The Project may result in a significant impact on Matters of National Environmental Significance (White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Communities) under the EPBC Act, therefore a referral under the EPBC Act will be made for the Project. **Other approvals** – *Biodiversity Conservation Act 2016*
Pre-conditions to exercising the power to grant approval	***Biodiversity Conservation Act 2016*** Part 7 of the BC Act applies to approvals under the EP&A Act. Section 7.9 requires a development application for State significant development to be accompanied by a Biodiversity Development Assessment Report (BDAR). Section 7.14 requires the consent authority to take into consideration the likely impact of the proposed development on biodiversity values as assessed in the Biodiversity Development Assessment Report.
Mandatory matters for consideration	**State Environmental Planning Policy (Resilience and Hazards) 2021** Section 4.6 stipulates that a consent authority must not consent to the carrying out of development unless: – It has considered whether the land is contaminated, and – If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and – If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose. Due to the historic agricultural use of the site, it is possible but considered unlikely that the site is contaminated. A Site Operational Environmental Management Plan will be developed to manage any unexpected finds of contaminated land. **State Environmental Policy (Biodiversity and Conservation) 2021** Chapter 4 provides for Koala habitat protection. Koalas have been recorded in close proximity to the site, therefore the requirements of Part 4.2 of this SEPP apply to access road upgrade works proposed within the Mid-Western Regional LGA (since Dubbo Regional LGA is not listed in Schedule 2 of the SEPP). ***Environmental Planning and Assessment Act 1979*** The following sections of the EP&A Act need to be considered by the consent authority prior to granting approval: – Section 1.3 – Objects of the Act – Section 4.15 – Evaluation – Section 4.38 – Consent for State Significant Development. **Environmental Planning and Assessment Regulation 2021** Under Section 61(3) of the Regulation, a consent authority must consider the *Dark Sky Planning Guideline* in determining a development application for development on land less than 200 kms from the Siding Spring Observatory, if the development is SSD. The Project is located about 160 kms south of the Siding Spring Observatory, therefore the *Dark Sky Planning Guideline* is relevant for the Project. **Dubbo Regional Local Environmental Plan 2022** Under the Dubbo Regional LEP 2022, electricity generating works are prohibited in both the RU1 and C3 zones. However, as per Section 2.36(1) of the T+I SEPP development for the purpose of electricity generating works may be carried out by any person with consent on any land in a prescribed rural, industrial or special use zone (including RU1). The EIS would need to demonstrate consideration of the objectives of the RU1 and C3 zones. The Dubbo Regional LEP includes other matters for consideration for the consent authority before granting development consent relating to the following relevant matters:

Matter	Comment
	– Section 5.14 – maintaining dark sky at Siding Spring Observatory – Section 7.1 – terrestrial biodiversity – Section 7.2 – earthworks – Section 7.3 – natural resource – riparian land and waterways – Section 7.5 – groundwater vulnerability.

5 Engagement

5.1 Interest groups identified

ACEN has undertaken an initial stakeholder scoping exercise and has identified a number of key interest groups as outlined in Table 5.1.

Table 5.1 Stakeholders identified

Stakeholder type	Stakeholder
Federal government	– Department of Climate Change, Energy, the Environment and Water (DCCEEW) – Australian Energy Market Operator (AEMO)
State government	– Department of Planning and Environment (DPE) – Department of Primary Industries (DPI) – Biodiversity Conservation Trust – NSW Environmental Protection Authority – Fire and Rescue NSW – NSW Rural Fire Service – Energy Corporation of NSW (EnergyCo)
Local government	– Dubbo Regional Council – Mid-Western Regional Council
Landholders	– One private landholder – WaterNSW
Aboriginal community and stakeholder groups	– Registered Aboriginal Parties – Mudgee Local Aboriginal Land Council – Wellington Local Aboriginal Land Council – Native Title Service Corporation – Central West Orana REZ First Nations Working Group – Warrabinga-Wiradjuri #7 native title claimants
Community - tourism	– Cudgegong River Holiday Park – Mookerawa Waters Holiday Park – Recreational users of Lake Burrendong
Community – business and media	– Mudgee Chamber of Commerce – Dubbo Chamber of Commerce and Industry – Mudgee Guardian – Social media – local Facebook pages
Community – local residents and broader community	– Residences located within 2 km radius of the Project – Residences located along the site access route – Broader community located outside locality (i.e. greater than 2 km)
Community – special interest groups	– Regional Development Australia – Orana Branch – Mid-Macquarie Landcare – OzFish – Wellington Chapter – Twin Rivers Fishing Club Wellington

5.2 Early engagement carried out

ACEN has commenced stakeholder consultation following the public announcement of grant funding to progress feasibility studies in December 2022. General media releases to date regarding plans to develop the project include the following:

– December 2022 **Phoenix pumped hydro project powers ahead with $7 million grant** | NSW Government
– December 2022 **ACEN Australia welcomes NSW Government support for long duration renewable energy storage facility** | ACEN

ACEN has established a project website portal which provides information on the Project, including progress to date and the next steps: **https://acenrenewables.com.au/projects/phoenix-pumped-hydro/**. ACEN has also prepared a project introduction document and questions and answers document for the Project, available on their website.

A mailout was sent out to dwellings within 2 kms of the Project site, and dwellings within proximity to the proposed construction access route. This mailout was sent to 63 dwellings outlining project information and an invitation to attend a community drop in session.

A community drop in session was held in Mudgee Scout Hall on Tuesday 14 March 2023, between 9 am and 6 pm, to inform the public about the Project. This provided an opportunity for stakeholders and community members to drop in to speak to the project team, view documents and plans and ask questions. The event was advertised through various channels, including local mailouts, advertisements in local media and social media posts.

The session attracted 16 attendees, including representatives from the local Traditional Owner community. The sentiment among attendees was positive, with community members expressing support for the Project. Concerns were raised regarding potential environmental impacts and impacts to recreational uses on Lake Burrendong. The project team addressed these concerns, providing additional detail on the Project design where applicable. Further consultation will continue to be undertaken as the Project progresses in alignment with the identified impacts and the remote nature of the site.

As a result of attendance from the community information session, a request from the Mudgee Rotary Club for ACEN Australia staff to present to members on the Project was made. A presentation to the Mudgee Rotary Club was delivered on Tuesday 16 May 2023. Additionally, the Gulgong Chamber of Commerce requested a presentation on ACEN Australia projects, specifically including the Project. This presentation was delivered on Tuesday 9 May. Following the presentation to the Mudgee Rotary Club, a member of the Club who is employed at St Matthews Catholic School (Mudgee) requested a presentation to Year 10-12 students.

ACEN continues to update the community on the project and the work of ACEN Australia via the Phoenix Pumped Hydro Facebook page and Project website.

Formal project briefings have been provided to the following groups to introduce the Project:

– DPE planning assessment team
– DPE water group
– Dubbo Regional Council
– Mid-Western Regional Council
– EnergyCo.

5.3 Engagement to be carried out

5.3.1 Community and Stakeholder Engagement Plan

A Community and Stakeholder Engagement Plan will be developed for the Project which will outline the activities that ACEN will undertake to inform and consult the community and other identified key stakeholders. ACEN will notify neighbouring property owners and the surrounding community of the

lodgement of this Scoping Report and provide an invitation to comment. ACEN will also provide project related information on its website.

5.3.2 Potential issues from community and stakeholders

Due to the location and nature of the Project, the following concerns are anticipated:

– Potential for increased traffic movements during construction (including heavy vehicle movements) and associated impact on the local road network.
– Curiosity about how the pumped hydro system will function and operate.
– Potential for community impacts or benefits, e.g. employment and economic development, workforce accommodation during construction.
– Potential for amenity impacts, e.g. noise and vibration and visual impacts.
– Impacts on recreational activities on Lake Burrendong.

5.3.3 Agency consultation

Further agency consultation will be undertaken with the interest groups identified in Section 5.1 and in accordance with the Project's Community and Stakeholder Engagement Plan that will be prepared for the EIS. Details of the engagement carried out, and the outcomes of the consultation will be included in the EIS.

6 Proposed assessment of impacts

The identification of issues to be addressed in the EIS has been undertaken through a risk-based approach in accordance with Appendix A of the *State Significant Development Guidelines – Preparing a Scoping Report* (DPE 2022a). This process involved reviewing previous reports, undertaking limited investigations (such as site inspections), and desktop searches of proprietary environmental databases to identify key issues and sensitive areas from January to March 2023.

A summary of the key environmental matters identified during the risk assessment is provided in section 6.1 through section 6.7. Other matters for consideration are identified in section 6.8. A Scoping Summary Table (as required by Appendix A of the *State Significant Development Guidelines – Preparing a Scoping Report*) is provided in Appendix A of this Scoping Report. The intent of the discussion is to demonstrate an understanding of the matters and the need for further environmental assessment and mitigation measures for these matters.

6.1 Biodiversity

6.1.1 Existing environment

Overview

Two GHD ecologists (including one accredited BAM assessor) completed a preliminary field survey from 13 to 15 December 2022. The focus of the preliminary field survey was to identify the presence and quality of habitat for threatened biota at the upper and lower reservoirs and was not intended to provide a comprehensive census of habitat resources.

At the time of the site visit, much of the subject area was covered with an infestation of St John's Wort, however despite the presence of this priority weed, there was relatively good native floristic diversity across the subject area, with large tracts of derived native grassland interspersed with stands of open woodland in gently undulating terrain, giving way to large dense patches of forest on rocky hillsides and ridges. Representative photos of vegetation in the upper and lower reservoir areas are provided in Figure 6.1 and Figure 6.2 respectively.

Figure 6.1 View over derived native grassland in upper reservoir area, showing predominantly native understory

Figure 6.2 View over lower reservoir area, showing dense infestation of St Johns Wort in understory

There are habitat resources of relevance for many threatened flora and fauna species within the subject areas, but primarily in areas of woodland and forest. There are numerous hollow-bearing trees. The lower reservoir area is close to Lake Burrendong and associated riparian and aquatic habitats of relevance for various threatened species.

Vegetation and TECs

Plant community types (PCTs) and their mapped occurrence (as per existing regional vegetation mapping (DPE 2022)) within key project components is provided in Table 6.1. Although non-native vegetation is mapped in some areas, based on the results of the preliminary field survey these grassland areas contain a sufficient cover of native species to require assessment as a native vegetation type during any future assessment. Table 6.1 also provides an assessment of whether mapped PCTs are commensurate with endangered ecological communities (EECs) or critically endangered ecological communities (CEECs) listed under the BC and/or EPBC Acts and notes whether the PCT is identified as an entity at risk of serious and irreversible impacts (SAII).

Table 6.1 PCTs mapped within the site by DPE (DPE 2022)

Current PCT ID	PCT name	Previous PCT ID (if relevant)	Previous PCT name (if relevant)	Conservation significance	SAII entity	Area within site (ha)		
						Access road	Lower reservoir	Upper reservoir
3540	Southwest Foothills Stringybark-Box Grassy Forest	266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes	4.22	14.02	
N/A	N/A	267	White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes	0.02	11.20	
3540	Southwest Foothills Stringybark-Box Grassy Forest	268	White Box - Blakelys Red Gum - Long-leaved Box - Nortons Box - Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes	0.03	1.78	
3376	Southern Tableland Grassy Box Woodland	277	Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes	0.63		
N/A	N/A	279	Blakely's Red Gum - White Cypress Pine woodland on footslopes of hills in central part of the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes		0.03	
3540	Southwest Foothills Stringybark-Box Grassy Forest	280	Red Stringybark - Blakely's Red Gum +/- Long-leaved Box shrub/grass hill woodland of the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes		0.04	
3541	Southwest Ranges Stringybark Exposed Forest	287	Long-leaved Box - Red Box - Red Stringybark mixed open forest on hills and hillslopes in the NSW South Western Slopes Bioregion	No associated TECs listed under BC Act or EPBC Act	No	5.51		
3536	Mudgee Ranges Stony Slopes Shrub Forest	324	Inland Scribbly Gum grassy open forest on hills in the Mudgee Region, NSW central western slopes	No associated TECs listed under BC Act or EPBC Act	No	0.15		
3536	Mudgee Ranges Stony Slopes Shrub Forest	326	Long-leaved Box - Red Box grass-shrub open forest on hillslopes in the Mudgee Region, NSW central western slopes	No associated TECs listed under BC Act or EPBC Act	No	0.46		
N/A	N/A	329	Red Ironbark - Red Stringybark - Tumbledown Gum heath low woodland on ridges, central NSW South Western Slopes	No associated TECs listed under BC Act or EPBC Act	No	1.19		

Current PCT ID	PCT name	Previous PCT ID (if relevant)	Previous PCT name (if relevant)	Conservation significance	SAII entity	Area within site (ha)		
						Access road	Lower reservoir	Upper reservoir
3535	Central West Stony Ranges Pine-Ironbark Forest	332	Tumbledown Red Gum - Black Cypress Pine - Red Stringybark woodland on rocky hills in the NSW central western slopes	No associated TECs listed under BC Act or EPBC Act	No	0.79		
3534	Central West Stony Hills Stringybark-Box Forest	345	Red Box - Tumbledown Gum - Red Stringybark - Long-leaved Box dry woodland, upper NSW South Western Slopes Bioregion	No associated TECs listed under BC Act or EPBC Act	No	0.00		
3399	Southwest Hills White Box-Blakelys Red Gum Forest	347	White Box - Blakelys Red Gum shrub/grass woodland on metamorphic hillslopes in the mid-southern part of the upper slopes sub-region of the NSW South Western Slopes Bioregion	CEEC BC Act CEEC EPBC Act	Yes	3.32		
4152	Central West Tumbledown Gum Grassy Forest	461	Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	No associated TECs listed under BC Act or EPBC Act	No	22.00	9.87	
3509	Capertee Escarpment Slaty Gum-Ironbark Forest	1177	Slaty Gum woodland of the slopes of the southern Brigalow Belt South Bioregion	No associated TECs listed under BC Act or EPBC Act	No	0.11		
3388	Central West Valleys White Box Forest	1610	White Box - Black Cypress Pine shrubby woodland of the Western Slopes	CEEC BC Act CEEC EPBC Act	Yes	0.36		
3406	Southwest Ranges White Box Woodland	N/A	N/A	CEEC BC Act CEEC EPBC Act	Yes			7.84
3534	Central West Stony Hills Stringybark-Box Forest	345	Red Box - Tumbledown Gum - Red Stringybark - Long-leaved Box dry woodland, upper NSW South Western Slopes Bioregion	No associated TECs listed under BC Act or EPBC Act	No	8.72		21.00
3734	Central Tableland Dry Slopes Stringybark-Box Forest	N/A	N/A	No associated TECs listed under BC Act or EPBC Act	No	12.99		3.22
N/A	Not native vegetation*	N/A	N/A	CEEC BC Act	Yes		29.29	

Current PCT ID	PCT name	Previous PCT ID (if relevant)	Previous PCT name (if relevant)	Conservation significance	SAII entity	Area within site (ha)		
						Access road	Lower reservoir	Upper reservoir
N/A	Not native vegetation+	N/A	N/A	CEEC BC Act	Yes			38.24

Notes: CEEC – critically endangered ecological community
* Native grassland likely to be commensurate with PCT 266
+ Native grassland likely to be commensurate with PCT 3406

Threatened species

Results of a desktop search indicate previous records or predicted occurrence of numerous threatened and/or migratory fauna species within the locality. Table 6.2 summarises the threatened species known to occur within the locality. It should be noted that lack of previous or historical survey effort (for example within dense vegetation on the range) may contribute to fewer known records and that these numbers are indicative only.

Table 6.2 Summary of threatened species previously recorded within the locality (10km) subject area

Species type	BC Act listed species known to occur in locality	EPBC Act listed species known to occur in locality	SAII entities previously recorded in locality
Flora	2	2	1 (*Zieria obcordata*)
Fauna	28	8	1 (Swift Parrot)

The only fauna species that is an SAII entity that has been recorded within the locality of the subject area is the Swift Parrot (*Lathamus discolor*). This species can be excluded from assessment as an SAII entity due to a lack of mapped important habitat or breeding habitat within the project footprint. The flora species *Zieria obcordata* has also been recorded within the locality of the Project footprint, and is an SAII entity. Targeted surveys would be required within areas of suitable habitat for the species to confirm whether it occurs within the Project footprint.

6.1.2 Potential impacts

Based on the existing biodiversity values, the site contains biodiversity constraints for the Project. The upper reservoir, lower reservoir and road upgrade alignment all contain native vegetation, including PCTs that are commensurate with TECs listed under both the BC Act and EPBC Act. There are suitable habitat resources present for several threatened flora and fauna species to occur. Native vegetation would be cleared or inundated to construct the Project.

The following specific biodiversity constraints have been identified within the site of the Project:

– Areas of native vegetation that comprise threatened species habitat. A development that includes removal of this vegetation would require appropriate biodiversity offsets under the BC Act and associated NSW Biodiversity Offsets Scheme (BOS) and Biodiversity Assessment Method (BAM).
– Local occurrences of the following CEECs:
  - White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Box Gum Woodland), as listed under the BC Act and/or EPBC Act.
– Potential habitat resources for threatened fauna species.
– Potential and known habitat for threatened plant species, based on the presence of suitable habitat and previous records in the local area, including:
  - Small Purple-pea (*Swainsona recta*), listed as endangered under the BC Act and EPBC Act.
  - Granite Zieria (*Zieria obcordata*), listed as endangered under the BC Act and EPBC Act.

6.1.3 Assessment approach

A Biodiversity Development Assessment Report (BDAR) would need to be prepared for the EIS in accordance with the BAM and the Project SEARs. Detailed seasonal flora and fauna surveys would need to be conducted throughout the project site. The BDAR would assess the potential impacts to threatened species, populations and communities and their habitats as a result of the project in

accordance with the BC Act and EPBC Act, and calculate the biodiversity credits required to offset the impacts of the project. Assessment of impacts on aquatic habitats would also be required.

The option of establishing a Biodiversity Stewardship site for the purpose of generating biodiversity credits under the NSW Government's Biodiversity Offsets Scheme is being explored for the site. If this is progressed, further details would be provided as part of the EIS.

6.2 Heritage

OzArk Environment and Heritage (OzArk) undertook a preliminary Aboriginal Cultural and Historic Heritage Assessment to support this Scoping Report. This assessment is summarised below.

6.2.1 Aboriginal

Existing environment

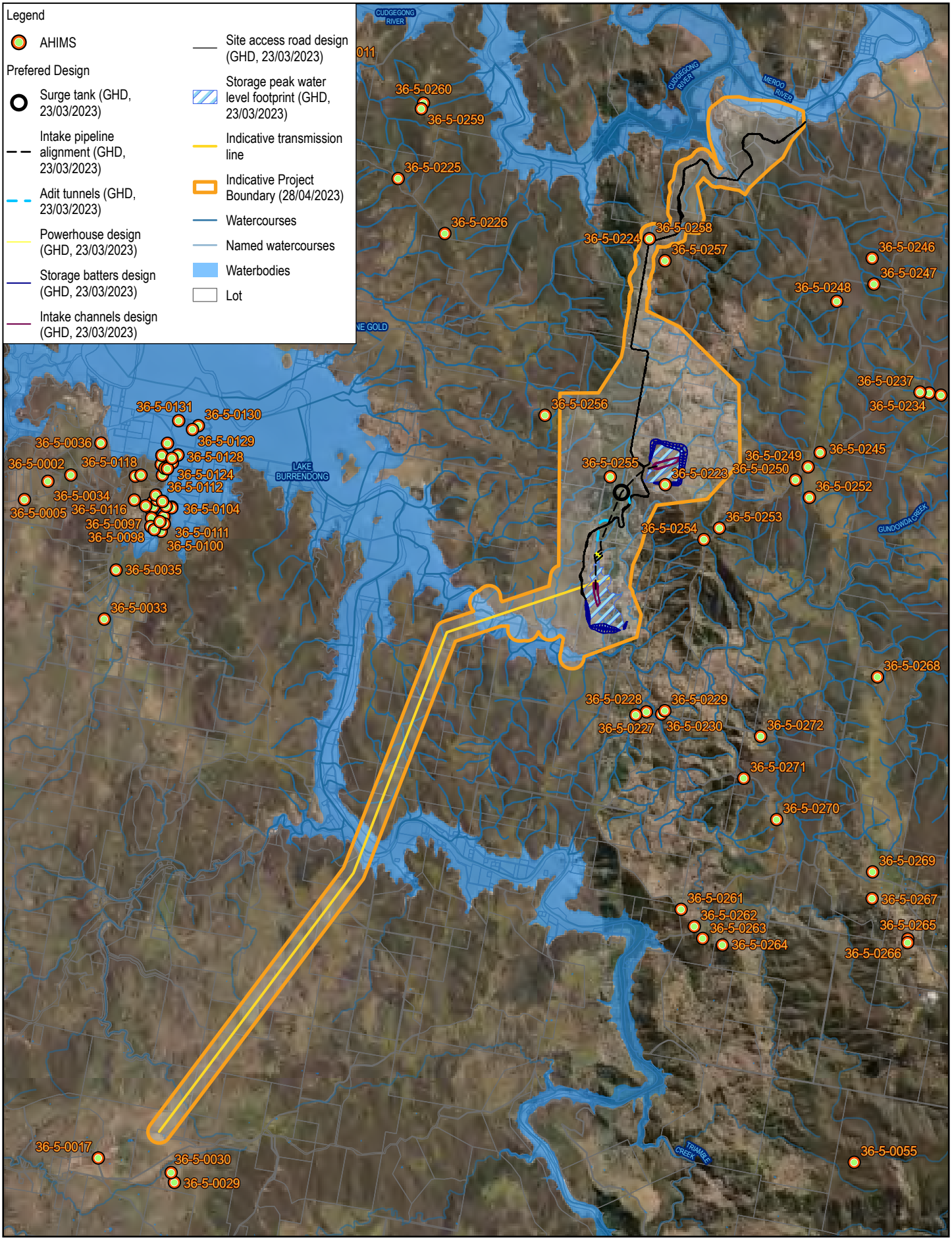
An AHIMS search undertaken on 1 December 2022 found that artefact sites with an unspecified quantity were the most frequently occurring site type in the region. Many of these were located on sloping landforms within the Goonoo and Mullion Slopes landscapes. Additional sites may exist within the Project boundary on similar landforms present. Aboriginal objects could be present on ridge and crest landforms within the Project boundary, but they are more likely to be located in greater densities in landforms associated with lower altitudes and with less-steep gradients.

OzArk undertook a visual inspection of the site on 13 December 2022. One previously unrecorded Aboriginal site was identified during this visual inspection, within the proposed location of the upper reservoir. The details of this Aboriginal site are outlined in Table 6.3.

Table 6.3 Long Tom Ridge OS1

Site name	Long Tom Ridge OS1
Site type	Artefact scatter
GPS coordinates	710315 E 6379768 N
Location of site	The site is located within Lot 38 DP756872 on an elevated plateau about 5.6 kms east of Lake Burrendong. It is situated adjacent to a tree line consisting of regrowth vegetation in a naturally occurring erosion scold. The site is located 290 m southeast of a minor headwater which feeds into several drainage lines along the elevated plateau.
Description of site	The site consists of a low-density artefact scatter containing 14 artefacts primarily manufactured from naturally occurring quartz. A single greywacke core was also recorded amongst the quartz objects along with one unidirectional quartz core. The site extends about 80 x 25 m along a cleared track within an erosion scold with 85 per cent ground surface visibility. Both the machine grading of the track and erosion present have disturbed the site, causing all artefacts to be recorded in a secondary context.

An updated AHIMS search was undertaken by GHD on 17 May 2023. The AHIMS sites identified near the site in this search are shown on Figure 6.3.



Paper Size ISO A4

0 1 2 3 4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

ACEN Australia Pty Ltd
Phoenix Pumped Hydro
Scoping Report

AHIMS site

Project No. **12532827**
Revision No. **A**
Date **30/05/2023**

FIGURE 6.3

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Print date: 30 May 2023 - 10:37

Potential impacts

There is a high likelihood for further Aboriginal objects being recorded within the Project boundary. The most likely areas are on the lower elevation landforms, particularly nearby watercourses, however the results of the visual inspection and recording of Long Tom Ridge OS1 indicates that sites such as artefact scatters and isolated finds have the potential to be recorded across the higher elevation landforms. However, these sites are likely to be in a secondary context due to erosion and therefore unlikely to be associated with potential archaeological deposits.

Further systematic surveys for Aboriginal objects will be undertaken on the site, supported by consultation with the Aboriginal community to gain an appreciation of cultural significance of any Aboriginal objects found.

Assessment approach

An Aboriginal Cultural Heritage Assessment Report (ACHAR) would be prepared for the Project as part of the EIS. As part of further investigations to be undertaken as part of the ACHAR, a site inspection would be completed by archaeologists and members of the Aboriginal community. The results of the survey would indicate whether test excavation at any specific landforms is warranted. Further investigations would include full consultation with the Aboriginal community following the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010).

6.2.2 Historic

Existing environment

Given the generally undeveloped nature of the site, discovery of historic heritage on the site is considered to be unlikely. A desktop search of the relevant NSW and Commonwealth heritage databases, and the Dubbo Regional LEP 2022 was undertaken in November 2022 for items of historic heritage. The search did not identify any heritage items within 2 kms of the proposed reservoirs.

Potential impacts

Owing to the current agricultural and partly undeveloped use of the site, construction of the Project is unlikely to result in direct or indirect impacts to known items of historic heritage. However, there is the potential for unexpected finds of historical material connected to former agricultural practices that may be of local interest or significance.

Assessment approach

A Statement of Heritage Impact (SOHI) will be undertaken to support the EIS. As part of the investigations to be undertaken for the SOHI, the Project area around the upper and lower reservoirs will be subjected to pedestrian survey by archaeologists to assess for the potential for historic heritage values being present.

6.3 Access

6.3.1 Existing environment

Access to the locality of the site is from Mudgee via the Castlereagh Highway, Hill End Road and Yarrabin Road. The preferred access route to the site of the upper and lower reservoirs is via Burrendong Dam Road, Endacott Road and a private access road, requiring upgrading of about 20 kms of unsealed roads, and requiring a new section of access road to bypass the Cudgegong River Holiday Park.

6.3.2 Potential impacts

Upgrading of the access road from the turn off to Burrendong Dam Road (from Yarrabin Road) to the site would be required, to provide for increased vehicle movements to the site, including heavy vehicles. Upgrades will provide an 8 m wide formation, requiring some vegetation clearance, excavation and fill. In addition, existing 4WD tracks within the site will be upgraded to provide for construction traffic access between the upper and lower reservoirs. The scope of upgrades required and potential impacts of these road upgrades will be assessed in the EIS.

Construction of the Project will result in increased vehicle movements (including heavy vehicles) from Mudgee to the site, resulting in potential noise and vibration and air quality amenity impacts for properties adjoining the access route from Mudgee. During operation, there would be a minimal increase in vehicle movements to the site associated with operation of the Project.

6.3.3 Assessment approach

A Traffic and Transport Impact Assessment will be undertaken for construction and operational phases of the Project. The assessment will:

– Consider the suitability of the proposed access road for construction traffic access, including equipment haulage
– Consider the structural adequacy of bridges on the access road given proposed construction traffic
– Consider the total impact of existing and proposed development on the road network
– Include details of any Traffic Management Plan (TMP) proposed to address the construction and operation phases of the Project
– Specific intersections to be considered in the assessment include the intersection of Hill End Road and Yarrabin Road, and the intersection of Yarrabin Road and Burrendong Dam Road.

Vegetation clearance associated with access road upgrades will be assessed in the BDAR to be prepared for the EIS.

6.4 Social

This initial scoping of social impacts has been prepared in accordance with the Department of Planning and Environment's (DPE) *Social Impact Assessment Guideline* for State significant projects (DPE, 2021). In accordance with these guidelines, social impact assessment (SIA) scoping is undertaken early in project development and involves:

– Establishing the social locality to understand the communities likely to be affected by the Project
– An initial evaluation of the social baseline of the social locality
– An initial evaluation of social impacts and benefits
– Consideration and articulation of any project refinements.

This process is assisted by applying the SIA worksheet provided by DPE. The following section provides an overview of the social locality and the outcomes of the initial evaluation of potential social impacts and benefits.

6.4.1 Existing environment

A preliminary social locality was identified based on the location of the Project and the communities most likely to experience impacts or benefits as a result of the Project. The preliminary social locality is outlined in Table 6.4.

Table 6.4 Preliminary social locality study areas

Study area	Area (ABS Statistical area)	Interaction with Project
Local	Yarrabin SAL	The proposed site area is situated within the locality of Yarrabin. In the 2021 Census, there was a total of 96 people in Yarrabin. Proximate residents in the area may experience social impacts and benefits resulting from construction and operation of the Project.
Regional	Dubbo Regional LGA	The proposed transmission line and site area is located within Dubbo Regional Local Government Area (LGA). Communities may experience social impacts and benefits during the construction and operation of the Project.
	Mid-Western Regional LGA	The locality of Yarrabin is located in Mid-Western Regional Local Government Area (LGA). Mudgee town centre is the largest population centre closest to the Project, and is located in Mid-Western Regional LGA. Communities may experience some social impacts and benefits during the construction of the Project.

The project site is located within the southern extent of the rural locality of Yarrabin, alongside Lake Burrendong within the LGA of Dubbo Regional Council, which forms part of the Central-West Orana region in NSW. The Wiradjuri people are the traditional custodians of the area.

The area is characterised by primary production land and environmental management land. Aerial imagery indicates there are ten rural residential dwellings within 5 kms of the immediate site, 1 km of the access road upgrades and proposed transmission line alignment. Lake Burrendong is a sport and recreation destination, offering year-round attractions for water sports, fishing, camping, hunting and other recreational activities (VisitNSW, 2022). There are four holiday accommodation facilities in the vicinity of Lake Burrendong:

– Lake Burrendong Holiday Park, about 11.5 kms northwest of the proposed lower reservoir.
– Mookerawa Waters Holiday Park, about 8 kms southwest of the proposed lower reservoir.
– Cudgegong River Holiday Park, about 7 kms north of the proposed upper reservoir.
– The Sport and Recreation Centre, 10 kms west of the proposed lower reservoir.

Lake Burrendong can be accessed via several smaller access roads from Burrendong Way in the south or Yarrabin Road or Goolma Road in the north. Mudgee, located about 35 kms north east, is the closest major town to the Project site. Mudgee has a population of 11,563. At the regional level, the population of Dubbo LGA is 54,922 persons and the population of Mid-Western LGA is 25,713 persons.

As a rural area, Yarrabin has a small population, which was 96 people in 2021. Compared to Dubbo and Mid-Western LGAs, Yarrabin has:

– An older population, with a median age of 50 years compared to 36 years for Dubbo and Mid-Western 42 for Mid-Western LGAs
– A higher proportion of people who require assistance (6.3 per cent compared to 3.0 per cent for Dubbo and 3.1 per cent for Mid-Western LGAs
– A higher level of relative disadvantage, ranking at decile 3 within the state compared to decile 5 for Dubbo LGA and decile 4 for Mid-Western LGA.

The councils of the Central-West Orana region are focused on creating new employment activities to support population growth (CERD, 2019). In particular, the *Central Orana Regional Economic Development Strategy 2018-2022* identifies the ongoing development of renewable energy projects as a key priority for regional development to support industry diversity and growth of the construction and manufacturing industries. These regional priorities align broadly with key strategic directions for the New South Wales economy, as set by the *NSW 2040 Economic Blueprint*, including that by 2040 the state

will diversify its energy sources to a more sustainable mix that includes renewables (wind, solar and wave) (NSW Government, 2019).

6.4.2 Initial evaluation of social impacts and benefits

The potential social impacts and benefits that may result from construction and operation of the Project have been identified through a review of the information presented in the Preliminary Environmental Assessment and this Scoping Report, the understanding of the social locality, and based on previous professional experience undertaking social impact assessments for state significant projects in NSW. The potential social impacts have been evaluated according to the characteristic of magnitude as defined in DPE's *Social Impact Assessment Guideline for State Significant Projects* (DPE, 2021). The outcomes of the social impact scoping process are summarised below.

The Project area is located on the lands of the Wiradjuri people; the access road study area is traversed by the Warrabinga-Wiradjuri #7 native title claim area. Construction of the Project has the potential to impact places of significance and/or cultural values. There may be opportunities for local Aboriginal communities, including business opportunities, employment opportunities, and cultural interpretation and design.

Dust, noise and vibration may be generated by construction activities, staff movements, haulage of materials and delivery of machinery and equipment, which may have localised impacts to amenity. Heavy vehicle movements would increase at the beginning and end of the construction phase and there would be additional light traffic along the local road network. Changes in the visual landscape may occur due to construction activities, any required vegetation clearing and new infrastructure for the operation of the Project. To help mitigate these impacts, consultation with landowners, including those along access roads, is recommended.

During construction there is potential for direct employment opportunities for skilled and semi-skilled workers. Local businesses may also benefit from construction workers spending money at local businesses, such as food outlets located in nearby townships. Potential procurement opportunities and increased patronage is likely to be viewed as important to local businesses.

Access arrangements may be required during construction and operation, which may result in temporary disruptions for residents and visitors to the area. The Project alignment will include properties located within primary production zoned areas. There will be localised impacts to primary production within the alignment and existing land use activities.

Construction of the Project would require a workforce that may require temporary accommodation in and around the site area. A construction camp will likely be established on the site which will alleviate some of the pressure on accommodation demands in the nearest town of Mudgee.

6.4.3 Assessment approach

The outcomes of the SIA Scoping Worksheet indicate that the potential social impacts and benefits that may occur during construction and operation would require a standard level of assessment in the EIS. This assessment is likely to include:

– A desktop review of relevant secondary data sources including population and economic data and research.
– Consultation with relevant local stakeholders such as Council's, Lake Burrendong State Park, local accommodation providers, community groups, local business chambers, and local Aboriginal stakeholders.
– EIS communication and engagement activities would also provide key input to the assessment process.

6.5 Amenity

6.5.1 Noise and vibration

Existing environment

Land uses surrounding the site are predominantly agricultural and low-density residential. The area surrounding the site is representative of a rural area. Sensitive receivers have been identified within 5 km of the reservoirs and connecting water conveyance tunnel, within 1 km of proposed access road upgrades, and within 1 km of the proposed transmission line alignment. These are identified in Table 6.5.

There are no schools, churches or other identified sensitive receivers within 5 kms of the Project site. The Cudgegong River Holiday Park is a sensitive receiver north of the site which may potentially be affected by access road upgrade works.

Table 6.5 Identified structures and potential residential sensitive receivers

ID	Address	Lot/DP	Approximate position of dwelling from Project	Comment
1	589 Endacott Road, Yarrabin	Lot 4 DP 756872	2.3 km northeast of upper reservoir	Dwelling and shed
2	Highland Home Road, Yarrabin	Lot 6 DP 756872	3.4 km east-northeast of upper reservoir	Dwelling
3	Highland Home Road, Yarrabin	Lot 12 DP 756903	3.3 km east of upper reservoir	Dwelling
4	Highland Home Road, Yarrabin	Lot 12 DP 756903	3.8 km east of lower reservoir	Dwelling and shed
5	1390 Black Willow Road, Hargraves	Lot 58 DP 756915	4.7 km southeast of upper reservoir	Dwelling
6	486 Fashions Mount Road, Yarrabin	Lot 54 DP 756872	1 km northwest of access road upgrades near Cudgegong River Holiday Park	Dwelling or shed
7	689 Burrendong Dam Road, Yarrabin	Lot 51 DP 756872	500 m northwest of access road upgrades near Cudgegong River Holiday Park	Cudgegong River Holiday Park
8	1519 Wallawaugh Road, Hargraves	Lot 1 DP 786247	4.5 km east of upper reservoir	Dwelling
9	1511 Wallawaugh Road, Hargraves	Lot 2 DP 786247	4.8 km east of upper reservoir	Dwelling
10	1000 Mookerawa Road, Mookerawa	Lot 215 DP 756871	1 km west of proposed transmission line	Mookerawa Waters Holiday Park

There are no existing significant noise sources in the vicinity of the site. There are no existing sources of vibration in the area. No sensitive heritage structures exist that would be potentially impacted by vibration.

Potential impacts

During construction, noise has the potential to be generated as a result of the following activities:

– Site establishment works
– Movement of heavy and light vehicles to and from site (construction traffic)
– Loading and unloading of material and waste
– Construction of reservoirs and water conveyance tunnel.

Noise generating activities during construction works are likely to exceed the noise management limits, however, considering the distance to the nearest sensitive receivers, noise is unlikely to impact sensitive receivers or cause sleep disturbance for any nearby residential dwellings.

Construction of the transmission line and upgrades to the access tracks have the potential to generate noise and impact nearby sensitive receivers. Assessment of these impacts would be considered at the EIS stage of the Project once the study areas have been confirmed.

Sources of vibration during construction would be from:

– Heavy vehicle movements
– Drilling or tunnelling activities.

It is expected that sensitive receivers are located at a sufficient separation distance to be unaffected by vibration. This will be assessed in further detail during the preparation of the EIS. The proposed construction schedule minimises the construction period (and associated construction noise and vibration) as far as practicable.

In terms of operational noise and vibration, the pump-turbines in the powerhouse are to be located deep within the silo powerhouse (about 80-90 m below ground level) with limited surface infrastructure. Accordingly, operation of the Project is not expected to give rise to any adverse noise or vibration impacts. This is particularly the case given that sensitive receivers are located at a sufficient separation distance to be unaffected by operational noise and vibration.

Assessment approach

A detailed quantitative assessment of the potential impacts of construction and operation noise and vibration on sensitive receivers will be undertaken to support the EIS. The significance of these impacts will be assessed in accordance with relevant guidelines. This would include:

– Baseline noise monitoring to identify the background noise levels
– Modelling of construction and operational activities and noisy equipment
– Identification of noise minimisation measures and modelling the effectiveness of these measures.

Consultation will be undertaken with sensitive receivers potentially impacted by the Project, including those near access routes.

6.5.2 Visual

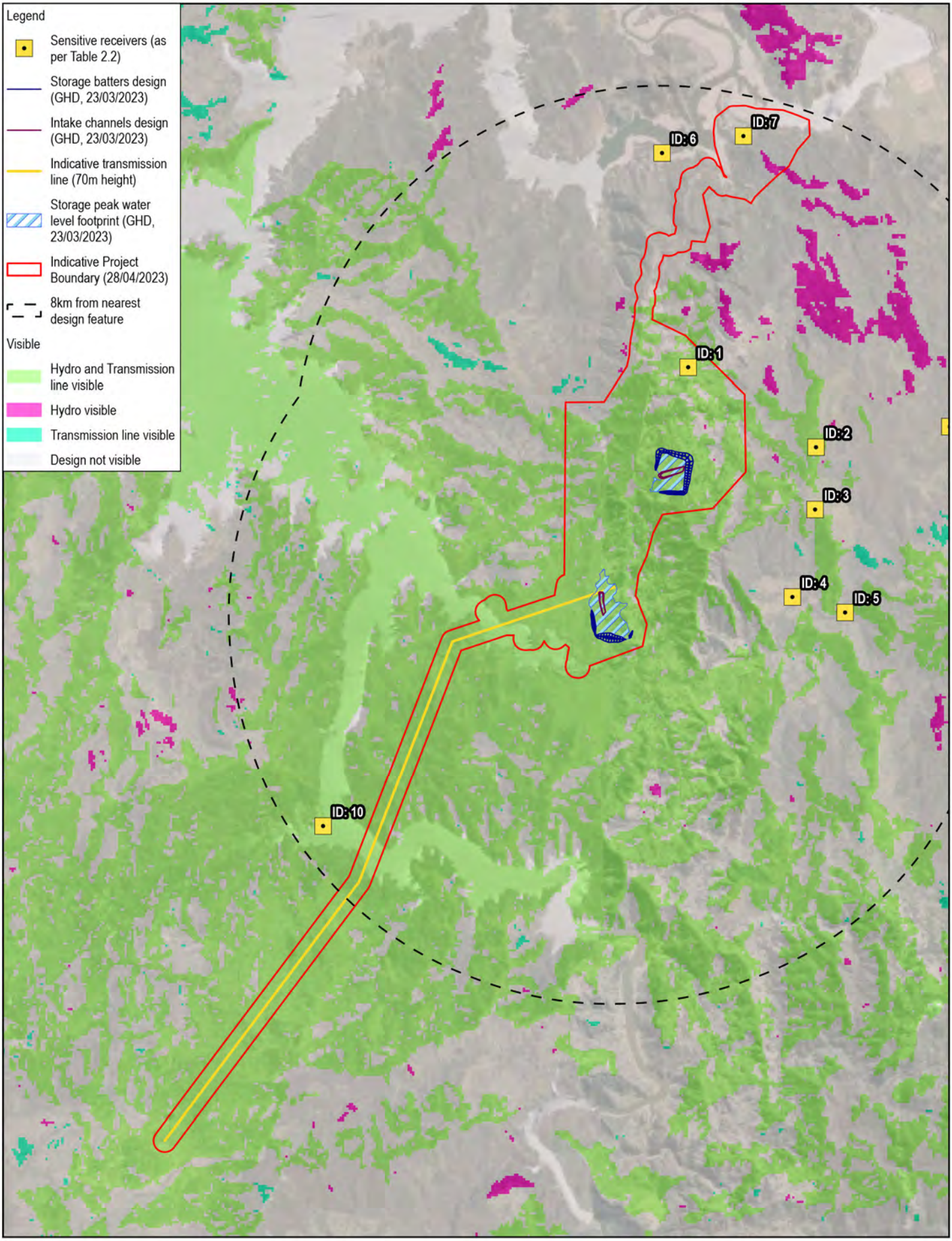
Existing environment

The site is characterised by generally open undulating terrain, dropping steeply off the escarpment to the south towards Lake Burrendong. Lake Burrendong is visible to the south-west from the escarpment. Views to and from the site are of undulating grazed pasture interspersed with native forest, with very few if any man-made structures visible. The site is located about 160 kms south of the Siding Spring Observatory, therefore the *Dark Sky Planning Guideline* is applicable.

Potential impacts

Construction of the reservoirs, connecting tunnel, access road upgrades and transmission line have the potential to have a visual impact in the landscape. However, with regard to the reservoirs and connecting tunnel, this area is sufficiently separated from sensitive receivers and potential viewpoints that no significant visual impacts are anticipated. In addition, the proposed excavated vertical shaft and tunnel from the upper reservoir to the powerhouse will be completely underground, avoiding any visual impacts. However, the proposed surge tank may extend about 5 m above ground as a concrete

structure. This would be backfilled with soil to conceal the tank, however this has the potential to create some visual impacts. A Preliminary Zone of Visual Influence figure has been produced for the Project, provided at Figure 6.4.



Paper Size ISO A4

0 1 2 3 4

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

GHD

ACEN Phoenix Pty Ltd
Phoenix Pumped Hydro
Scoping Report

Project No. **12532827**
Revision No. **F**
Date **30/06/2023**

Zone of Visual Influence

FIGURE 6.4

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Print date: 30 Jun 2023 - 15:23

The Project also has the potential to incorporate lighting that may affect dark sky observing conditions at the Siding Spring Observatory.

Assessment approach

A Landscape and Visual Impact Assessment will be undertaken for the EIS, to assess visual impacts of the Project from sensitive receivers and public vantage points. This assessment will also consider lighting impacts on the night sky as per the *Dark Sky Planning Guideline*.

6.6 Water

6.6.1 Existing environment

Surface water

The site is located within the Macquarie surface water catchment and the Macquarie-Castlereagh Surface Water Resource Plan area. The Macquarie River catchment is part of the Murray-Darling Basin in Central-West NSW, and together with the Castlereagh River covers seven per cent of the Murray Darling Basin area and contributes 8.4 per cent of water to the Murray Darling Basin.

Lake Burrendong is located about 1.5 kms south-west of the site at its closest point. The proposed upper reservoir is located at the head of an ephemeral stream that flows to the north into Steep Creek, which flows into Lake Burrendong. The proposed lower reservoir is located in a valley between two minor ridgelines; a minor creek traverses this valley, which flows south into Oakey Creek and Lake Burrendong.

The combined catchment of the two proposed reservoirs is about 2.5 km^2, while the catchment of Lake Burrendong is about 13,886 km^2. Therefore, the proposed reservoirs will at most affect about 0.02% of the catchment of Lake Burrendong. The site is not identified within a mapped flood prone area as indicated on the Dubbo Regional LEP 2022.

Groundwater

The Cudgegong River Holiday Park (close to the proposed access route) is mapped on the Groundwater Vulnerability Map of the Dubbo Regional LEP 2022. There is one bore located on the site; this water is used for agriculture. There are no other known bores in close proximity to the site.

6.6.2 Potential impacts

Construction

Water will be required during construction, for both concrete works and for dust suppression. The source of this water is yet to be determined. Potential sources may include groundwater if excavation works intersect groundwater, or Lake Burrendong.

In addition, Project elements (e.g. power station and water conveyance tunnel) are likely to intersect groundwater and require dewatering during construction. The potential impacts on both water quality and quantities will be further investigated during the preparation of the EIS.

Operation

Considering the site's proximity to Lake Burrendong, it is proposed that bulk water would be purchased from WaterNSW to initially fill the reservoirs and ongoing minor purchases to replace evaporation losses. Initial filling of the reservoirs would be required to provide dead storage below minimum

operating level in both reservoirs, to provide the live storage of 12 GL and an additional 2 GL for evaporation contingency. This is expected to total about 16.2 GL to be purchased from WaterNSW. The water would be purchased when general supply is available either by agreement with WaterNSW or through a water sales agent. Annual evaporative losses from the Project are expected to be about 400-500 ML/yr. These losses would be replaced by further purchases of water from Lake Burrendong.

Emergency spillways are proposed for both reservoirs, to provide for emergency releases of water from the reservoirs. This water would be untreated raw water from Lake Burrendong, and therefore would not contain any chemicals or other contaminants that would impact the quality of water in Lake Burrendong. The emergency spillways would be designed to avoid scour and erosion impacts on the downstream receiving environment.

6.6.3 Assessment approach

A Surface Water Impact Assessment will be undertaken for the EIS, covering Project impacts on waterways and drainage, and construction and operational phase water quality. This assessment will also cover proposed water purchases from Lake Burrendong, including the risk of scarcity during drought.

A Groundwater Impact Assessment will be undertaken for the EIS to determine potential impacts of proposed excavation on groundwater drawdown, groundwater recharge and nearby groundwater users.

6.7 Property

6.7.1 Existing environment

The Project is located on lands of the Wiradjuri people. A search of the Native Title Claims register undertaken in November 2022 identified claim NC2018/002 - Warrabinga-Wiradjuri #7, which covers a small portion of the site near the Cudgegong River Holiday Park and extends from this holiday park in the west to Wollemi National Park in the east, and from Dunedoo in the north to Lithgow in the south.

Table 6.6 identifies key property information for the site.

Table 6.6 Key property information

	Upper reservoir	Lower reservoir	Water conveyance shaft and tunnel	Surface powerhouse	330 kV transmission line
Lot and DP	Lots 4, 13, 37 and 38 of DP 756872	Lots 5 and 6 of DP 756903	Lots 6 and 17 of DP 756903	Lot 6 of DP 756903	Various – transmission line options cover large area
Ownership and lease areas	Privately owned	WaterNSW	WaterNSW	WaterNSW	
Land use zoning	RU1 Primary Production	C3 Environmental Management	C3 Environmental Management	C3 Environmental Management	

The site of the Project is currently used for livestock grazing. Land within the vicinity of the site is either undeveloped or developed for agricultural use, and comprises landholdings greater than 200 hectares in size. The broader locality is characterised by agricultural land uses and rural residential properties.

6.7.2 Potential impacts

The Project will change the land use of the site from agriculture to electricity generation. This has the potential to impact surrounding rural and primary production land uses, and result in potential land use

conflict. The Project has a relatively small operational footprint, therefore the Project is unlikely to impact the viability of current agricultural practices across the site. There is the potential for agricultural activities (e.g. grazing) to continue in the areas immediately adjacent to the Project once operational.

Acquisition of privately owned land in the vicinity of the upper reservoir (i.e. lots 4, 13, 37 and 38 of DP 756872) is proposed. A long term lease is proposed for the portion of the site that traverses WaterNSW land.

6.7.3 Assessment approach

To assess potential impacts of the Project with regard to adjoining land uses, the EIS would be supported by an assessment of the compatibility of the construction and operation of the development with existing land uses, including:

– Consideration of the zoning provisions applying to the land
– Completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide*.

6.8 Other matters

This section provides an overview of other environmental matters for those environmental aspects that, based on existing information and the description of the Project, would require limited or no further assessment in the EIS.

Table 6.7 Summary of relevant information for issues other than key issues for the Project

Environmental matter	Existing environment	Potential impacts	Level of assessment/assessment approach
Air	The air quality in the locality of the Project is generally good, as indicated by the air quality monitoring stations at Orange and Dubbo (NSW Government 2022). A search of the National Pollutant Inventory did not identify any facilities within a 10 km radius of the Project. Existing air quality would generally be impacted by dust from agricultural activities, or by strong winds in drought conditions.	Construction activities, particularly earthworks and stockpiling activities, have the potential to generate dust mobilised and transported by wind. Truck and other vehicle movements over unsealed roads also create the potential for dust generation, while the vehicles themselves generate emissions. Therefore, construction activities could result in increases in concentration of PM10 and PM2.5 particulates, and could also result in short term, localised impacts on sensitive receivers.	An Air Quality Impact Assessment will be undertaken at EIS stage to determine the existing air quality conditions of the site, sources of potential air pollutants and dust, predictions of air quality emissions during the construction phase, and analysis of potential impacts on air quality against relevant assessment criteria. Sensitive receivers potentially impacted by air quality emissions (including construction dust) will be consulted as part of the EIS.
Built environment	Existing built forms in the locality are low-density residential dwellings and agricultural structures.	No buildings will be demolished or impacted by the proposed works.	No further assessment is required given the built environment will not be affected by the Project.

Environmental matter	Existing environment	Potential impacts	Level of assessment/assessment approach
Hazards and risks	The site is mapped as bushfire prone land vegetation categories 1 and 2, and vegetation buffer. The site is not mapped within a flood prone area under the Dubbo Regional LEP 2022. A search of the EPA contaminated sites register did not identify any contaminated sites within the locality of Yarrabin. Based on historical aerial photography, the site has been used for agricultural purposes for over 60 years, and broadscale clearing for agriculture had already occurred in the region by 1963 (NSW Government 2020). Agricultural activities have the potential to introduce fertilisers, pesticides and herbicides. The use of agricultural machinery and plant also have the potential to result in accidental spills of hydrocarbons and lubricants.	Construction: – Operation of plant and equipment during construction has potential for an ignition source of fire. – Unexpected finds of contamination could occur from historical agricultural practices. – Potential fire hazard poses a risk to construction activities which could lead to loss or damage to equipment and plant, or introduce safety risk to personnel. Operation: – The Project introduces the potential of dam failure and subsequent inundation of downstream areas of both reservoirs. However, the Project would be designed to meet relevant engineering standards therefore dam failure is not considered to be a realistic potential outcome. – The Project has the potential to generate a variety of wastes during construction and operation and can result in contamination of soils and waterways. Appropriate storage, handling and management of hydrocarbons, fuels and wastes would be important to minimise potential impacts to the environment. – Potential fire hazard remains relevant during operation, which could lead to loss or damage to equipment and plant, or introduce safety risk to personnel. – The proposed 330 kV transmission line connection could pose a fire ignition hazard if constructed too close to vegetation or if appropriate maintenance is not undertaken.	A Bushfire Assessment will be undertaken to support the EIS. A Surface Water Impact Assessment (including consideration of hydrology) will also be undertaken. To assess the potential for historic contaminated soils, a Preliminary Site Investigation (PSI) will be undertaken for the EIS.

Environmental matter	Existing environment	Potential impacts	Level of assessment/assessment approach
Land	The topography of the area is variable, with gentle slopes and ridges north of the escarpment, and a steep drop south of the escarpment down to Lake Burrendong. Local soil landscapes are mapped as Mookerawa on the upper and lower portions of the site and Burrendong in the central (steep) portion of the site (eSpade 2022). Mookerawa exhibits minor to moderate sheet erosion, and moderate gully erosion, while Burrendong exhibits moderate to severe sheet and gully erosion. The site is not mapped as containing Acid Sulphate Soils under the Dubbo Regional LEP 2022. A search of the NSW Environment Protection Authority (EPA) contaminated sites and notified sites database undertaken in November 2022 did not return any results for the site or surrounding areas. The local and regional area is predominantly dominated by agricultural land use supporting grazing, as well as areas of native vegetation. Agricultural land uses within the site could involve the application of fertilisers, herbicides and pesticides which have the potential to be present within the soils.	**Construction** Site establishment and construction of the Project would involve some land clearance, excavation and fill, which would alter the local landscape. Soil erosion could mobilise sediment that could be transported downstream into Lake Burrendong during major rainfall events. Movement of construction plant over exposed surfaces may lead to erosion and compaction of soils. Topsoil and subsoil materials stockpiled during construction have the potential to become mobilised by wind or rain. Construction of the transmission line and upgrades to access tracks have the potential to generate soil erosion. Assessment of these impacts would be considered at the EIS stage once the study areas have been confirmed. Potential contaminants may be present in the soil from previous land uses which could become mobilised. Management of the site and soil stockpiles would be important to prevent increased erosion and potential off-site sedimentation. If unexpected contamination is identified this would need to be managed in accordance with the EPA Guidelines on the Duty to Report Contamination (EPA 2015) under the Contaminated Land Management Act 1997 (CLM Act). There is also potential for localised contamination of soils due to maintenance activities or spills. **Operation** The Project would result in an alteration of the landform at the upper and lower reservoirs. This change in topography could impact local drainage lines in the vicinity of these reservoirs. **Adjacent uses** Burrendong Resources Pty Ltd holds an exploration licence (reference EL9375) for Group One (1) minerals. This licence covers a portion of the site, and areas to the west of the site. Based on publicly available information online, it is understood that Burrendong Resources Pty Ltd (operating as Burrendong Minerals Ltd) intends to mine for gold in areas west of the site.	Undertake detailed investigations to determine the site sub surface conditions, erosion potential, soil characterisation and potential existing contamination. To assess the potential for historic contaminated soils, a Preliminary Site Investigation (PSI) will be undertaken for the EIS.

6.9 Cumulative impacts

Cumulative impacts of the Project would be assessed in the EIS. The assessment would focus on the Project's key issues that have the potential to generate cumulative impacts with other projects in the vicinity which are likely to have concurrent construction and/or operational timeframes.

A search of the DPE Major Projects database was undertaken in March 2023 to identify SSD and SSI projects within the vicinity of the Project that may be relevant for the EIS cumulative impact assessment. This search identified the Burrendong Wind Farm (SSD-8950984), a 650 MW wind farm proposed to be constructed on ridgelines on and surrounding the Project site. This project is currently at the 'Prepare EIS' stage. There is the potential for the two projects to be constructed concurrently, including access road and transmission requirements. In addition to the Burrendong Wind Farm, it is noted that a number of other renewable energy projects are currently in various stages of development within the Dubbo Regional LGA and Mid-Western Regional LGA, and may be constructed concurrently with the Project. This could place pressure on the regional centres of Mudgee, Wellington and Dubbo to house the workforce for these projects.

The Project may generate cumulative biodiversity, social, visual, Aboriginal heritage, noise and traffic impacts with the Burrendong Wind Farm proposal (SSD-8950984). The biodiversity, social, visual impact, Aboriginal heritage, noise and traffic assessments would include consideration of cumulative impacts, and these would be summarised in the EIS in accordance with the *Cumulative Impacts Assessment Guidelines for State Significant Projects* (DPE 2022b).

The Project also has the potential to generate significant positive cumulative impacts in conjunction with other renewable energy projects in the CWO REZ to decarbonise energy generation in NSW. It is also expected that the combined renewable energy projects in the region will have positive cumulative impacts on the regional economy and economies of Mudgee, Wellington and Dubbo resulting from expenditure on local goods, services and employment.

7 References

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Appendix A

Scoping summary table

Table A.1 Scoping summary table

Level of assessment	Matter	Cumulative impact assessment?	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
Detailed	Biodiversity	Yes	General	Biodiversity Assessment Method (Department of Planning, Industry and Environment 2020)	Section 6.1
Detailed	Aboriginal cultural heritage	Yes	Specific	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (Office of Environment and Heritage 2011) Aboriginal Cultural Heritage Consultation Requirements for Proponents (Department of Environment, Climate Change and Water 2010)	Section 6.2.1
Standard	Historic heritage	No	General	Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch of the Department of Planning 2009)	Section 6.2.2
Detailed	Access	Yes	Specific	Guide to traffic management Part 12: Integrated Transport Assessments for Developments (Austroads 2020)	Section 6.3
Detailed	Social	Yes	Specific	Social Impact Assessment Guideline (Department of Planning and Environment February 2023)	Section 6.4
Standard	Amenity – noise and vibration	Yes	Specific	Noise Policy for Industry (Environment Protection Authority 2017) Interim Construction Noise Guideline (Department of Environment, Climate Change and Water 2019) NSW Road Noise Policy (Guideline (Department of Environment, Climate Change and Water 2011) Assessing vibration: A technical guideline (Department of Environment, Climate Change and Water 2006)	Section 6.5.1
Detailed	Amenity - visual	Yes	Specific	Dark Sky Planning Guideline (Department of Planning and Environment 2016) Guidelines for Landscape and Visual Impact Assessment Third Edition (2013) (GLVIA), prepared by the Landscape Institute and Institute of Environmental Management and Assessment	Section 6.5.2
Detailed	Water	No	General	Australian and New Zealand guidelines for fresh and marine water quality (ANZECC & ARMCANZ 2000) Guidelines for Groundwater Protection in Australia Guidelines for Groundwater Documentation for SSD/SSI Projects – Technical guideline	Section 6.6
Detailed	Property	No	General	Land Use Conflict Risk Assessment Guide (Department of Primary Industries 2011)	Section 6.7
Standard	Air	No	General	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2016)	Section 6.8

Level of assessment	Matter	Cumulative impact assessment?	Engagement	Relevant government plans, policies and guidelines	Scoping report reference
No further assessment	Built environment	No	General	N/A	Section 6.8
Standard	Hazards and risks	No	General	Planning For Bushfire Protection (NSW Rural Fire Service 2019) Assessment Guideline: Multi-Level Risk Assessment (Department of Planning and Infrastructure, 2011) Waste Classification Guidelines Part 1: Classifying Waste (NSW Environment Protection Authority, 2014) Guidelines for the Assessment and Management of Groundwater Contamination (NSW Environment Protection Authority 2007) NSW Waste and Sustainable Materials Strategy 2041: Stage 1: 2021-2027 (NSW Department of Planning, Industry and Environment, 2021)	Section 6.8
Standard	Land	No	General	National Environment Protection (Assessment of Site contamination) Measure (National Environment Protection Council 2011) Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (Environment Protection Authority 2015)	Section 6.8

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