Liddell Battery and Bayswater Ancillary Works Project

Environmental Impact Statement

IS334000

March 2021

AGL Macquarie Pty Limited

Certification

Submission of environmental impact statement prepared under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979*.

Name:	Tina Donovan, Jennifer Shaw and Thomas Muddle		
Qualifications:	Tina Donovan - Bachelor of Science (Resource and Environmental Management) and Bachelor of Applied Science (Chemistry and Microbiology) Thomas Muddle - Graduate Diploma of Urban and Regional Planning and Bachelor of Environmental Science Jen Shaw - Bachelor of Environmental Studies (Hons): Environment and Business and Diploma in Environmental Assessment		
Address:	Jacobs Group (Australia) Pty Ltd Level 4, 12 Stewart Avenue, Newcastle West, NSW 2302		
Responsible person:			
Name:	Mr Neil Cooke Senior Manager Project Development, AGL Energy Limited		
Address:	Liddell Power Station and Bayswater Power Station, New England Highway, Muswellbrook, New South Wales, 2333.		
Environmental impact statement prepared by:			
Jacobs Group (Australia) Pty Ltd			
Address of the land on which the infrastructure to which the statement relates:			
Liddell Power Station and Bayswater Power Station, New England Highway, Muswellbrook, New South Wales, 2333.			
Environmental impact statement prepared by:			
An environmental impact statement is attached addressing all matters in accordance with Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979*.			
Declaration:	This Environmental Impact Statement contains all available information that is relevant to the environmental assessment of the development. I certify that I have prepared the contents of this environmental impact statement in response to the Secretary's environmental assessment requirements dated 23 September 2020 and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. To the best of my knowledge the information contained in the environmental impact statement is not false or misleading.		
Name:	Tina Donovan	Signature:	
Date:	27/03/2021		

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Glossary of terms and abbreviations

Terms and abbreviations	Definition
AAET	Areal actual evapotranspiration
ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHCRP	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*
AEC	Area of environmental concern
AEGIS	Australian Greenhouse Emissions Information System
AEMO	Australian Energy Market Operator
AGLM	AGL Macquarie Pty Limited
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ALARP	As low as reasonably practicable
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
Approved Methods	NSW EPA's Approved Methods for the Modelling and Assessment of Air Pollutants in NSW
APZ	Asset Protection Zone
AQIA	Air Quality Impact Assessment
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARTC	Australian Rail Track Corporation
ASS	Acid Sulphate Soils
BC Act	*Biodiversity Conservation Act 2016*
BAM (Biodiversity Assessment Method)	Established under section 6.7 of the BC Act to assess impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values, where required under the BC Act.
BAW	Bayswater Ancillary Works
BCD	Biodiversity Conservation Division
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BFPL	Bush Fire Prone Land
BOM	Bureau of Meteorology
BOS	Biodiversity Offsets Scheme
BTEXN	Benzene, toluene, ethyl benzene and xylenes
BWAD	Bayswater Ash Dam
CALPUFF	A Lagrangian air quality dispersion model

Terms and abbreviations	Definition
CCGT	Combined cycle gas turbine
CCTV	Closed-circuit television
CDG	AGL Macquarie Community Dialogue Group
CEEC	Critically Endangered Ecological Communities
CEMP	Construction Environmental Management Plan
CEMS	Construction Environmental Management Strategy
CLM Act	*Contaminated Land Management Act 1997*
CLMA	*Crown Land Management Act 2016*
CMS Act	*Coal Mine Subsidence Compensation Act 2017*
CNE	Former NSW Roads and Maritime Services Construction Noise Estimator
CNVG	Construction Noise and Vibration Guideline
COAG	The Council of Australian Governments
Coastal Management SEPP	State Environmental Planning Policy (Coastal Management) 2018
COP 21	UNFCCC Paris Climate Conference
COPC	Contaminants of Potential Concern
COVID-19	Coronavirus disease
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalents.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSM	Conceptual site model
CSSI	Critical State Significant Infrastructure
CTMP	Construction traffic management plan
DAWE	Department of Agriculture, Water and the Environment
dB	Decibel
dB(A)	A-weighted decibels
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment Climate Change and Water
DPE	Department of Planning and Environment (now known as Department of Planning, Industry and Environment)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
DRG	Division of Resources and Geoscience
EEC	Endangered Ecological Community

Terms and abbreviations	Definition
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electromagnetic fields
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
EP&A Act	*Environmental Planning and Assessment Act 1979*
ERF	Emissions Reduction Fund
ERP	Estimated resident population
ESB	Energy Security Board
ESD	Ecologically sustainable development
ESOO	Electricity Statement of Opportunities
ETMHC	Electricity Transmission Ministerial Holding Corporation
FCAS	Frequency Control Ancillary Services
FFR	Fast Frequency Response Services
FM Act	*Fisheries Management Act 1994*
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gases
GWH	Gigawatt-hour
GWP	Global warming potential
Heritage Act	*Heritage Act 1977*
HIPAP	DPIE's Hazardous Industry Planning Advisory Paper No. 6
HRSTS	Hunter River Salinity Trading Scheme
HVAC	Heating, ventilation, and air conditioning
IBRA	Interim Biogeographic Rationalisation for Australia
ICNG	*Interim Construction Noise Guideline*
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMOS	International Council on Monuments and Sites
IPCC	International Panel on Climate Change
ISCA	Infrastructure Sustainability Council of Australia
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ISMC	Infrastructure Sustainability Materials Calculator

Terms and abbreviations	Definition
ISO	International Organisation for Standardisation
ISP	Integrated System Plan
Koala SEPP	State Environmental Planning Policy (Koala Habitat Protection) 2020
kV	Kilovolt
L_{Aeq}	Sound level in decibels equivalent to the total A-weighted sound energy
LALC	Local Aboriginal Land Council
LEP	Local environmental plan
LGA	Local government area
LSC	Land and soil capability
MNES	Matters of national environmental significance
MW	Megawatt
MWh	Megawatt-hour
NEM	National Energy Market
NGER	National Greenhouse Gas and Energy Reporting
NHVR	National Heavy Vehicle Regulator
NML	Noise management level
NPI	NSW EPA's *Noise Policy for Industry*
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service
NRAR	Natural Resources Access Regulator
NSCAS	Network Support and Control Ancillary Services
NSW	New South Wales
NVA	Noise and vibration assessment
OEH	Office of Environment and Heritage (now known as the Department of Premier and Cabinet (Heritage) or Heritage NSW)
OOH	Out-of-hours (outside recommended standard hours)
OSOM	Oversized overmass
PAD	Potential archaeological deposit
PARF	AGL's Powering Australian Renewables Fund
PCT	Plant community type
PHA	Preliminary Hazard Analysis
Pipelines Act	*Pipelines Act 1967*
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate matter less than or equal to 10 micrometre diameter

Terms and abbreviations	Definition
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometre diameter
POEO Act	*Protection of the Environment Operations Act 1977*
RAP	Registered Aboriginal Parties
RBLs	Rated background level
RFS	NSW Rural Fire Service
Roads Act	*Roads Act 1993*
Rural Fires Act	*Rural Fires Act 1997*
SCM	Supplementary cementitious material
SEARs	Secretary's Environmental Assessment Requirements
SEPP SRD	State Environmental Planning Policy (State and Regional Development) 2011
SEPP 33	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No 55– Remediation of Land
SHR	NSW State Heritage Register
SIA Guidelines	*Social Impact Assessment Guideline for State significant mining, petroleum production, and extractive industry development*
SRAS	System Restart Ancillary Services
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
TRH	Total Recoverable Hydrocarbons
TSP	Total suspended particulates
TTA	Traffic and transport assessment
UGOH	Underground to overhead
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
V	Volt
WAL	Water access licences
WAOAW	Bayswater Water and Other Associated Operational Works project
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
Water Act	*Water Act 1912*
WBCSD	World Council for Sustainable Business Development
WHS Act	*Work Health and Safety Act 2011*
WM Act	*Water Management Act 2000*
WRI	World Resources Institute

Executive Summary

Background

AGL Macquarie Pty Limited (**AGLM**) owns and operates the Bayswater Power Station (**Bayswater**) which is approved to generate up to 2,740 megawatt **(MW**), the 2,000 MW Liddell Power Station (**Liddell**), the 50 MW Hunter Valley Gas Turbines and associated ancillary infrastructure systems. Together, Bayswater, Liddell and the Hunter Valley Gas Turbines operate to produce around 23,000 gigawatt hours (**GWh**) annually, or approximately 35 per cent (**%**) of New South Wales' **(NSW**) electricity supply.

AGLM is seeking approval for the Liddell Battery and Bayswater Ancillary Works Project (**the Project**). The Project is a State Significant Development (**SSD**) under the *State Environmental Planning Policy (State and Regional Development) 2011* (**SEPP SRD**) and is subject to Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**) which requires the preparation of an Environmental Impact Statement (**EIS**) in accordance with Secretary's Environmental Assessment Requirements (**SEARs**).

Project overview and purpose

AGLM are progressing plans to facilitate the efficient, safe and reliable continuation of electricity generating works from Bayswater and the Liddell site. The Project consists of the following:

- **The Battery**: A grid connected Battery Energy Storage System with capacity of up to 500 MW and 2 GWh
- **Decoupling works**: Alternative network connection arrangements for the Liddell 33 kilovolt (**kV**) switching station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and potential third-party industrial energy users
- **Bayswater Ancillary Works** (**BAW**): Works associated with the ongoing operation of Bayswater which includes (but is not limited to), upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, expansion or demolition
- **Consolidated consents:** A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets.

Construction works associated with the Battery and Decoupling works would likely involve as follows:

- Installation and maintenance of environmental controls including temporary and permanent water management infrastructure
- Establishment of access from the existing Liddell access roads
- Demolition or deconstruction of existing equipment as required
- Establishment of a hardstand pad and construction laydown areas
- Cut and fill to Battery compound, transformer compounds, footings and construction laydown area
- Trenching and installation of cable from the Battery to 330 / 33 kV transformer compounds
- Structural works to support Battery enclosures, inverters, transformers, buildings and transformer compounds
- Delivery, installation and electrical fit-out of the Battery
- Delivery, installation and fit out of transformers and ancillary equipment for Decoupling works
- Testing and commissioning activities
- Removal of construction equipment and rehabilitation of construction areas.

Alternatives

The Project's overall purpose and objective is to continue to provide dispatchable energy and other network services to the NEM from the AGLM landholding and facilitate the increased penetration of renewable energy into the network.

AGLM continues to consider all options for responding to the ongoing transition occurring within the NEM. Alternatives for the Project have been assessed and include the following:

- Power generation alternatives such as wind, solar, gas fired and nuclear
- Site and technology selection for the Battery
- A "Do Nothing" option.

It has been identified from reviewing the above options that the Project, as described in this EIS, best meets the Project's objective of facilitating the efficient, safe and reliable continuation of electricity generating works from Bayswater and the Liddell site.

Location and existing environment

Liddell and Bayswater are located approximately 15 kilometres (**km**) south-east of Muswellbrook, 25 km north-west of Singleton and approximately 165 km north-west of Sydney. The total area of the AGLM landholding is approximately 10,000 hectares (**ha**), including the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands.

The Project is located within an area dominated by mining and power generation. The locality is heavily influenced by industrial activity. Local land use is dominated by large-scale infrastructure associated with Bayswater and Liddell and open cut mining activities at Ravensworth Mine Complex, Mount Arthur Coal, Hunter Valley Operations, Liddell Coal Mine and Maxwell project. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGLM landholding.

The nearest residential receiver to the Battery is the Lake Liddell Recreation Area's owner's residence, located approximately 2 km north of the Battery and Decoupling works areas. While the nearest sensitive receiver to BAW footprint is at Jerrys Plain, approximately 700 metres (**m**) to the south of the Project.

The New England Highway runs between Liddell and Bayswater, with access from the highway provided by means of a dedicated road network designed to service the power stations. The Northern Railway Line runs to the east of the AGLM landholding.

The majority of the AGLM landholding has been previously disturbed during the construction and operation of Liddell and Bayswater and historic agricultural activity.

Statutory context

The Project is located within the Muswellbrook and Singleton Local Government Areas (**LGAs**). The land on which the Project is proposed to be carried out is zoned SP2 Infrastructure: Power Station and RU1 Primary Production respectively. Under clause 34 of State Environmental Planning Policy (Infrastructure) 2007 (**ISEPP**) 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. Land which is zoned SP2 and RU1 are prescribed zones for the purposes of clause 34 of ISEPP. Accordingly, the Project is permissible with development consent.

The Project is for the purpose of "electricity generating works" as defined in the Standard Instrument (Local Environmental Plans) Order 2006 and the SEPP SRD and has a capital investment value of more than $30 million. The Project is accordingly SSD under the SEPP SRD and requires assessment in accordance with

Division 4.7 of the EP&A Act. The Independent Planning Commission or the Minister for Planning and Public Spaces (by delegate) is the consent authority for SSD under Division 4.2 of the EP&A Act.

An *Environmental Protection and Biodiversity Conservation Act 2000 (***EPBC Act**) referral (2020 / 8844) was made to the Department of Agriculture, Water and the Environment (**DAWE**) on 20 November 2020 to consider whether the Project would be a controlled action. On 8 January 2021, DAWE determined the Project is not a 'controlled' action under the EPBC Act. Accordingly, the Project does not require assessment or approval under the EPBC Act.

This EIS has been prepared addressing the Planning Secretary's SEARs issued by the NSW Department of Planning, Industry and Environment (**DPIE**) on 23 September 2020 and focuses on key issues of hazards, traffic and transport, biodiversity, land and contamination, heritage, air quality and greenhouse gas (**GHG**), noise and vibration, visual, waste, water and socio-economic impacts. The SEARs also require consideration of infrastructure, cumulative and long term management impacts and risk assessment to confirm no other key issues requiring assessment may arise. The EIS has not found any issues that would preclude the approval of the Project by the consent authority.

A summary of the findings of assessments of the key environmental issues identified in the SEARs is provided in the following sections.

Hazards and risk

The Preliminary Hazard Analysis (**PHA**) found that the Project can be managed in accordance with the established risk criteria and in accordance with as low as reasonably practicable (**ALARP**) principles.

All hazards including fire events, magnetic and electromagnetic fields (**EMF**), hazardous materials or reactions, leaks and spills would be mitigated by employing a combination of common management measures, including following all applicable standards, separation distances and setbacks, physical protection, and control systems measures.

Traffic and transport

The AGLM landholding is connected to the surrounding road network via an access road and grade-separated interchange to and from the New England Highway. This interchange currently operates at a good level of service with abundant spare capacity.

During construction, the expected additional traffic generated by each component of the Project would be about:

- The Battery (Stages 1 to 3) – 200 daily light vehicle movements and 40 daily heavy vehicle movements
- Decoupling works – 100 daily light vehicle movements and 20 daily heavy vehicle movements
- BAW – 200 daily light vehicle movements and 100 daily heavy vehicle movements.

In addition, up to 43 one way oversized overmass (**OSOM**) deliveries and 43 unladen return trips could be expected throughout the construction period for the delivery of large components to the Project area.

Traffic modelling carried out as part of the traffic assessment for construction peak scenario found that queue lengths are expected to be very low and are not expected to extend into, nor impact the New England Highway operations. In addition, there is excess capacity at the interchange to accommodate the cumulative additional traffic generation on the New England Highway without having a large impact on the operation of the highway.

During operation, the Battery and Decoupling operations would require negligible vehicle movements, whilst the BAW operations would be consistent with existing Bayswater operations. As such, the overall operation of the Project would not result in impacts to the performance of the road network.

Biodiversity

The development site is located within a highly disturbed landscape that does not possess large expanses of intact native vegetation and generally has a low ecological value. The limited amount of native vegetation (mostly rehabilitation or regrowth) that would be disturbed is of poor to moderate quality and threatened species habitats are limited.

The Project may require the clearing of up to 42.3 ha of native vegetation (worst case total), which includes about 13.9 ha of the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions Threatened Ecological Community (**TEC**) listed under the *Biodiversity Conservation Act 2016* (**BC Act**). One patch (2.04 ha) of the EPBC Act listed TEC - Central Hunter Eucalypt Forest and Woodland Ecological Community is located within the development site and would be retained. One species credit threatened species, the Southern Myotis, is assumed to be directly impacted through the potential loss of up to 10 ha of habitat.

Considering the highly disturbed nature of the landscape within the development site, there are not expected to be any significant indirect impacts that would adversely affect areas of vegetation that would be retained.

Where impacts on biodiversity cannot be avoided or minimised, appropriate offsets would be provided.

Land and contamination

Targeted contamination assessments have previously been conducted across "areas of environmental concern" (**AECs**) at the AGLM site. These areas were identified as having the potential to be impacted from power station activities conducted since Bayswater and Liddell were initially constructed.

Key impacts of the Project relevant to land and contamination include erosion and sedimentation from earthworks, and contamination risks associated with historical land uses which may be encountered during earthworks.

Significant remedial works are unlikely to be required as part of the Project. Contamination risks associated with the Project can readily be managed by the implementation of a Construction Environmental Management Plan (**CEMP**) and are not an impediment to the implementation of the Project.

Aboriginal heritage

Seventeen previously recorded sites listed on the Aboriginal Heritage Information Management System (**AHIMS**) are located in proximity to or within the development site, two of which are recorded as being destroyed. All sites are artefact scatters on open ground, one artefact scatter also includes potential archaeological deposit (**PAD**).

A field survey was carried out in November 2020, covering all areas within the Project area where impacts are proposed. Thirteen new sites and one previously recorded site were identified within the area assessed and these consisted of isolated finds and artefact scatters. The significance of all 13 new sites was found to be low, using the assessment criteria described in the Australia ICOMOS Burra Charter (Australia ICOMOS, 2013).

There are 12 sites wholly within the development site which have the potential to be directly impacted by construction of the Project. All of these are expected to be harmed in their entirety. A small portion of one site is located within the development site and would potentially be subject to impact, in the event of pipeline repair works. Although impacts to Aboriginal items are unavoidable, environmental management measures including surface collection prior to construction.

No adverse impacts on Aboriginal cultural heritage (either direct or indirect) are anticipated following completion of construction of the Project.

Air quality

The Project will not result in any changes to the air emissions generated from coal combustion at Bayswater and Liddell. The air quality assessment determined that the Project would not result in changes to local air quality outside of historical variations. Further, the Project would not result in additional exceedances of the Environment Protection Authority's (**EPA**) impact assessment criteria during construction and operation.

However, given that elevated particulate matter concentrations associated with development across the Hunter Valley have historically occurred at representative receiver locations near the Project area, management measures would be implemented to limit the potential for cumulative air quality impacts.

Greenhouse gases

The construction and operation of the Battery is expected to contribute a total of 1.52 metric tons of carbon dioxide equivalent (**$MtCO_2e$**) over the course of its 20 year operating life.

During construction, emissions are dominated by those relating to the manufacture of the Battery components. The transport of the components to site is relatively small in comparison, and the construction process itself is not an energy intensive process. Vegetation clearance is the second largest source of emissions.

The operation of the Battery does not generate direct emissions nor does it generate electricity. Instead, it increases the GHG intensity of the electricity supplied to the National Energy Market (**NEM**) as a result of system losses. The operational assessment documents the GHG intensity implications for the NEM of the Project. The assessment illustrates that during the first year of full operation (2026), the Battery would increase the carbon intensity of electricity supplied to the NEM via the Project, but this would drop during later year of operation when renewables are expected to form the majority of generation in NSW.

AGL has publicly announced its intention to transition towards a low-carbon future and respond to the NEM and customer requirements. Liddell is approaching its end of life and is scheduled for closure in 2023. Bayswater would continue to be operated through to 2035 to support the transition of the NEM toward net-zero emissions and then is intended to be retired. AGL has committed to closing all coal fired generation assets in its portfolio by 2050.

Noise and vibration

The noise and vibration assessment (**NVA**) determined that construction noise levels would be within criteria for identified sensitive receivers, and that the additional construction traffic movements would not result in unacceptable changes in traffic noise levels at sensitive receivers along the local road network. The NVA also concluded that operational noise would not result in unacceptable impacts at the identified sensitive receivers.

Non-Aboriginal heritage

There are no listed non-Aboriginal heritage items within the Project area. The nearest heritage item within the vicinity of the Project is the Inn and Outbuildings (former) listed on the State Heritage Register (**SHR**) (00242) and Singleton LEP 2013 (I34), which is located approximately 500 m north of the BAW, to the east of Bayswater.

No listed non-Aboriginal heritage items or features are likely to be impacted by the construction and operation of the Project.

Visual amenity

The Project is located within an area dominated by mining and power generation. The location of the Battery and Decoupling works would be located immediately adjacent to Liddell turbine hall and Liddell 330 kV switchyard

(**Liddell switchyard**). This area is not visually prominent within the landscape due to mature trees and existing power-related infrastructure surrounding the site.

The visual impacts during construction would include clearing of vegetation and stockpiling of debris from construction activities, and would be limited to AGLM personnel and contractors, and construction personnel.

During operation, the visual impacts of the BAW are considered negligible as limited views exist and the composition and character of views of Bayswater and ancillary infrastructure would be substantially unaltered. The Battery and Decoupling components have the potential to introduce a change within the landscape that may be visible from publicly accessible locations. This would include the installation of containerised batteries and additional electrical infrastructure with possible overhead powerlines. However, the viewpoint analysis carried out as part of the visual impact assessment determined that the overall visual impacts of the Battery and Decoupling components of the Project would be negligible.

Waste

Waste would be generated during construction of the Project. This waste would be typical of construction projects and would be classified and managed in accordance with industry standard practices.

The operation of the Project would not generate additional waste streams or alter waste management processes beyond improvements to how waste liquids from Bayswater are stored prior to disposal.

Waste management for the Project would be based on the waste management hierarchy established by the objectives of the *Waste Avoidance and Resource Recovery Act 2001* (**WARR Act**). Any necessary waste disposal would be undertaken using licenced waste transporters and facilities. Local disposal options are available for all anticipated waste streams.

Battery technology is in its early stage of deployment and maturity and the rapid increase in deployment makes end of life planning for batteries an important consideration. At this stage, AGLM have not appointed a technology supplier and do not have an agreement that the batteries will be returned to the supplier at the end of their useful life. Where possible, all components of the asset would be recycled or reused as to align with the preferences of the waste hierarchy and it is anticipated, based on review of current recycling schemes and opportunities, that most components would be recycled at end of life.

Water

Waterways in the Project area are highly disturbed and are not classified as sensitive receiving environments.

Potential impacts to water quality and hydrology during construction would be limited to erosion and sedimentation resulting from ground disturbance, stockpiling, transportation of materials and run-off. Indirect impacts to surface water and groundwater may occur as a result of potential spills or leaks during construction, however, with appropriate environmental management measures in place, construction activities are unlikely to result in any significant adverse effects on water quality, groundwater and hydrology.

The operation of the Project would not change the water use and the site water management system or require any new water discharge points under the environment protection licences (EPL's) held for the sites. The Project would involve the establishment of new permanent impervious surfaces that would include drainage management to prevent potential risks of soil erosion and subsequent transportation of sediment into nearby receiving waterways.

Water required for the Project would be drawn from within the existing AGLM water allocations and would be negligible compared to existing uses. The Project would not substantially alter the Bayswater and Liddell water balance.

The nature of the BAW components, being either environmental improvements aimed at reducing water quality risks or otherwise in keeping with existing conditions, mean water impacts are limited.

Social and economic impacts

During construction, potential socio-economic benefits and impacts of the Project would mainly be associated with direct and indirect employment opportunities for up to 250 people, benefits for businesses that support construction activities, increased construction traffic, demand for workforce accommodation, and potential impacts on community values. Due to the remoteness of the Project to sensitive uses, construction activities are not expected to result in construction noise, dust or lighting impacts that would affect local communities.

Once operational, the Project would benefit communities, businesses and industry by increasing the reliability in the NEM, as well as supporting the transition to a low carbon energy future. The key benefits of the Battery are in providing energy storage and firming capacity to enable the transition from thermal generation to a renewable future. The key benefits of the remainder of the Project is in facilitating the ongoing operation of Bayswater identified as a critical component of NSW's energy future until its planned retirement in 2035.

Infrastructure impacts

Within the development site, the existing Liddell switchyard and transmission lines are the only infrastructure that would be impacted by the Project. The Battery and Decoupling works would be located next to the Liddell switchyard which is owned by the Electricity Transmission Ministerial Holding Corporation (ETMHC) and operated by TransGrid, with some parts of the Decoupling works being within TransGrid easements (i.e. the connection into the Liddell switchyard).

Prior approval from ETMHC would be sought for any works required to be undertaken within the Liddell switchyard and any easements required to be created would be negotiated and agreed with TransGrid. During Battery commissioning activities it is expected there would be a short term increased risk of disruption to power supplies to Bayswater and other onsite infrastructure loads on the 33 kV network due to only one transformer being relied upon. Any increased risk to disruption to power would be managed accordingly.

Cumulative impacts

Construction specific cumulative effects would most likely occur where construction works overlap with other local projects in terms of timing and location. The scale of the impacts largely depends on the type of work, duration, and the sensitivity of surrounding land uses.

The majority of the proposed projects in the locality were not considered to interact with the Project in a manner likely to lead to any cumulative impacts. This is largely due to their distance from the Project. However, other AGLM projects and Glencore projects within or near the Project area do have the potential for localised cumulative impacts during construction. As the Project and other AGLM projects are wholly within the AGLM land holding, which includes extensive buffer lands around the site, minimal cumulative impacts on hazards, amenity (visual, air, noise and vibration), non-Aboriginal heritage and water off site are expected. In addition, the Project and other AGL and Glencore projects would implement management measures to reduce or ameliorate environmental impacts and the majority of these impacts would be temporary and localised to the AGLM landholding and would unlikely contribute to impact in the broader region.

Environmental mitigation and management

The EIS is based on a current design status for each Project component which may be amended through the detailed design process. Construction methods may vary subject to design refinements and the selection of the construction contractor.

AGLM proposes to develop an overarching Construction Environmental Management Strategy (**CEMS**) for the Project that would be adopted and implemented through the development of contractor's CEMPs. The CEMS

would document the required environmental performance outcomes, management commitments and conditions of approval for the Project and each CEMP would document reasonable and feasible measures for the Project component to implement and document these requirements.

The existing operational environmental management system (**EMS**) for Bayswater and Liddell would be reviewed to incorporate commitments and approval conditions associated with the Project. In particular, the Battery component represents a new operation that would warrant new or revised management plans. This would include the preparation of an emergency response plan, as recommended in the PHA.

Community consultation

AGLM engaged with key stakeholders throughout the development of the Project, including government (local, State and Commonwealth), service providers, community groups, landowners and the Aboriginal community. Engagement activities commenced in 2020 and have informed the development of the Project.

The EIS will be placed on public exhibition to allow stakeholders the opportunity to review the EIS and make a submission. The EIS will be available for viewing and download on the DPIE Major Projects website (www.planningportal.nsw.gov.au/major-projects).

Engagement carried out after exhibition of the EIS will focus on responding to issues raised in submissions and preparing a submissions report. This submissions report would also be available to the public via the DPIE Major Projects website. The NSW Government would then carry out a regulatory assessment and determine whether the Project should be approved, and if so, apply relevant conditions of consent to the Project.

AGL's Community Engagement Strategy enables community members to submit feedback through multiple channels including online forum, email address and a 24/7 contact number to ensure community members can provide feedback and complaints through a method that they are comfortable with. These feedback channels would be available to facilitate ongoing feedback over the duration of the Project.

Justification

The Project is necessary to facilitate the efficient, safe and reliable continuation of electricity generating works from the AGLM landholding. The essential nature of the Project is considered to outweigh any identified adverse impacts. While some environmental impacts cannot be avoided, they would be minimised where possible through both the design process and implementation of sound environmental management measures.

The Project represents a continuation of the electricity generation uses, being a form of industrial development, currently carried out on the site and does not conflict with the ongoing operations or any other currently proposed land uses.

Social costs and benefits

The Project would have some localised social impacts. Offsite social impacts would be limited to additional traffic and minor contribution to dust related air quality issues in the region. The Project does not introduce land use conflicts to any surrounding land uses and would not be audible off site at any sensitive receptor locations. Additional workers during construction and operation would require accommodation however this is not expected to exceed the capacity of the local townships. Positive social impacts include the flow-on effects of those workers accessing goods and services in the region and thedirect and indirect employment opportunities for up to 250 people.

Biophysical costs and benefits

The Project involves vegetation clearing. These impacts would be offset in accordance with the BC Act in accordance with any approval conditions. The Project supports AGL's intention to transition towards a low-

carbon future, by facilitating the planned closure and decommissioning of Liddell and the increased penetration of renewable energy into the network, which would ultimately lead to improved air quality outcomes.

Economic costs and benefits

The Project has an estimated capital investment value of about $763 million. This would be spent on the engagement of labour, materials, project components, plant and equipment. Plant, materials and equipment would be procured locally where practicable. Local benefits would also include spending by additional workers required for the Project on accommodation, food and services in the local area.

More broadly, the Project facilitates the ongoing operation of Bayswater which has previously been identified as critical to energy security within the NEM through the provision of reliable, dispatchable electricity and supporting a planned transition to a low carbon energy future.

Public Interest

The Project represents a significant and cost-efficient private investment in electricity infrastructure. It results in strong net public benefits by delivering the Battery which would provide essential energy storage and firming capacity as part of the energy transition. The Project will furthermore facilitate the efficient, safe and reliable continuation of electricity generation at Bayswater until its planned retirement in 2035.

1. Introduction

This chapter provides a general overview of the background for the Liddell Battery and Bayswater Ancillary Works Project (**the Project**) and justification of the Project including a statement of the objectives, description of the strategic need and Project outcomes. It also describes the proponent, outlines the project location and provides the purpose and structure of this environmental impact statement (**EIS**).

1.1 Project overview

AGL Macquarie Pty Limited **(AGLM)** own and operate the Bayswater power station (**Bayswater**) which is approved to generate up to 2,740 megawatt **(MW**), the 2,000 MW Liddell power station (**Liddell**), the 50 MW Hunter Valley Gas Turbines and associated ancillary infrastructure systems. Together, Bayswater, Liddell and the Hunter Valley Gas Turbines operate to produce around 23,000 gigawatt hours (**GWh**) annually, or approximately 35 percent (**%**) of New South Wales (**NSW**) electricity supply. AGL Energy Limited (**AGL**) acquired these assets, from the NSW Government in September 2014 and in doing so formed the subsidiary AGLM.

AGL has publicly announced its intention to transition towards a low-carbon future and respond to the National Energy Market (**NEM**) and customer requirements. Liddell is approaching its end of life and is scheduled for closure in 2023. Bayswater would continue to be operated through to 2035 to support the transition of the NEM toward net-zero emissions and then is intended to be retired. AGL has committed to closing all coal fired generation assets in its portfolio by 2050. As such, AGLM are now progressing an application to facilitate the efficient, safe and reliable continuation of electricity generating works from the Bayswater and Liddell site (**AGLM landholding**). The Project would consist of the following:

- **Liddell Battery (the Battery)**: A grid connected Battery Energy Storage System with capacity of up to 500 MW and 2 GWh
- **Decoupling works**: Alternative network connection arrangements for the Liddell 33 Kilovolt (**kV**) Switching Station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and third-party industrial energy users
- **Bayswater Ancillary Works (BAW):** Works associated with the ongoing operation of Bayswater which includes (but is not limited to) upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, expansion or demolition
- **Consolidated consents:** A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets (Consolidated consents).

Further separate development applications would be made for the development associated with the demolition of Liddell and Bayswater so as to facilitate the ultimate reuse of the sites following the closure of Liddell, and ultimately Bayswater. No works associated with these future activities form part of the Project.

The Project location and key components of the Project are shown in **Figure 1-1** and **Figure 1-2**, respectively. A detailed description of the Project and each component is provided in **Chapter 2**.

Because the Project is a State Significant Development (**SSD**) under the *State Environmental Planning Policy (State and Regional Development) 2011* (**SEPP SRD**), the Project is subject to Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**) (refer to **Section 3.1.1**), which requires the preparation of an EIS in accordance with Secretary's Environmental Assessment Requirements (**SEARs**) (**Appendix A**) and the approval of the Independent Planning Commission under circumstances described in SEPP SRD or the NSW Minister for Planning and Public Spaces.

The application does not seek approval for changes to how Bayswater and Liddell are operated in relation to electricity generation and no increase in coal consumption, emissions or ash generation is proposed as a result of the Project. The BAW component of the Project is intended to authorise the currently anticipated works associated with existing ancillary infrastructure of Bayswater over its remaining operational life. To the extent

any further works are proposed to be carried out at Bayswater, including in relation to its ultimate closure , these would be separately assessed under the EP&A Act and do not form part of the Project the subject of this application.

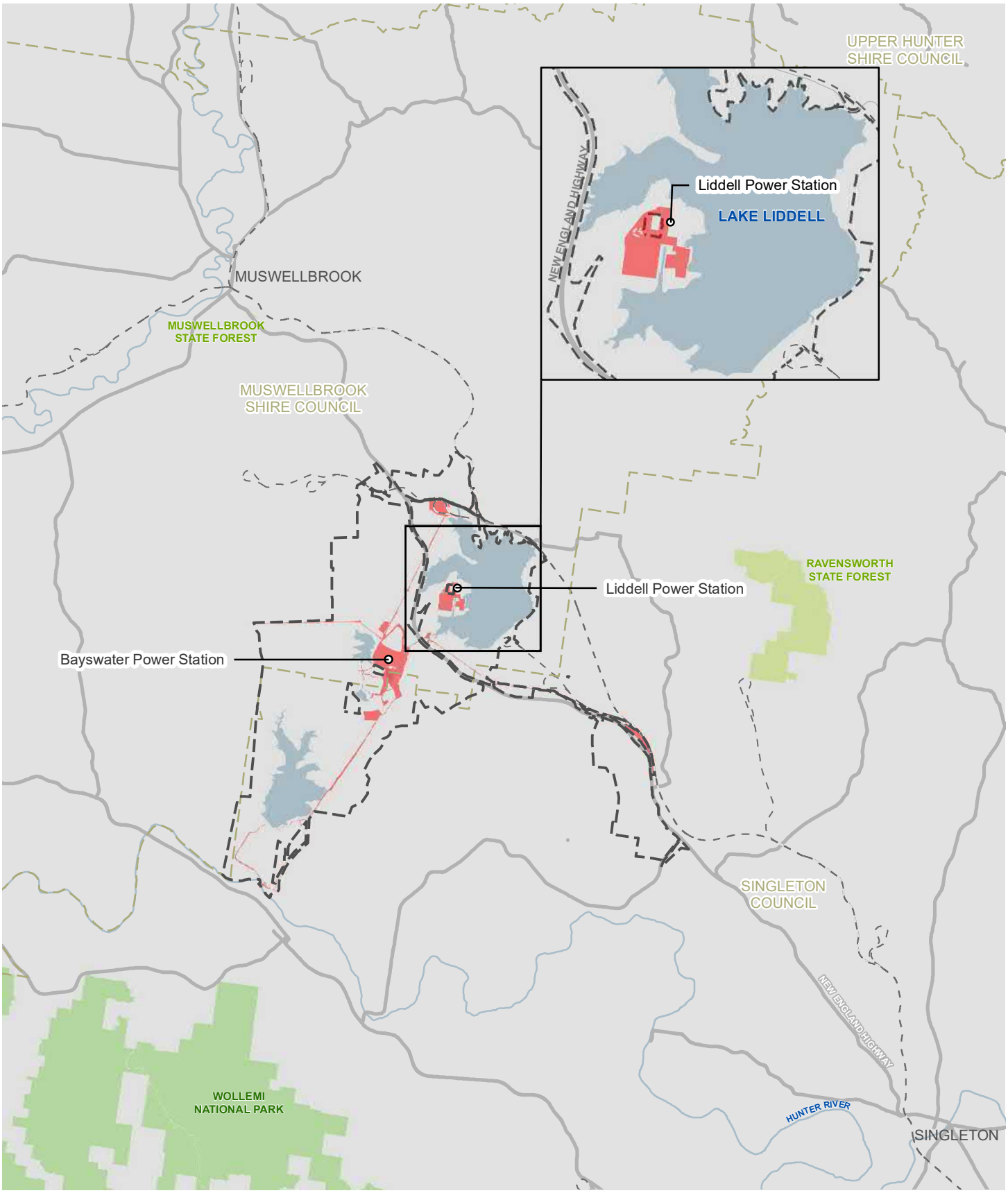
1.1.1 Definitions

For the purposes of predicting environmental impacts of the Project, a development site has been defined. The development site consists of the sum of the Battery footprint, Decoupling works footprint and BAW footprint and encompasses the extent of physical disturbance that may be required to accommodate construction activities and Project operational areas.

A broader Project area has also been defined. The Project area represents the limits of the Project and includes all aspects of the Project including the development site and consolidated consents. Not all of this area would be physically disturbed as while the Project includes the continuation of activities authorised under the consents proposed to be consolidated, no new development is proposed in these areas except to the extent included as part of the specific activities forming part of the Project.

Other terms used throughout the EIS include:

- 'The Project' refers to all items being the subject of this application
- 'Project components' refers to the separate works proposed that collectively form the Project
- 'The study area' encompasses the Project area and the area that may be of relevance to assessment of impacts for the Project. The study area varies for specialist assessments and has been defined throughout **Chapter 6**
- 'The locality' encompasses the area in a 10 km radius of the Project.



Legend

- Project area
- AGL owned land
- LGA boundary
- Railway
- Road
- Waterway
- Waterbody
- State forest
- National park

0 5 10 km

1:200,000 at A4

N

Data sources

Jacobs 2020
©Department of Finance, Service and Innovation Aug 2020
AGL 2019
GDA94 MGA56

Figure 1 - 1 Project location

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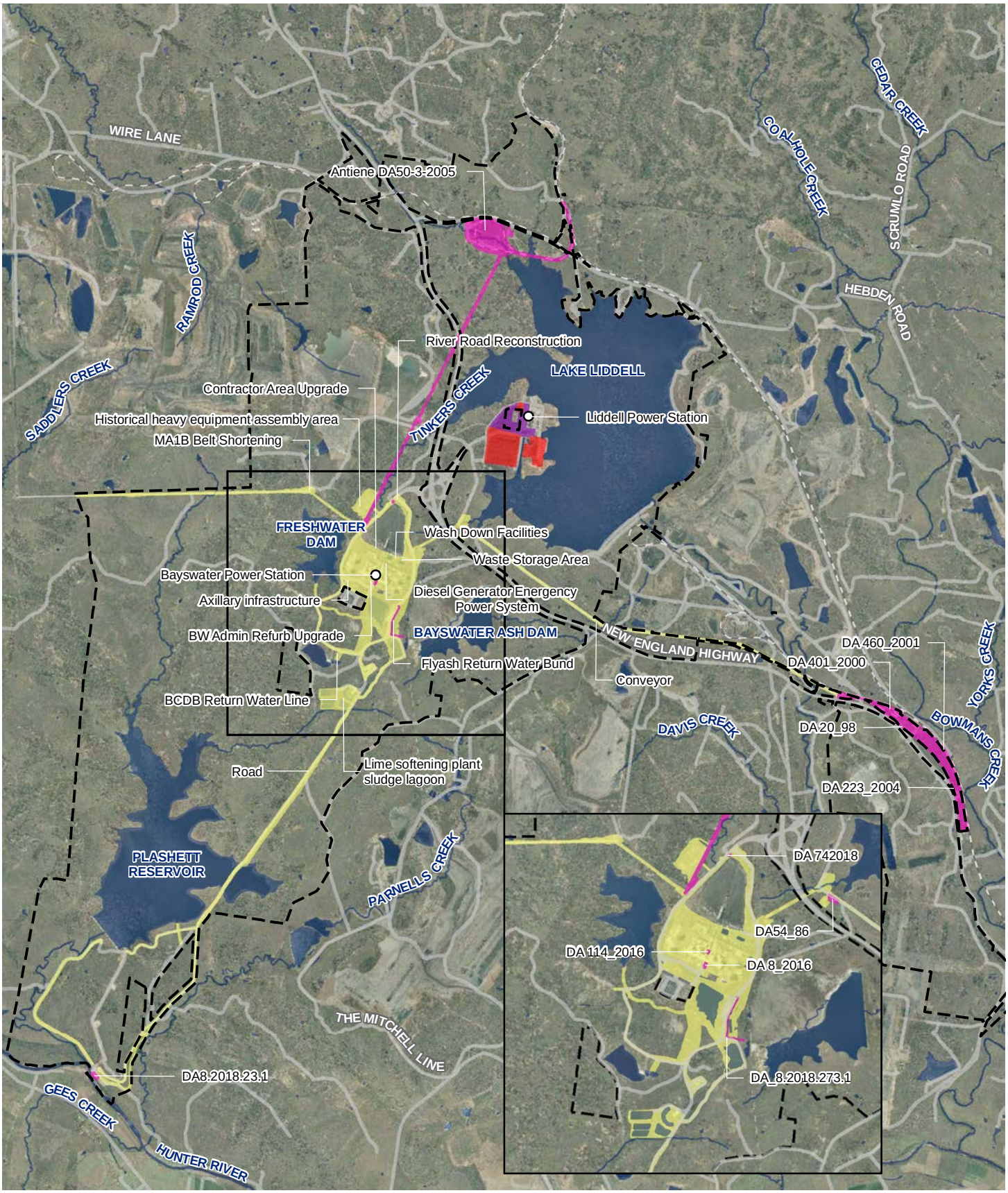

Legend

Project area
Bayswater Ancillary Works
Battery energy storage system
Decoupling area
Consolidated consent
AGL owned land

Railway
Road
Waterway
Waterbody

0 2 4km

1:90,000 at A4

Data sources
Jacobs 2021
AGL 2020
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Imagery:
© Department of Customer Service 2020

GDA94 MGA56

Figure 1 - 2 Project overview

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Created by : NT | QA by : KM

1.2 Project history

AGL acquired Liddell and Bayswater and the other assets previously owned by the former NSW Government owned Macquarie Generation, in September 2014.

Liddell was commissioned in 1971 and forms part of AGLM's integrated power generation complex. This complex also incorporates Bayswater (commissioned in 1985), the Hunter Valley Gas Turbines and a range of supporting water management, coal supply, power supply and control system infrastructure.

AGL has announced plans to cease coal fired generation at Liddell when the asset has reached the end of its current design and economic life. The generation unit retirement schedule has been set as one unit around April 2022 and the remaining three units around April 2023. The Decoupling works forming part of this Project are intended to facilitate the separation of Bayswater from Liddell ahead of the planned closure of Liddell from around April 2023.

Bayswater has a planned retirement date of 2035. Following closure of Liddell, Bayswater would continue to use much of the shared infrastructure originally built to support Liddell. The ongoing use, maintenance and upgrade of this shared infrastructure forms part of the Project application.

Over the past decade there has been a progressive increase in installed renewable generators within the NEM. Renewable generation (in particular wind and solar) is intermittent in nature, generating when wind and solar resources are available respectively. During this same period, there has been progressive retirement of thermal generators from the NEM. The transition from thermal generation to renewable generation is expected to continue into the future. There will continue to be a requirement to provide energy storage and firming capacity to enable the transition from thermal generation to a renewable future. The proposed Battery will provide storage and firming capacity to the NEM as well as additional services to assist grid stability including frequency control ancillary services. The operation of the Battery will be complementary to the ongoing operation of Bayswater.

The replacement of a portion of Liddell's dispatchable electricity supply has been identified as required for the NEM. As part of this response, AGL proposes to construct and operate a grid connected utility scale Battery. The Battery would have storage capacity to facilitate maximum discharge of up to 500 MW for a four-hour period or up to 2 GWh.

Planning approval was received for the Bayswater Turbine Efficiency Upgrade Project involving the replacement of the original turbines with modern, more efficient turbines in December 2018. The approval allowed for the replacement of one turbine per year such that the efficiency gains would be achieved to coincide with the closure of Liddell. The ongoing operation of Bayswater until 2035 has been recognised as critical to the NEM while the transition to renewables occurs. The Project includes ancillary works necessary for the ongoing safe and efficient operations of Bayswater, including further environmental improvements building on the separate Bayswater Water and Other Associated Works (**WOAOW**) project currently under assessment by the NSW Department of Planning, Industry and Environment (**DPIE**).

As part of the assessment and consultation associated with the Bayswater Turbine Efficiency Upgrade project and the WOAOW project, Muswellbrook Shire Council and DPIE highlighted, and AGLM acknowledged, that Bayswater and Liddell are regulated under several planning approvals. AGLM committed to undertake a review aimed at rationalising these approvals. This review sought to consider future operational requirements with the aim of consolidating relevant approvals, where practicable, as part of future DAs. The outcome of the review has led directly to the proposed surrender and consolidation of a number of development consents relating to the ongoing operation of shared infrastructure as part of this Project application.

1.3 Site and surrounds

The AGLM landholding is located approximately 15 kilometres (**km**) south-east of Muswellbrook, 25 km north-west of Singleton, and approximately 165 km west north west of Sydney in NSW. The total area of the AGLM

landholding is approximately 10,000 hectares (**ha**), including Bayswater and Liddell operational areas, the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands. The location of AGLM landholding is shown in **Figure 1-1**.

The Battery and Decoupling components would generally be undertaken in close proximity to Liddell and are targeting the use of previously disturbed operational lands no longer required for Liddell operations (referred to as non-process development land). The BAW would occur throughout the AGLM landholding and is located in close proximity to existing infrastructure where prior disturbance has typically occurred.

The Project is located within an area dominated by mining and power generation. The locality is heavily influenced by industrial activity. Local land use is dominated by large-scale infrastructure associated with Bayswater and Liddell and open cut mining activities at Ravensworth Mine Complex, Mount Arthur Coal, Hunter Valley Operations, Liddell Coal Mine and the Maxwell project. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGLM landholding.

There are limited sensitive receivers or social infrastructure in the locality of the Project. The closest social infrastructure and sensitive receiver is the Lake Liddell Recreation Area approximately 2 km north of the Battery and Decoupling work areas across Lake Liddell. The nearest residential receiver is the Lake Liddell Recreation Area's owner's residence, located approximately 2 km north of the Battery and Decoupling work areas. While the nearest sensitive receiver to BAW footprint is at Jerrys Plain, approximately 700 m to the south of the Project.

The New England Highway runs between Liddell and Bayswater, with access from the highway provided by means of a dedicated road network designed to service the power stations. The Northern Railway Line runs to the east of the AGLM landholding.

The majority of the AGLM landholding has been previously disturbed during the construction and operation of Liddell and Bayswater and historic agricultural activity.

The Project lies within the catchment area of the Upper Hunter Valley (**Upper Hunter**), which is the largest coastal catchment within NSW. The largest tributary of the Hunter River is the Goulburn River which joins the Hunter River approximately 25 km to the west of the Project. The Hunter River flows to the west and then around the south of the Project. The Hunter River is located about 13 km from the Project.

The Project is underlain by the Late Permian age Whittingham Coal Measures and Wollombi Coal Measures. These are primarily sub-horizontally bedded sedimentary strata comprising interbedded coal seams, claystones, tuffs, siltstones, sandstones and conglomerates (Geoscience Australia, 2019). Soil landscape mapping suggests that shallow soils comprising residual and colluvial shallow loams and sands would be anticipated on ridgelines, with brown solodic soils on the lower slopes. Sandy earths and possible siliceous sands may be observed within drainage lines on the lower slopes. The Project area elevation ranges between 90 and 250 m above sea level.

Vegetation in the Upper Hunter is characterised by forest and open woodland of White Box, Forest Red Gum, Narrow-leaved Ironbark, Grey Box, Grey Gum, Spotted Gum, Rough-barked Apple and extensive stands of Swamp Oak in upper reaches and foothills. River Oak and River Red Gum are characteristic of vegetation along the streams.

1.4 Strategic justification and project need

1.4.1 Project need

As described in **Section 1.2**, over the past decade there has been a progressive increase in installed renewable generators and progressive retirement of thermal generators from the NEM. The transition from thermal generation to renewable generation is expected to continue into the future. There will be a requirement to provide energy storage and firming capacity to enable the transition from thermal generation to a renewable future. The proposed Battery will provide storage and firming capacity to the NEM as well as additional services to assist grid stability including frequency control ancillary services.

AGL has publicly announced both an intention to transition towards a low-carbon future and respond to NEM and customer requirements. Liddell is approaching its end of life and is scheduled for closure in 2023. Bayswater would continue to be operated through to 2035 to support the transition of the NEM toward net-zero emissions and then is intended to be retired. The Decoupling works forming part of this Project are intended to facilitate the separation of Bayswater from Liddell ahead of the planned closure of Liddell from around April 2023.

Liddell will be retired in stages, with one unit retiring around April 2022 and the remaining three units retiring around April 2023. As a result of the Liddell planned retirement, a new power supply scheme to the Liddell 33 kV Switching Station is required to service Bayswater ancillary infrastructure and dependant Ausgrid electricity customers. Bayswater also relies on the ongoing use of shared infrastructure including water and coal supply systems.

Dispatchable electricity and other network services are increasingly important to the stability of the NEM as intermittent renewable energy enters the market. The Project is needed to replace dispatchable electricity into the NEM following the planned retirement of Liddell and to provide other network services required due to increased penetration of renewables into the NEM.

This Project aims to take advantage of the sites strategic location within the NEM by utilising the connection capacity that would result from the closure of Liddell and existing transmission infrastructure. The Battery is expected to operate by charging the Battery during low electricity demand periods and discharging during high demand periods and can provide a range of services based on market signalling.

1.4.2 Statement of Project objectives and expected outcomes

The Project's overall purpose and objective is to continue to provide dispatchable energy and other network services to the NEM from the AGLM landholding and facilitate the increased penetration of renewable energy into the network. These objectives, and the Project itself are aligned with the principals of sustainable development as discussed in **Section 9.1.1**.

The Project would meet this objective by delivering the following outcomes:

- Supporting the ongoing operation of Bayswater until its planned end of life by facilitating the separation of Bayswater from Liddell and the BAW works required to further support the ongoing operation of Bayswater
- Provision of a battery providing up to 500 MW over a four hour discharge duration of dispatchable energy
- Provision of the following essential networks services required by the NEM to maintain stability:
  - Wholesale energy market services
  - Frequency Control Ancillary Services (FCAS), for all regulation and contingency services
  - Fast Frequency Response (FFR) service
  - System Restart Ancillary Services (SRAS)
  - Network Support and Control Ancillary Services (NSCAS), for all service types
  - Demand management services for local network service providers (NSPs)
  - Reliability support services

It is considered highly likely that based on these opportunities, the Project could be constructed and operated in an economically feasible manner with limited short term construction impacts and long term environmental and social impacts significantly lower than those associated with the existing operation of Liddell.

1.5 Alternatives considered

AGLM continues to consider all options responding to the ongoing transition occurring within the NEM. At a generation portfolio level, this is demonstrated in AGL's NSW Generation Plan, which included plans for the retirement of Liddell, and the resulting changes to its portfolio to assist in meeting the potential electricity market gap that this would create. The Battery was identified in this document as part of the plan to replace the loss of generation capacity which will follow the closure of Liddell.

At site and Project level, alternatives for the Project have and continue to be developed throughout the design stages to make sure the design best meets the Project objectives and has consideration for environmental, social, and economic outcomes. Alternatives have been assessed for:

- Power generation alternatives such as wind, solar, gas fired and nuclear
- Site selection and technology selection for the Battery
- A "Do Nothing" option.

1.5.1 Power generation alternatives

Commercial power generation alternatives available include:

- Wind and solar
- Hydro-electric and pumped storage
- Battery storage
- Gas fired peaking power stations
- Nuclear.

Solar and wind power generation are viable commercial solutions, however, are an intermittent energy generation, that requires dispatchable electricity generation to 'firm' the supply. More viable solar and wind development locations are located off site and while AGL are investing in these forms of generation, and may consider them for the site in the future, as non-dispatchable generation they do not meet the Project objective.

Pumped storage facilities are geographically constrained and have long development and construction periods. AGL are investigating the feasibility of pumped hydro in various locations but no on site options that would be available in the immediate term have been identified.

Nuclear generation is prohibited under the *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* and AGL has no plans to generate electricity in this manner.

Gas-fired peaking power stations can meet a variable demand, and have lower atmospheric emissions of GHGs, oxides of nitrogen and sulphur dioxide when compared to coal power stations. These are fast-start facilities that can be turned on to meet peak demands. Gas generation has previously been considered at the site but would require significant investment in gas supply which is not currently considered viable.

The Battery option was selected as the preferred option as it would provide the best means of meeting the objective of supplying dispatchable energy and other network services to the NEM from the AGLM landholding. Furthermore, it facilitates the increased penetration of renewable energy into the network. AGLM would continue to invest in the efficient operation of Bayswater until its retirement.

1.5.2 The Battery options

AGL has reviewed options regarding Battery technology through a request for tender to current Battery technology providers. Currently viable options to provide the services AGL are looking to provide were limited to lithium ion type batteries and all options were offered in the form of containerised arrangements.

The selection of locations for the Battery has been driven by proximity to the available connection point, land ownership, availability and compatibility with Liddell demolition works and the minimisation of clearing requirements. While other land is available within the AGLM landholding, the selected Battery locations are considered most suitable.

1.5.3 BAW options

The BAW components respond to the ongoing operational requirements of Bayswater and as such location options are limited to that of the existing infrastructure and no other alternatives beyond a do nothing option are considered.

1.5.4 Do Nothing option

The 'Do Nothing' option was not considered to be a feasible alternative to the overall Project on the following basis:

- AGL needs to replace Liddell generation to meet contracted supply agreements with customers
- The Decoupling works are necessary to allow ongoing operation of Bayswater and for the contracted supply of electricity to Ausgrid for third parties post Liddell closure.

A do nothing option for some BAW components may be viable. Other components of BAW which AGLM are seeking approval for include environmental improvements that may be driven by obligations under the AGLM landholding EPLs. Overall, the BAW components generally facilitate improved operations of Bayswater from either a safety, efficiency, reliability or environmental perspective and as such are preferable to a do nothing scenario.

1.6 Proponent

AGLM is the owner and operator of Bayswater and Liddell as well as the proponent for the Project. The AGLM landholding and generation assets were acquired from the former NSW Government owned, Macquarie Generation, in September 2014.

AGLM is owned by AGL and forms a key component of the company's generation portfolio. AGL operates base load, peaking and intermediate electricity generation plants supplying energy using traditional thermal generation as well as renewable sources including hydro, wind and solar. AGL employs over 8,300 people across Australia.

Bayswater and Liddell currently produce approximately 12 % of the electricity needed by consumers in the NEM. Bayswater and Liddell employ over 600 people in the Hunter Valley, with most living in the Hunter region. The assets in the Hunter Valley have been a major source of employment to the region over the last 30 years and contribute more than $1.35 billion annually to the regional economy.

AGL supplies energy and other services to almost 4.2 million customer accounts. AGL are committed to making energy, alongside other essential services, simple, fair and transparent. AGL operates the largest electricity portfolio in the NEM made up of traditional coal and gas-fired generation, and renewables such as wind, hydro and solar. AGL also operate gas storage and production assets. AGL is focussed on developing flexible supply, building on their history as Australia's leading private investor in renewable energy, to support the transition to a new energy system. AGL are dedicated to making things better for communities, customers, the Australian economy and our planet.

Bayswater, which shares infrastructure with Liddell, is scheduled for closure in 2035. Closure would be in accordance with AGL's Greenhouse Gas Policy (AGL, 2015) and the commitments made in AGL's Climate Statement & Commitments (AGL, 2020). The AGL Rehabilitation Report (AGL, 2017a) outlines how AGL is approaching the challenges associated with rehabilitating large, long-lived assets and infrastructure and provides an overview of processes, strategies and timelines that are considered in the development of

rehabilitation plans. Further seperate planning applicationswill be made for the development associated with the ultimate demolition and rehabilitation of Liddell and Bayswater so as to facilitate the ultimate reuse of the sited following the closure of Liddell, and ultimately Bayswater and no works associated with these future activities form part of the Project.

Until Bayswater and Liddell are retired, AGL would continue to invest in the assets in accordance with all regulatory requirements and the commitments made in the AGL Health, Safety and Environment Policy.

1.7 EIS Structure and purpose

The EIS has been prepared to address the form and content requirements of the *Environmental Planning and Assessment Regulation 2000* (**EP&A Regulation**) and the *Environmental Protection and Biodiversity Conservation Act 2000* (**EPBC Act**) and regulations including Project specific SEARs. The EIS is structured as follows:

- **Chapter 1** provides a general Project overview and describes the environmental and historic context in which it would occur. It also identifies the need and strategic justification for the Project, and details the Project objectives and alternatives considered
- **Chapter 2** provides the full description of the Project including activities associated with construction, operation and decommissioning, where relevant, of each Project component based on current available design information
- **Chapter 3** provides the statutory context for the Project
- **Chapter 4** provides the strategic context of the Project
- **Chapter 5** provides a summary of consultation undertaken by AGLM with the relevant local, State or Commonwealth Government authorities, exploration licence and mining lease title holders, service providers, community groups and affected landowners
- **Chapter 6** provides an assessment of key environmental issues, assesses the impacts and proposes environmental management measures
- **Chapter 7** provides an assessment of other environmental issues, assesses the impacts and proposes environmental management measures
- **Chapter 8** provides a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS, and how these measures would be integrated with the existing environmental management, monitoring and reporting regime for Bayswater and Liddell
- **Chapter 9** details the risk analysis process by which the potential environmental issues for assessment were identified
- **Section 10** presents an evaluation of the Project as a whole, drawing conclusions on the overall merits of the Project
- **Appendix A** provides the Project SEARs and the EP&A Regulation compliance and cross reference table
- **Appendix B** lists the consents to be surrendered
- **Appendix C** Traffic and Transport Assessment (**TTA**)
- **Appendix D** Contamination assessment
- **Appendix E** Biodiversity Development Assessment Report (**BDAR)**
- **Appendix F** Aboriginal heritage assessment
- **Appendix G** Hazard and risks assessment report
- **Appendix H** Air quality assessment
- **Appendix I** Greenhouse gas assessment methodology

- **Appendix J** Noise and Vibration Assessment (**NVA**)
- **Appendix K** Visual Impact Assessment (**VIA**)
- **Appendix L** Political donation statement
- **Appendix M** Additional Project details.

Table 1-1 outlines the SEARs and where they are addressed in this EIS.

Table 1-1: SEARs compliance requirements

Requirement	Location where this is addressed in the EIS
General requirements	
The Environmental Impact Statement (EIS) must comply with the requirements of Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the EP&A Regulation) including:	This EIS and **Appendix A.2**.
▪ the information required under clause 6 of Schedule 2 of the EP&A Regulation;	The certification page is provided at the beginning of the EIS.
▪ the content listed in clause 7 of Schedule 2 of the EP&A Regulation, including, but not limited to:	
▪ a stand-alone executive summary;	Executive summary
▪ a full description of the project, including: ▪ all components, materials and activities required to construct the project (including any infrastructure that would be required for the project, but the subject of a separate approvals process); ▪ site plans and maps at an adequate scale; ▪ the location and dimensions of all project components; and ▪ likely staging or sequencing of the project, including construction and rehabilitation;	**Section 1.1** provides an overview of the Project. A full description of the Project is contained in **Chapter 2** including: ▪ A Project overview in **Section 1.1** ▪ Description of Project components in **Sections 2.2, 2.3** and **2.4** ▪ Project staging and timing in **Section 2.1** **Figure 1-1** shows the Project location and **Figure 1-2** illustrates the development site and Project components.
▪ the likely interactions between the project and any other existing, approved or proposed major projects in the vicinity of the site	Cumulative impacts are addressed in **Section 6.15.**
▪ a statement of the objectives of the project, including a description of the strategic need, justification, objectives and outcomes (including a detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market);	**Section 1.4** provides a discussion of strategic justification and project need and objectives including: ▪ Project need in **Section 1.4.1** ▪ Project objectives and expected Project outcomes **Section 1.4.2.** The strategic context is provided in **Section 4**

Requirement	Location where this is addressed in the EIS
▪ an analysis of feasible alternatives to the carrying out of the project, including an analysis of options considered having regard to the project objectives, the suitability of the chosen option and whether or not the project is in the public interest;	The alternatives that were considered are discussed in **Section 1.5.**
▪ an analysis of the project, including an assessment, with a particular focus on the requirements of the listed key issues, in accordance with clause 7(1)(d) of Schedule 2 of the EP&A Regulation (where relevant);	A description of the Project is provided in **Chapter 2** and statutory context in **Chapter 3.** An environmental impact assessment of key issues is provided in **Chapter 6.** Environmental management measures are provided in **Chapter 7.**
▪ an identification of how relevant planning, land use and development matters (including relevant strategic and statutory matters) have been considered in the impact assessment (direct, indirect and cumulative impacts) and/or in developing management/ mitigation measures;	The statutory context of the Project is included in **Chapter 3.**
▪ a compilation of the measures proposed to mitigate any adverse effects of the project on the environment;	A compilation of environmental management measures is included in **Chapter 7.**
▪ a justification for the preferred project taking into consideration the objects of the Environmental Planning and Assessment Act 1979 (EP&A Act); and	The justification of the Project is discussed in **Section 9.1** and consideration of the objects of the EP&A Act is included in **Section 9.2.**
▪ a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS	A compilation of environmental management measures is included in **Chapter 7.**
▪ a conclusion evaluating the merits of the project, having regard to the requirements in Section 4.15 of the EP&A Act). While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the EP&A Regulation, the development application must be accompanied by a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the EP&A Regulation), including details of all the assumptions and components from which the capital investment value calculation is derived.	Consideration of Section 4.15 of the EP&A Act is provided in **Section 9.3**.

Requirement	Location where this is addressed in the EIS
Key issues	
The EIS must address the following specific issues with the level of assessment of likely impacts proportionate to the significance of, or degree, of impact on, the issue, within the context of the project location and the surrounding environment:	
Hazards and Risk – including: ▪ a preliminary hazard analysis (PHA) prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis'* and *Multi-level Risk Assessment*; and ▪ an assessment of potential hazards and risks including but not limited to bushfires, electromagnetic fields or the proposed grid connection infrastructure against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields*;	A preliminary hazards analysis is included in **Appendix G.** An assessment of hazards and risks associated with the Project is included in **Section 6.1.**
Air – including: ▪ an assessment of the likely air quality impacts of the project in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016); d ▪ demonstrated ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Clean Air) Regulation 2010; and ▪ an assessment of the likely greenhouse gas impacts of the project;	An air quality assessment is provided in **Appendix H** and summarised in **Section 6.2**. An assessment of likely GHG impacts is included in **Section 6.3**.
Noise and vibration – including: ▪ an assessment of the likely construction noise impacts of the project under the *Interim Construction Noise Guideline* (DECCW, 2009); ▪ an assessment of the likely operational noise impacts of the project under the *NSW Noise Policy for Industry* (EPA, 2017); ▪ an assessment of the likely road noise impacts of the project under the *NSW Road Noise Policy* (EPA, 2011); and ▪ an assessment of the likely vibration amenity and structural impacts of the project under *Assessing Vibration: A Technical Guideline* (DEC. 2006) and *German Standard DIN 4150-3 Structural Vibration – effects of vibration on structures*;	The NVA is provided in **Appendix J** and summarised in **Section 6.3**
Traffic and Transport – including: ▪ details of traffic types and volumes likely to be generated by the project; ▪ details of the proposed transport routes, site access, safety issues and requirements for road works or upgrade;	The TIA is provided in **Appendix C** and summarised in **Section 6.2**

Requirement	Location where this is addressed in the EIS
▪ an assessment of the likely impacts of the project on the capacity, condition, safety and efficiency of the road network, in particular heavy vehicles, oversize/ over-mass vehicles; and ▪ details of measures to mitigate and / or manage potential impacts during construction, developed in consultation with the relevant road and rail authorities (if required);	
Biodiversity – including: ▪ an assessment of the biodiversity values and direct and indirect biodiversity impacts of the development throughout its life in accordance with the *Biodiversity Conservation Act 2016* (NSW), the *Biodiversity Assessment Method* (BAM), and documented in a *Biodiversity Development Assessment Report* (BDAR), including a strategy to offset any residual impacts, unless a BDAR waiver is granted; ▪ the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and ▪ a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time;	The BDAR is provided in **Appendix E** and summarised in **Section 6.6.**
Land and Contamination – including: ▪ an assessment of impacts of the project on soils, land capability and geotechnical stability of the site and surrounds; ▪ an assessment of the extent and nature of any contaminated materials or acid sulphate soils on site; ▪ as assessment of potential risks to human health and the receiving environment; and ▪ a description of the measures that would be implemented to avoid or mitigate impacts;	An assessment of land and contamination impacts of the Project is provided in **Appendix D** and summarised in **Section 6.7.**
Heritage – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the project, including adequate consultation with Aboriginal stakeholders having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH, 2010);	The ACHAR is provided in **Appendix F** and summarised in **Section 6.8.** An assessment of non-Aboriginal heritage impacts is included in **Section 6.9.**
Visual – including: ▪ an assessment of the likely visual impacts of the development on the amenity of the surrounding area, private residences near the development and local road network; and ▪ a detailed description of the measures that would be implemented to minimise the visual impacts of the development;	The VIA is provided in **Appendix K** and summarised in **Section 6.10.**

Requirement	Location where this is addressed in the EIS
Waste – including identification, quantification and classification of the likely waste streams likely to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste including waste to be used for reclamation or other project activities;	An assessment of waste generated by the Project is included in **Section 6.11.**
Water – including: ▪ a description of water demand, a detailed water balance, a breakdown of water supplies and the measures to minimise water use; ▪ an assessment of the likely impacts of the development (including flooding) on the quantity and quality of the region's surface and groundwater resources, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; ▪ a description of the proposed water management system, water monitoring program and all other proposed measures to mitigate surface water and groundwater impacts; and ▪ a description of the erosion and sediment control measures that would be implemented to mitigate any impacts during construction;	An assessment of surface water, flooding and hydrology impacts of the Project are provided in **Section 6.12.**
Social and Economic – including an assessment of the social and economic impacts and benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services;	The social and economic impacts of the Project are discussed in **Section 6.13.**
Infrastructure Impacts – including an assessment of impacts on infrastructure, including other utility servicing infrastructure (such as electricity, gas and water supply);	An assessment of impacts on infrastructure is provided in **Section 6.14.**
Cumulative – including industrial facilities in the area and other nearby approved and proposed development, particularly in relation to hazards and risk, air quality, noise and vibration, traffic and soil and water; and	Cumulative impacts are addressed in **Section 6.15.**
Long Term Management – including an assessment of impacts associated with the operation and maintenance of the proposed facilities, including inspection arrangements and measures to ensure its integrity.	The long term management of the Project and associated impacts are discussed in **Section 6.16.**
Environmental risk analysis	
Notwithstanding the above key assessment requirements, the EIS must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the EIS.	The Environmental Risk Analysis is provided in **Chapter 8.**

Requirement	Location where this is addressed in the EIS
Consultation	
An appropriate and justified level of consultation with relevant parties during the preparation of the EIS must be undertaken, including with local, State and Commonwealth government authorities; relevant Aboriginal stakeholders, such as the Local Aboriginal Land Councils; utilities and service providers; and the public, including any relevant community groups and adjoining and affected landowners. The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	The Project engagement activities are discussed in **Chapter 5.**
Further consultation after 2 years	
If you do not lodge a development application and an EIS for the development within 2 years of the issue date of these Environmental Assessment Requirements (EARs), you must consult further with the Planning Secretary in relation to the preparation of the EIS.	Noted.

2. Project description

This chapter provides the full description of the Project including activities associated with construction, operation and decommissioning, where relevant, of each Project component based on current available design information.

2.1 Project overview

AGLM are progressing plans to facilitate the efficient, safe and reliable continuation of electricity generating works from the AGLM landholding. The Project would consist of the following:

- The Battery: A grid connected Battery Energy Storage System with capacity of up to 500 MW and 2 GWh
- Decoupling works: Alternative network connection arrangements for the Liddell 33 kV switching station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and potential third-party industrial energy users
- BAW: Works associated with Bayswater which may include upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, expansion or demolition
- Consolidated consents: A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets (**Consolidated consents**).

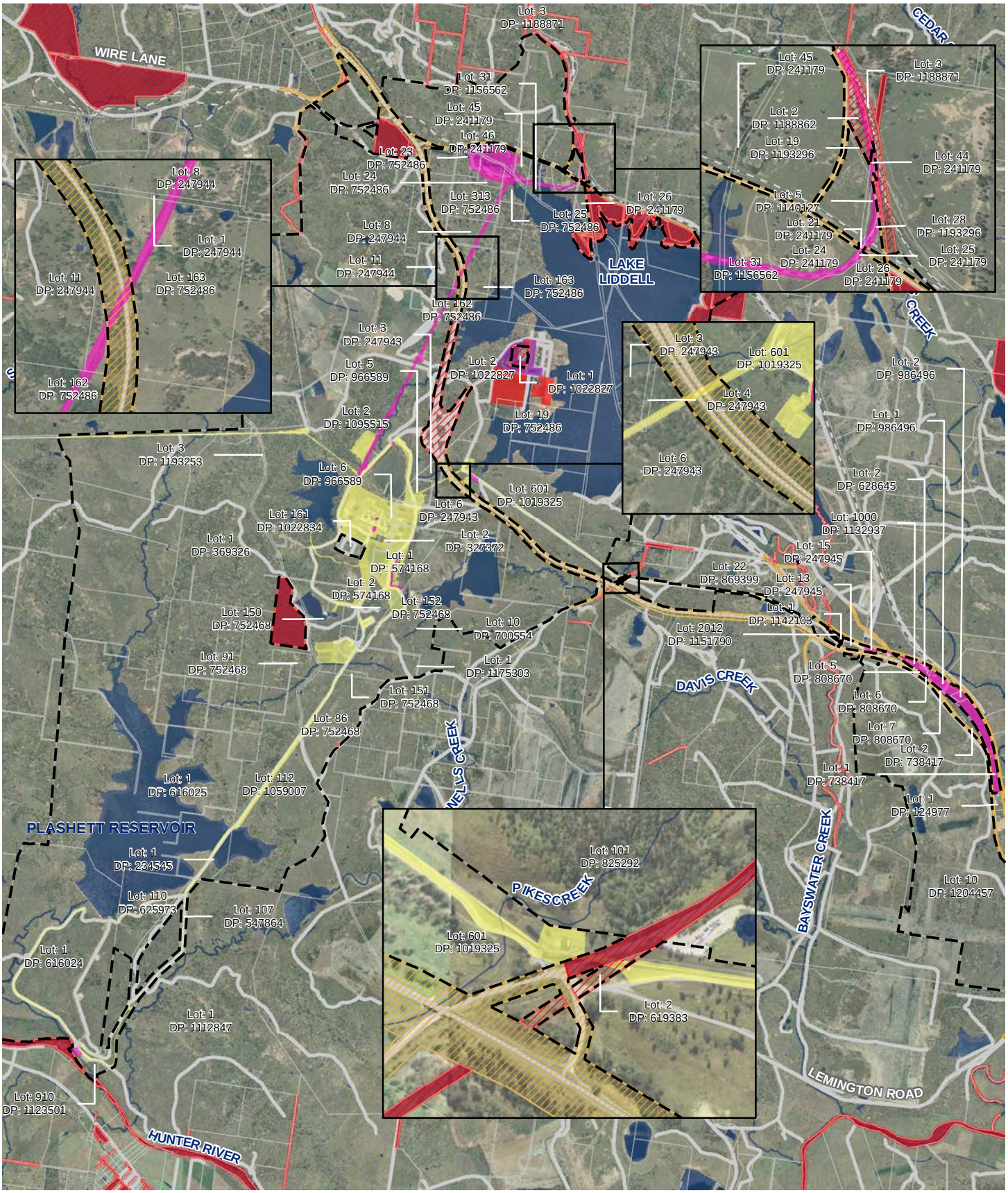
A summary of the overall Project is provided in **Table 2-1** and documents the reasonable worst-case conditions assessed. More detailed description of the Battery, Decoupling works, BAW and development consents to be surrendered and consolidated are provided in **Sections 2.2** to **Section 2.4** respectively. The works described in these sections are subject to detailed design. The Project description represents a reasonable worst case to facilitate impact assessment.

Table 2-1: Project summary

Project element	Summary of the Project
Local Government Area (**LGA**)	Muswellbrook and Singleton.
Project location	AGLM Landholding located approximately 15 km south-east of Muswellbrook, 25 km north-west of Singleton, and approximately 165 km west north west of Sydney in NSW.
Formal identifier	The Project area includes the flowing parcels of land (refer to **Figure 2-1**): ▪ AGLM-owned: ▪ Lot 112 DP 1059007 ▪ Lot 19, 23-25, 163 & 162, 313 DP 752486 ▪ Lot 3, 4 & 6 DP 247943 ▪ Lot 2 DP 327372 ▪ Lot 110 DP 625973 ▪ Lot 13 &15 DP 247945 ▪ Lot 86, 91, 150 -152 DP752468 ▪ Lot 1 DP 616024 ▪ Lot 1 DP 369326 ▪ Lot 107 DP 547864

Project element	Summary of the Project
	▪ Lot 5 & 6 DP 966589 ▪ Lot 1 DP 616025 ▪ Lot 1 & 2 DP 574168 ▪ Lot 2 DP 1022827 ▪ Lot 910 DP 1123501 ▪ Lot 1 DP 1142103 ▪ Lot 2012 DP 1151790 ▪ Lot 2 DP 1095515 ▪ Lot 601 DP 1019325 ▪ Lot 10 DP 1204457 ▪ Lot 3 DP 1193253 ▪ Lot 1 DP 234545 ▪ Lot 10 DP 700554 ▪ Lot 1 DP 1175303 ▪ Lot 2 DP 628645 ▪ Lot 1 &2 DP 986496 ▪ Lot 5 & 6 DP 808670 ▪ Lot 1000 DP 1132937 ▪ Lot 5 DP 1140127 ▪ Lot 31 DP 1156562 ▪ Lot 19 & 28 DP 1193296 ▪ Lot 1,8 &11 DP 247944 ▪ Lot 21, 24, 25, 26, 44 -46 DP 241179 ▪ Lot 1 DP 738417 ▪ Non AGLM-owned: ▪ Lot 1 DP 1022827 (Liddell 330 kV switchyard (**Liddell switchyard**) owned by Electricity Transmission Ministerial Holding Corporation (**ETMHC**) and operated by TransGrid) ▪ Lot 2 DP 619383 (Road reserve owned by Transport for NSW (TfNSW) at Pikes Gully) ▪ Lot 2 DP 1188862 (Near Antiene rail unloader within approvals to be consolidated only) ▪ Lot 3 DP 1188871 (Near Antiene rail unloader within approvals to be consolidated only). Several unidentified lots associated with the New England Highway, Pikes Gully Road and Hebden Road are also intersected by the Project area with no new physical works or infrastructure proposed in these locations.
Zoning	SP2 Infrastructure (Power Station) under the Muswellbrook Local Environment Plan 2009 (**Muswellbrook LEP**) and RU1 – Primary Production under Singleton Local Environmental Plan 2013 (**Singleton LEP**).
Access	Access to and from Bayswater and Liddell is provided by slip-lanes from the New England Highway into an existing site access road.
Project area	The overall Project area the subject of the application is approximately 462 ha and is predominantly within the AGLM landholding.

Project element	Summary of the Project
Development site	The development site for the Project is approximately 353 ha within the Project area consisting of: ▪ Battery footprint of approximately 56 ha of which approximately 20 ha would be selected ▪ Decoupling works areas of approximately 23 ha with only a limited proportion of which would ultimately be disturbed ▪ BAW works areas of approximately 274 ha with a limited proportion impacted by the BAW works forming part of this application.
Peak construction workforce	Up to 250 people per day.
Construction schedule	▪ Battery construction is expected to be delivered in three or more stages commencing 2021, 2023 and 2025 with approximate 12 month durations ▪ Decoupling works are expected to commence and be completed prior to 2024 and would take up to 12 months with the installation of additional transformers installed as Battery capacity is increased ▪ BAW works described would be undertaken on a progressive basis and are likely to be concentrated over a five year period with any additional works occurring through to 2035.
Vehicle movements	▪ Up to 250 light vehicles arriving and departing during peak traffic periods ▪ Up to 70 heavy vehicles arriving and departing per day ▪ Up to 43 over size over mass vehicle deliveries in total arriving and departing outside of peak periods and subject to applicable permits.
Water demand	Water for construction demand would be up to 6 mega litres (**ML**) (in total) used predominantly for dust suppression purposes. Water for construction purposes would be sourced from existing fill points for both sites covered by existing water license entitlements. No additional water is required for the operation of the Project.
Demolition	The Project may involve the following demolition works of existing redundant infrastructure: ▪ Removal of infrastructure associated with the Liddell Solar array as part of Battery Construction subject to site selection ▪ Removal of parts of the Liddell coal yard infrastructure as part of Battery construction subject to site selection ▪ MA1B Conveyer (MA1B) shortening as part of BAW construction. At the end of the life of the Project, built infrastructure associated with the Battery would be removed and the Battery site would be graded and rehabilitated to a safe, sustainable and non-polluting landform. Further separate planning applications will be made for the development associated with the ultimate demolition and rehabilitation of Liddell and Bayswater so as to facilitate the ultimate reuse of the sited following the closure of Liddell, and ultimately Bayswater and no works associated with these future activities form part of the Project.
Rehabilitation	Areas disturbed as part of construction and not required for operation would be rehabilitated following completion of works to return areas to the existing use. Following end of operations and demolition, the development site would be rehabilitated in accordance with all regulatory requirements



Legend

- AGLM owned land
- Project area
- Bayswater Ancillary Works
- Battery energy storage system
- Decoupling area
- Consolidated consent
- Cadastre
- Crown land
- Non AGLM owned land
- Road corridor
- Railway
- Road
- Waterway
- Waterbody

0 2 4 km

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Data sources
Jacobs 2020
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AGL 2019

Imagery:
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Figure 2-1 Property ownership

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2.2 The Battery

The replacement of a portion of Liddell's dispatchable electricity supply has been identified as required for the NEM. As part of this response, AGLM proposes to construct and operate a grid connected utility scale Battery. The Battery would have storage capacity to facilitate maximum discharge of up to 500 MW for a four-hour period or up to 2 GWh. The Battery would be located adjacent to existing **Liddell switchyard** on AGLM owned land, and reuse of existing connections into the switchyard. A summary of the Battery is provided in **Table 2-2**.

Table 2-2: Battery summary

Project element	Summary
Specifications	
Discharge capacity	Up to 500 MW.
Storage capacity	Up to 2000 GWh or four hours of maximum discharge capacity.
Typical operating cycle	250 cycles per year (once per week day) with weekend operation to address network requirements charging and discharging directly from and to the NEM.
Battery round trip efficiency	Approximately 82 % (71 % including system losses associated with network connection).
Components	The approximate component requirements to achieve the maximum storage capacity for the Battery has been calculated with reference to potential technology providers as follows: ▪ Approximately 3,700 pre-assembled battery enclosures containing approximately 50,000 lithium-ion type batteries, internal cooling and fire suppression systems ▪ 450 inverters ▪ 250 off 630 Volt (**V**) to 33 kV step-up transformers ▪ Four control / switch rooms ▪ Underground (or overhead (subject to detailed design)) 33 kV cable to connect to 33 kV / 330 kV Transformer Compound (refer to Decoupling works for Transformer Compound description) ▪ Four 33 kV / 330 kV transformers and 330 kV connection cables ▪ Ancillary infrastructure potentially including water tanks for bushfire protection purposes, lightning protection, security fencing and closed-circuit television (**CCTV**). Numbers provided are indicative only.
Dimensions	Battery compound of approximately 20 ha which may be established as smaller parcels within the overall development site. Each compound would include: ▪ Battery enclosures with approximate dimensions of 2.5 m in height and a footprint of 2.6 m by 2.2 m each arranged in groups and housing lithium-ion type battery cells, associated control systems and heating, ventilation, and air conditioning **(HVAC**) units ▪ Inverters and 630 V to 33 kV transformers with approximate height of 5 m. ▪ Control / switch room buildings with approximate height of up to 4 m. For the purposes of the VIA, a 5 m high building envelope has been applied to the entire Battery and Decoupling area. While it is noted that some components such as the transformers may exceed the 5 m height, this is limited and the impacts to viewpoints would be immaterial.

Project element	Summary
Operations	
Operational life expectancy	The Battery is expected to operate for 20 years and this may be extended subject to replacement of components.
Operational workforce	The Battery can be operated remotely. Inspection and maintenance activities would be undertaken by up to three personnel from the technology provider.
Daily Operation Traffic Movements	No additional operational vehicle movements are considered likely.
Facility Noise Emission Level	Noise emissions during operation are associated with operation of transformers, inverters and HVAC systems. Overall compound noise emissions are predicted not to exceed 80 A-weighted decibels **(dBA**) at the boundary of the Battery area and would not be audible outside the AGLM landholdings.

2.2.1 Battery location

As part of the Liddell site rehabilitation and redevelopment plan, AGLM are currently considering the preferred layout of post Liddell land use. As such the location of the Battery is yet to be finalised and it may be located within either the former coal yards area and non-process development land (Area 1), the solar array area (Area 2) or the non-process development land north of the Liddell Switchyard (Area 3).

Figure 2-2 shows these potential areas currently being considered.

The existing infrastructure and environment of the potential Battery locations are shown in to **Photo 2-1** to **Photo 2-3**.

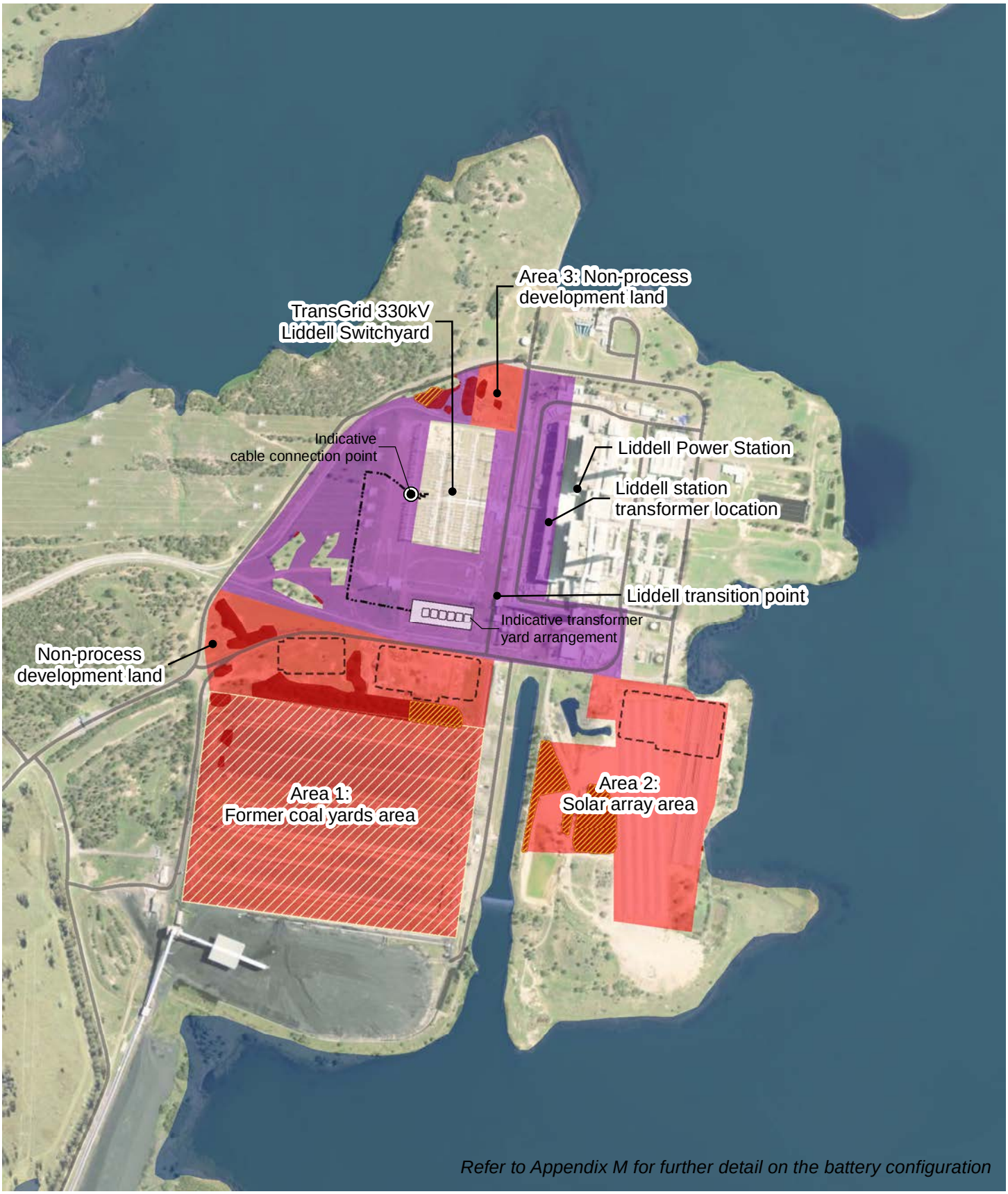
Photo 2-1: Area 1-Battery footprint north of existing coal yard

Photo 2-2: Area 2-Existing Solar array within Battery footprint

Photo 2-3: Area 3-Battery footprint north of the Liddell switchyard

The maximum disturbance area for the Battery, including temporary construction areas and permanent footprint, is approximately 20 ha. Batteries are expected to be mounted on footings and be containerised or otherwise enclosed in a formalised layout, as shown in **Figure 2-2**.

Figure 2-2: Indicative Battery layout



Legend

Project area
- Battery energy storage system
- Decoupling area
- Former coal yards area

- Indicative cable connection point (for discussion with TransGrid)
- Indicative 330kV cable route
- Transformer yard relocation
- Indicative battery block footprint

- Species impact
- PCT impact - offset required
- Road
- Waterway
- Waterbody

0 100 200m

1:10,000 at A4

Data sources
Jacobs 2021
AGL 2020
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Imagery:
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Figure 2 - 3 The Battery and Decoupling layout

2.2.2 Battery technology

While the Battery technology provider is yet to be determined, the Battery is likely to consist of containerised Lithium-Ion type batteries with associated control systems, inverters, heating, ventilation and air conditioning units, transformers, and control rooms. Battery containers, inverters and transformers would be provided with internal bunding and environmental controls for hazardous substances management suitable for the selected technology in accordance with applicable guidelines.

2.2.3 Battery operations

The Battery is expected to operate once per day. A typical daily cycle would include an approximate six hours of charging and up to four hours of discharge availability. The typical operating scenario is expected to involve one cycle per weekday with weekend operation subject to NEM requirements.

Battery operations would be supervised remotely. Routine inspections and maintenance of the Battery are expected to be undertaken on a regular (monthly or quarterly) basis with repairs undertaken on an as needs basis.

The Battery compounds and asset protection areas would be maintained in accordance with existing site management arrangements.

2.2.4 Upgrades and decommissioning

Over the life of the Battery, various components may require or benefit from upgrade or replacement. This is most likely to involve the replacement of battery cores within the Battery Energy Storage System stacks but may also involve the repair or replacement of other infrastructure. If required, works intensity would not exceed, and is likely to be significantly lower than construction works described above. Should additional generation capacity also be attainable from improved technology without increasing the disturbance area or exceeding assessed performance outcomes, then this may also occur.

Following the end of economic life, all above ground, built infrastructure associated with the Battery would be removed and the Battery site would be graded and rehabilitated to a vegetated, safe, sustainable and non-polluting landform.

2.3 Decoupling works

2.3.1 Decoupling works summary

The Liddell 33 kV Switching Station owned by AGLM is connected to the NEM via Liddell station transformer connections to the Liddell switchyard and supplies several loads critical to AGLM operations including:

- Hunter River Pumping stations
- Lake Liddell cooling water make-up pumps
- Bayswater 33 kV /11 kV station transformer
- 33 kV Ausgrid feeders that supply Ravensworth coal receiving facilities and Ravensworth Ash Return Water system
- Hunter Valley Gas Turbines
- Ausgrid 33 kV supplies to major mine customers in the area.

With the planned retirement of Liddell, a new connection between the Liddell switchyard and AGLM's 33 kV Switching Station is required to facilitate ongoing supply of these assets. The works necessary to facilitate this new connection are referred to as 'Decoupling works'.

The Battery would also connect into the Liddell switchyard and the Decoupling works may make provision for up to four additional 33 kV / 330 kV connection points. While these Battery connections may be delivered as a separate work package, they are described and assessed as part of Decoupling works.

2.3.2 Existing infrastructure

The Liddell 33 kV Switching Station currently receives 33 kV supply via overhead feeders 730 and 731 from Liddell's 330 kV / 33 kV station transformers, 1A and 2A (Jacobs, 2020a) via the Liddell transition point (33 kV feeders 730 and 731 underground to overhead (**UGOH**) connection). The site layout is shown on **Figure 2-3** with existing infrastructure illustrated in **Photo 2-4** to **Photo 2-7.** The 330 kV / 33 kV station transformers 1A and 2A are in separate transformer yards adjacent to the Liddell turbine house outer wall and within the power station compound. The station transformers are supplied by overhead powerlines from the 330 kV bays in the Liddell switchyard hung from the Liddell turbine house.

Photo 2-4: Liddell station transformer

Photo 2-5: Liddell to transition point underground connection

Photo 2-6: Liddell transition point

Photo 2-7: Liddell switchyard

2.3.3 Decoupling works

The Decoupling works are expected to include and not be limited to the following:

- Establishment of new 330 kV / 33 kV transformer compounds adjacent to the Liddell switchyard. The 33 kV / 330 kV transformers are expected to be around 7 metres in height
- Installation of up to six 330 kV / 33 kV station transformers within the transformer compounds
- Installation of new switch/control room building/s, and equipment near the existing Liddell transition point inclusive of auxiliary supplies
- Installation of new 33 kV cables to connect the 330 kV / 33 kV station transformers to the existing 730 and 731 33 kV feeders to the new 33 kV switch room
- Connection to the Liddell switchyard.

AGLM are assessing the opportunity to re-use certain components of the Liddell 330 kV / 33 kV transformers and other infrastructure in these works.

The following works may also be required within the Liddell switchyard:

- 330 kV tie ins
- Removal of existing Liddell station transformer 330 kV landing spans
- Earth grid tie-in to the earth grid of the 330 kV /33 kV transformer compounds
- Replacement of protection panel equipment, installation and proofing of new rerouted protection and control cables
- Commissioning works.

2.4 BAW

2.4.1 Summary of BAW

The ongoing operation of Bayswater occurs under a range of approvals and existing use rights that have carried over from when Bayswater was State owned and operated. Over time, and in the absence of a single

development approval that can be modified, the State and more recently AGL, has been required to either obtain stand-alone development consents for changes and upgrades to ancillary infrastructure or otherwise consider the environmental impacts in accordance with the EP&A Act, where development consent was not required. Recent examples of this include the Bayswater Turbine Efficiency Upgrade application to authorise the increased generating capacity of turbines that required replacement and the WOAOW project required to facilitate improved water, ash and salt management. The WOAOW EIS was submitted to DPIE for assessment in June 2020.

Going forward, AGLM are seeking a consistent planning approval pathway for any further ancillary works associated with Bayswater which may include upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, upgrades, expansion and/or removal. The application does not seek approval for changes to how Bayswater is operated in relation to electricity generation and no increase in coal consumption, emissions or ash generation is proposed as a result of the Project. Similarly, the Application does not seek approval for the ultimate demolition, repurposing or rehabilitation of Bayswater with the intention being that the approval may be modified at a later date to address these works when planning for closure commences.

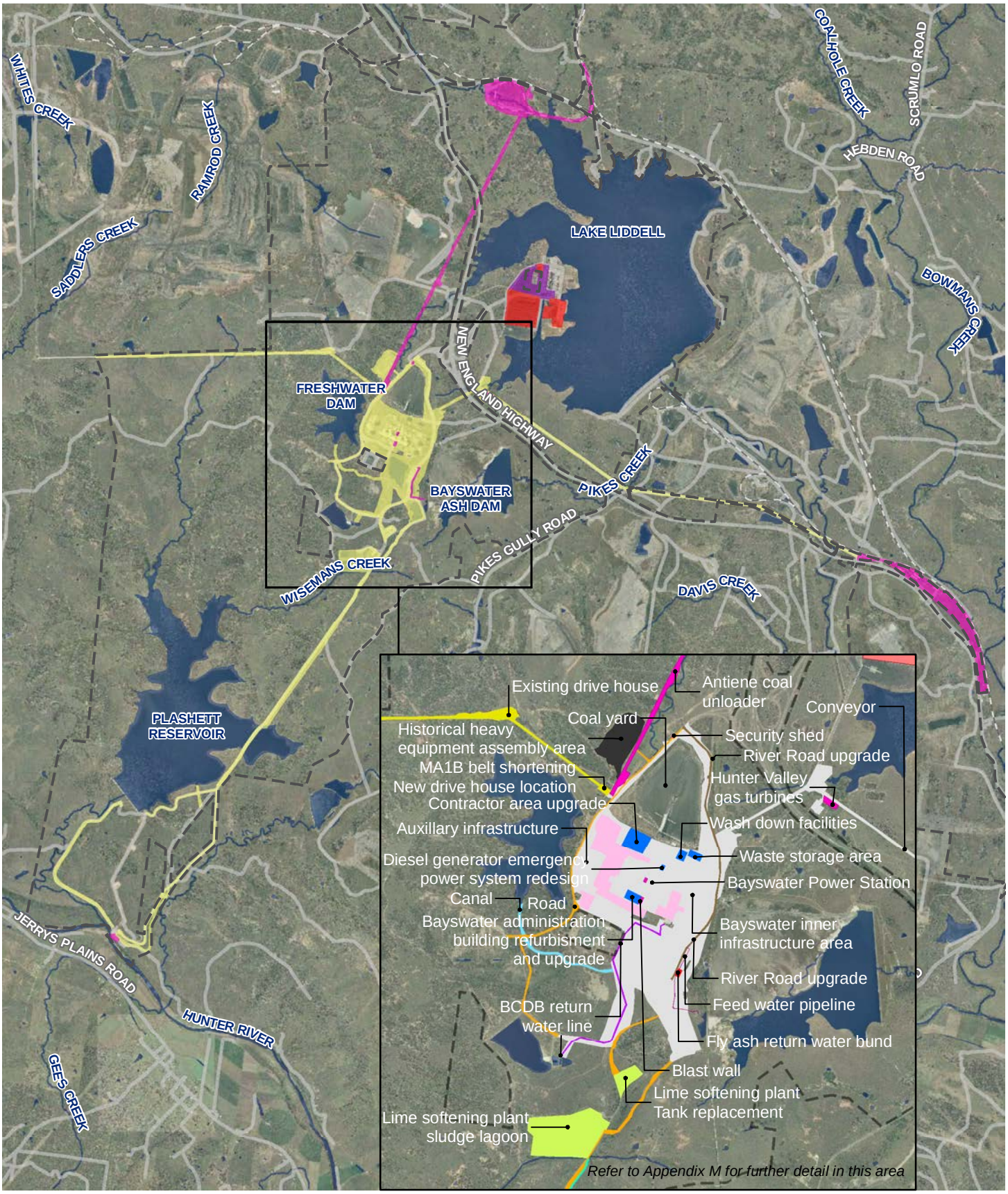
The BAW included as part of this Project comprises:

- MA1B Conveyor shortening
- Environmental improvement projects
- Brine concentrator return water pipeline
- Chemical storage tank upgrades
- Ancillary infrastructure upgrades
- Waste storage area formalisation
- Cultural heritage storage area
- Contractor area formalisation
- Administration building and social club refurbishment
- River road refurbishment
- Emergency power system upgrade.

The location and maximum disturbance areas of these components are illustrated in **Figure 2-4** with further details shown in **Appendix M**. While a large footprint is shown, only portions of it are currently proposed to be directly impacted in any way.

It is also proposed that the ongoing maintenance and use of existing Bayswater assets be authorised as part of this Project. Ongoing maintenance works are generally low impact and include vegetation clearing for inspection and bushfire protection purposes and maintenance and repairs on an as needs basis to roads, conveyors, pipelines, powerlines, pumping stations, canals and other Bayswater Ancillary facilities. These activities are managed under a range of existing management plans and procedures as documented in **Chapter 7**.

The Project also includes emergency works to repair and replace infrastructure within the development site that may be required. While specific locations and details of potential works are not able to be identified, the assessments have considered works occurring within the development site and environmental management measures are proposed.



Legend

Project area
- Consolidated consent
- Battery energy storage system
- Decoupling area
- Bayswater Ancillary Works
- AGL owned land
- Railway
- Road
- Waterway
- Waterbody

Inset map

Bayswater Ancillary Works
- Road
- Canal
- Lime softening plant and sludge lagoons
- High pressure water pipeline
- Bayswater Power Station and infrastructure
- Auxillary infrastructure
- Building and equipment upgrades
- MA1B belt shortening
- Historical heavy equipment assembly area
- BCDB return water line
- Fly ash return water bund
- River Road reconstruction

Other works
- Battery energy storage system
- Consolidated consent

0 1 2km

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Data sources

Jacobs 2021
AGL 2020
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Figure 2 - 3 BAW component locations

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2.4.2 MA1B Conveyor shortening

The MA1B conveyor was constructed and operated to deliver coal to Bayswater from Mt Arthur Coal Mine (refer to **Photo 2-8**). Bayswater no longer receives coal from Mt Arthur via this conveyor and the conveyors only remaining function is to transfer coal from the junction with the existing Antiene coal conveyor check weigh bin over the last 500 m to the Bayswater coal handling plant.

As the MA1B conveyor is largely redundant, it is proposed to shorten it as part of the Project. Proposed works would include:

- Construction of a new concrete foundation adjacent to the existing Antiene Check Weigh Bin
- Modification to ancillary power, water and communications infrastructure
- Relocation of the drive house (refer to **Photo 2-9**) and associated infrastructure from its current location to the new concrete foundation adjacent to the junction with the Antiene conveyor
- Establishment of spillage control and capture and water management infrastructure
- Removal of redundant conveyor belts and associated conveyor stringer, purlins, idler rollers footing piers, electrical cabling, pull wires and roof sheeting
- Rehabilitation of areas no longer required for operational purposes.

The works are anticipated to be undertaken over a three month period and involve approximately 25 construction personnel.

The shortened MA1B conveyor would continue to operate over the remaining life of Bayswater with no increased impacts over the existing operations. While not quantified, reduced impacts would result from the shortened conveyor length including reduced energy use, localised noise and air quality impacts being removed and rehabilitated footprint being returned to a more naturalised condition removing barriers to fauna movement.

Photo 2-8: MA1B conveyor and service road

Photo 2-9: MA1B drive house to be relocated

2.4.3 River Road refurbishment

River Roads bitumen running surface is reaching the end of its life and is no longer suitable for repairs (refer to **Photo 2-10** and **Photo 2-11**). The Project seeks approval for works to reconstruct approximately 3 km of the dual lane River Road from its junction with the Bayswater Access Road to the Bayswater tank farm. Works would include:

- Current road surface removal
- Repairs to the underlying layers and levelling
- Construction of the new road surface.

The works would be contained within the existing disturbance area and undertaken by approximately 50 contractors over an approximate two month period. No operational changes are proposed.

Photo 2-10: River Road looking south

Photo 2-11: River Road looking north

2.4.4 Environmental improvement projects

Environmental improvement projects arising out of pollution reduction investigations under the Environment Protection Licence 779 (**EPL 779**) are proposed and would be associated with existing infrastructure at identified high risk areas. Improvement projects include the following:

- Waste /Water Management System Review recommendations as required under EPL 779 including:
  - Construction works to regrade road, install a dish drain, excavate and pour a concrete washdown sump and construct a permanent sediment basin to improve coal fines containment at the M2/M3 coal conveyor transfer point
  - Construction of controls to separate clean and dirty water, sump and sediment basin at the M2/M1/R1 conveyor transfer point
  - Vegetation removal and potential replacement or upgrade of the oil water separator system at the Hunter Valley Gas Turbines including removal of the existing oil water separator, installation of new oil water separator and backfill, pipework connections

- Bayswater fly ash silos drainage improvements including construction of sump and pumping system to capture and return spilt ash to the Bayswater Ash Dam

- Lime softening plant, water treatment plant and demineralisation plant environmental improvements to ensure ageing plant equipment is replaced/maintained to a safe and reliable operating condition such as pipelines, tanks, bunds, and clean water diversions
- Creation of a formalised waste storage area for hydrocarbons, oils, and greases generated onsite with a total storage capacity of approximately 20 Kilolitre (**kL**) and inclusion of environmental controls such as bunding, runoff management and roofing.

Works would include the installation, replacement or relocation of environmental controls such as bunding, diversions, drainage, pipes, pits and waste management structures.

Works would be undertaken by up to 30 personnel. The subject infrastructure would continue to operate over the remaining life of Bayswater with no increased impacts. It is expected that there would bereduced overall impacts due to operation of the environmental improvement projects outlined above.

2.4.5 Brine concentrator return water pipe

AGLM are proposing to construct and operate a new small diameter approximately 3 km pipeline to return brine from the brine concentrator decant basin to the brine concentrator. This would be used for reprocessing and treatment through the salt caking plant for disposal at the separately proposed salt cake landfill, if approved under the WOAOW project application. The brine concentrator return water pipe would essentially replicate the existing Brine Concentrator Pipe as shown in **Photo 2-12** and **Photo 2-13**.

Minimal earth works are required and the works would be completed by up to 20 contractors over an approximate one month period.

The works would support the overall improvement in salt management being implemented across Bayswater. No additional operational impacts are considered likely.

Photo 2-12: Existing brine concentrate pipeline (looking south)

Photo 2-13: Existing brine concentrate pipeline (looking north)

2.4.6 Chemical storage tanks upgrades

The Project includes works to replace two existing 27 kL rubber lined ferric chloride steel tanks (see **Photo 2-14**) with two 30 kL polyethylene tanks. The current tanks were installed in 1982 and require replacement so as to reduce any risk of failure.

Works would involve:

- Decontamination and removal of existing tanks and pipeline/s
- Removal of associated structures
- Any necessary repairs on the bund and drain valves
- Installation of new tanks and pipelines.

Works would be contained within existing disturbed areas where possible and new tanks installed within the existing hazardous chemical storage area hardstand. No changes to operations of the Lime Softening Plant are proposed.

Photo 2-14: Existing ferric chloride tanks within the Lime Softening Plant

2.4.7 Emergency Power System redevelopment

Emergency diesel generator power supply is critical for Bayswater plant and personnel safety because both the 1/2 and 3/4 end diesel generators are no longer operational (refer to **Photo 2-15**), containerised portable diesel generators have been installed to supply emergency power to Bayswater. The current configuration is temporary and while meeting current needs, does not constitute a long-term solution.

Photo 2-15: Diesel generator building and proposed location of two of the three new generators

The Project seeks approval for the replacement of the existing emergency power system with a new system. The new system would include three 415 V diesel generators with two located outside the existing diesel generator building that would connect to the existing 6.6 kV network via 415 V / 6.6 kV step up transformers. The third diesel generator would remain connected to the 1/2 end 415 V diesel generator switchboard via a change-over switch such that power can be supplied from the third diesel generator or via the 6.6 kV network. The existing diesel generator building would also be gutted of all redundant equipment allowing the building to be re-purposed.

Works would be completed by approximately five contractors over a two month period.

The emergency diesel generators would operate in the event of emergency loss of power and are otherwise tested on a routine basis. The operational impacts are in keeping with existing conditions and no additional diesel use over a do nothing scenario would eventuate.

2.4.8 Various works within the Bayswater operations area

The Project seeks approval for the installation and upgrade of various ancillary facilities in the immediate vicinity of the Bayswater operational area including the following:

- Formalisation of contractor area (see **Photo 2-16** and **Photo 2-17**) involving upgrades to the current informal contractor area established between Bayswater turbine hall and coal handling yards including electrical works, earthworks, drainage improvements and establishment of carparks and offices for use during maintenance shutdowns
- Creation of a formalised waste storage area for hydrocarbons, oils, greases for approximately 20 kL and inclusion of environmental controls such as bunding, runoff management and roofing. The current liquid waste storage area is shown in **Photo 2-18** and **Photo 2-19**
- Installation of axillary infrastructure such maintenance storage areas, laydown, car parks, security gatehouse upgrades, washdown facilities, car wash, equipment wash
- Establishment of a cultural heritage storage area for heritage items salvaged associated with future earthworks at Bayswater

- Bayswater administration building and social club refurbishment and/or upgrade works including redesign and upgrade of workspaces, kitchens and amenities.

Specific details of these works will be provided as part of the detailed design which will comply with all applicable guidelines. Subject to staging, workforce requirements are unlikely to exceed 50 workers at any one time for these Project components.

No changes to operations within the area are proposed.

Photo 2-16: Current contractor area

Photo 2-17: Current contractor area

Photo 2-18: Current liquid waste storage area (looking north)

Photo 2-19: Current liquid waste storage area (looking south)

2.5 Construction

Construction works associated with the Battery and Decoupling would be likely to involve:

- Installation and maintenance of environmental controls including temporary and permanent water management infrastructure
- Establishment of access from the Liddell access road
- Demolition or deconstruction of existing equipment as required

- Establishment of a hardstand pad and construction laydown areas
- Cut and fill to Battery compound, Transformer compounds, footings and construction laydown area
- Trenching and installation of cable from Battery to 330 kV / 33 kV transformer compounds
- Structural works to support Battery enclosures, inverters, transformers, buildings and transformer compounds
- Delivery, installation and electrical fit-out of the Battery
- Delivery installation and fit out of transformers and ancillary equipment for Decoupling works
- Testing and commissioning activities
- Removal of construction equipment and rehabilitation of construction areas.

Construction works for BAW components are generally described in **Section 2.4**.

2.5.1 Construction program

The development of the Battery may be staged to respond to market demand. AGL anticipates the construction occurring over multiple stages. These stages could potentially be:

- Stage 1 consisting of 150 MW and 150 MWh targeting construction commencement in 2021
- Stage 2 consisting of 150 MW and 150 MWh targeting construction commencement in 2023
- Stage 3 consisting of 200 MW and up to 1700 MWh targeting construction in 2025 with storage capacity being added in response to the needs of the NEM.

The construction of each Battery stage is anticipated to take up to 12 months consisting of the civil works component, mechanical and structural component, electrical works and testing and commissioning. Stage 3 may be further divided into smaller stages subject to market demand and be delivered on a progressive basis. A reasonable worst case assumption of two concurrent 150 MWh capacity installations occurring concurrently has been assessed.

The Decoupling works are proposed to be undertaken prior to 2024 to facilitate the planned closure and decommissioning of Liddell. Decoupling works are anticipated to take up to 12 months.

The BAW may be undertaken at any time up to the planned retirement of Bayswater.

2.5.2 Construction Hours

Works would generally be limited to standard construction hours of:

- Monday-Friday 0700-1600
- Saturday 0800-1300
- No works on Sunday or public holidays.

Works outside of standard construction hours may be required to facilitate connection works to the Liddell switchyard to coincide with outages. The delivery of Project components may also occur outside standard construction hours.

2.5.3 Construction traffic

Daily traffic volumes (entering and leaving Liddell) for the Battery and Decoupling are expected to be approximately:

- 50 workers arriving and departing in peak times for Decoupling
- 20 heavy vehicle movements (10 deliveries) per day for Decoupling

- 100 workers arriving and departing Liddell during peak times for the Battery
- 40 heavy vehicle movements (20 deliveries) to Liddell per day for the Battery
- Approximately 43 over size over mass (**OSOM)** deliveries may be required including:
  - 11 deliveries of new or refurbished transformers for the Decoupling
  - Six transformer component deliveries to end of 2023 for the Battery
  - Six transformer component deliveries between 2024 -26 for the Battery
  - Ten deliveries of 33 kV equipment to end of 2023 for the Battery
  - Ten deliveries of 33 kV equipment between 2024 -26 for the Battery.

OSOM deliveries would most likely occur outside of peak times and in accordance with applicable permits and licences. Unladen return trips (up to 43) may occur at any time.

Construction traffic for the BAW components would be subject to staging of works delivery but would not exceed 100 contractors arriving and departing Bayswater during peak times and up to 100 heavy vehicle movements (50 deliveries) per day.

Daily traffic volumes presented are subject to change as detailed design and construction planning progresses.

2.5.4 Construction plant, equipment and materials

A range of plant and equipment would be used during construction. The final equipment and plant requirements would be determined by the construction contractor. Indicative plant and equipment has been broadly categorized into typical activities as follows.

Equipment required for earthworks:

- Front end loaders
- Dump trucks
- Road trucks
- Excavators
- Graders
- Compactors
- Water trucks.

Equipment associated with civil works, Battery and Decoupling component installation and BAW:

- Concrete trucks
- Elevated work platforms
- Cranes
- Concrete saws and grinders
- Compacters and rollers
- Scrapers
- Backhoe
- Generators.

Equipment associated with routine maintenance of infrastructure:

- Chainsaws

- Tractors
- Light vehicles
- Wood chippers/mulchers.

In addition to Battery and Decoupling components, the following volumes of materials are likely to be required:

- Approximately 300 tonnes (**t**) of structural steel
- Approximately 5000 cubic metres (**m3**) of concrete
- Cables (quantity subject to detailed design)
- Prefabricated buildings
- Two 30 kL tanks
- Oil water separator components
- Various pipelines, pumps and fittings
- Sand, gravel, clay and rock (quantities to be confirmed)
- Bitumen (quantities to be confirmed).

Up to 6 ML of water is expected to be required predominantly for compaction and dust suppression activities. Water would be sourced from AGLM's current water entitlements.

2.5.5 Third party infrastructure impacts

Other than the works within Liddell switchyard operated by TransGrid as described in **Section 2.3.3,** no other third party infrastructure would be impacted as part of the Project.

2.6 Long Term Management

The Management of the Project components and infrastructure associated with the development consents to be surrendered and consolidated would involve minimal change to existing operations.

Long term management would involve:

- Routine inspections
- Ad-hoc repair and replacement of components in the event of failure
- Maintenance of landscaping and asset protection areas
- Testing of emergency response equipment
- Maintenance and repair of access tracks, water management infrastructure and environmental controls.

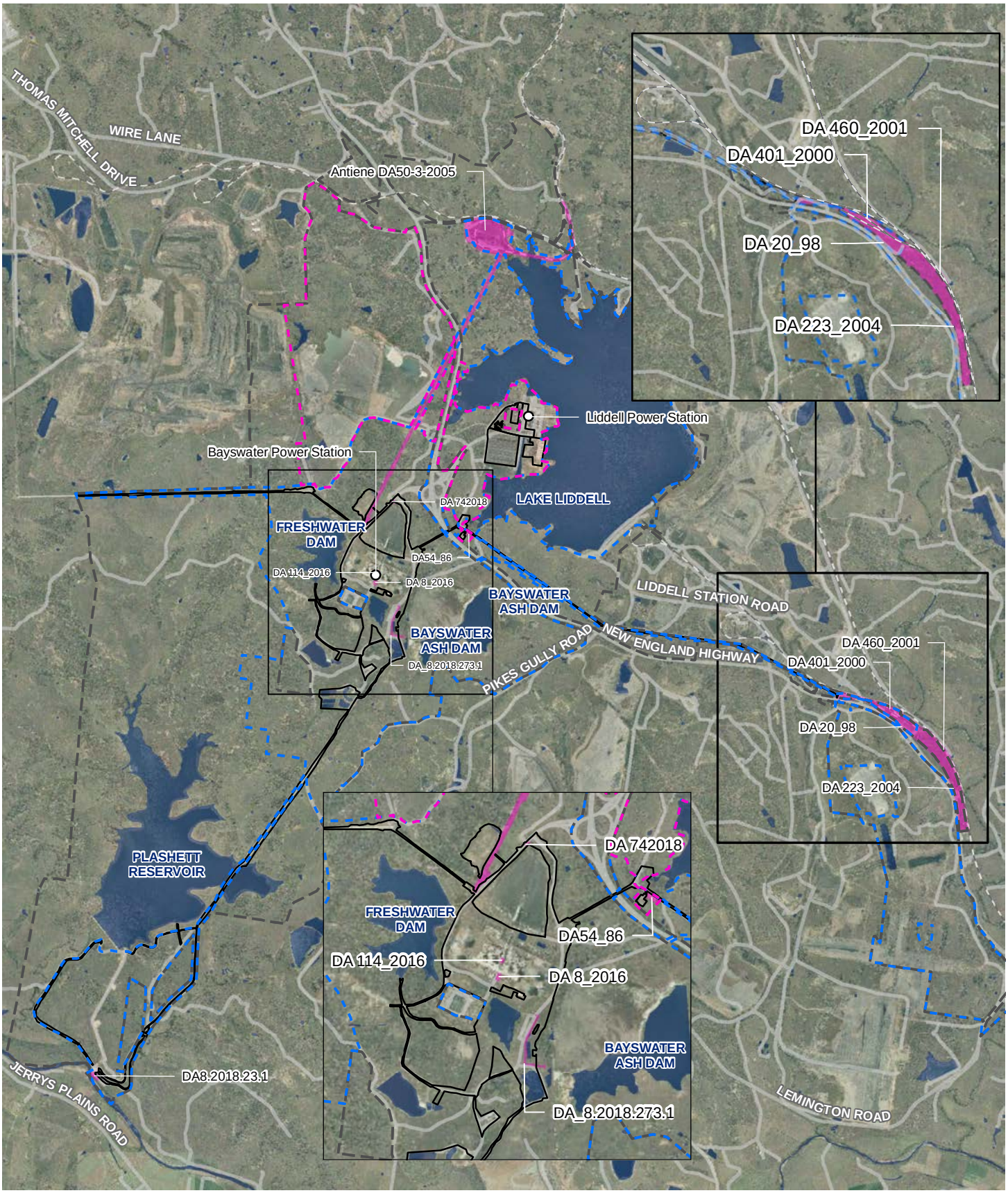
Works to respond to incidents or significant asset failures occurring within the Project area may also be required on an emergency basis. A range of management plans are in place and would be updated as described in **Section 7.1.**

2.7 Consolidation and surrender of other approvals

In response to consultation with DPIE, Muswellbrook Shire Council and Singleton Council and the outcome of AGLM's review of existing consents and future operational requirements, the following consents listed in **Table 2-3** are proposed to be voluntarily surrendered and consolidated into the Project application if approved. The consents are shown on **Figure 2-3** and provided in **Appendix B.**

Table 2-3: Existing consents proposed to be voluntarily surrendered and consolidated into the Project application

Consent / DA No.	Determining authority	Description
DA 50-3-2005 Antiene Coal Unloader	NSW Government Department of Planning (Mining and Extractive Industries) now DPIE (Mining and resources)	Construction and operation of a rail coal unloader and associated infrastructure (approximately 8 km south west of Muswellbrook at Antiene).
DA 8/2016 – Blast Wall	Muswellbrook Shire Council	Construction of a new blast wall at Bayswater.
DA 74/2018 Bayswater security shed	Muswellbrook Shire Council	Construction of office premises and car parking area ancillary to security and traffic control at Bayswater.
DA 8.2018.23.1 Feed water Pipeline	Singleton Council	Water reticulation system (relocation of water pipeline).
8.2018.23.1 Low Pressure Pump Station Stabilisation	Singleton Council	Alterations to water supply system (water reticulation system).
8.2018.23.2 Low Pressure Pump Station Modification	Singleton Council	Alterations to water supply system (water reticulation system), this modification is required to remove vegetation.
DA 54-86 Hunter Valley Gas Turbines	Muswellbrook Shire Council	Construction and operation of gas turbines.
DA 20_98 Ravensworth Coal Unloader	Singleton Council	Develop a rail coal unloading facility.
DA 114_2016 Change of Use	Muswellbrook Shire Council	Change of use from storage shed to operations centre.
DA 223_2004 Rail Sidings	Singleton Council	Construction of four rail sidings and associated facilities.
DA 401_2000 Coal Rail Unloader Augmentation	Singleton Council	Coal/rail unloader augmentation.
DA 460_2001 Unloader Upgrade	Singleton Council	Ravensworth rail unloader upgrade.



Legend

- Development site
- Consolidated consent
- AGL owned land
- Bayswater EPL
- Liddell EPL
- Railway
- Road
- Waterbody

0 2 4km

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N

PORT MACQUARIE
DUBBO
MUSWELLBROOK
SINGLETON
NEWCASTLE
SYDNEY
WOLLONGONG
GOULBURN

Data sources
Jacobs 2020
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AGL 2019

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Figure 2 - 5 Consolidated consents

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3. Statutory context

This chapter describes the environmental impact assessment and approval process for the Project as well as the statutory context for the Project, including:

- How the Project meets the provisions and objectives of the EP&A Act and EP&A Regulation
- Consideration of the Project against relevant Environmental Planning Instruments (**EPIs**)
- Approvals that must be obtained before the proposed Project can commence
- The likely interactions between the existing development consents and other environmental regulatory instruments.

3.1 Summary of statutory context

3.1.1 Power to grant approval

The Project involves Decoupling works, BAW and the construction and operation of a Battery and meets the definition of the purpose of 'electricity generating works' with a capital investment value of more than $30 million.

The Project is accordingly SSD under the SEPP SRD. On this basis, the Project requires assessment in accordance with Division 4.7 of the EP&A Act.

Pursuant to s4.5(a) of the EP&A Act, the consent authority for SSD is the Independent Planning Commission if the development is of the kind described in clause 8A(1)(a)-(c) of the SEPP SRD, or is the Minister for development not of that kind (although the Minister has delegated this function to senior governmental officers).

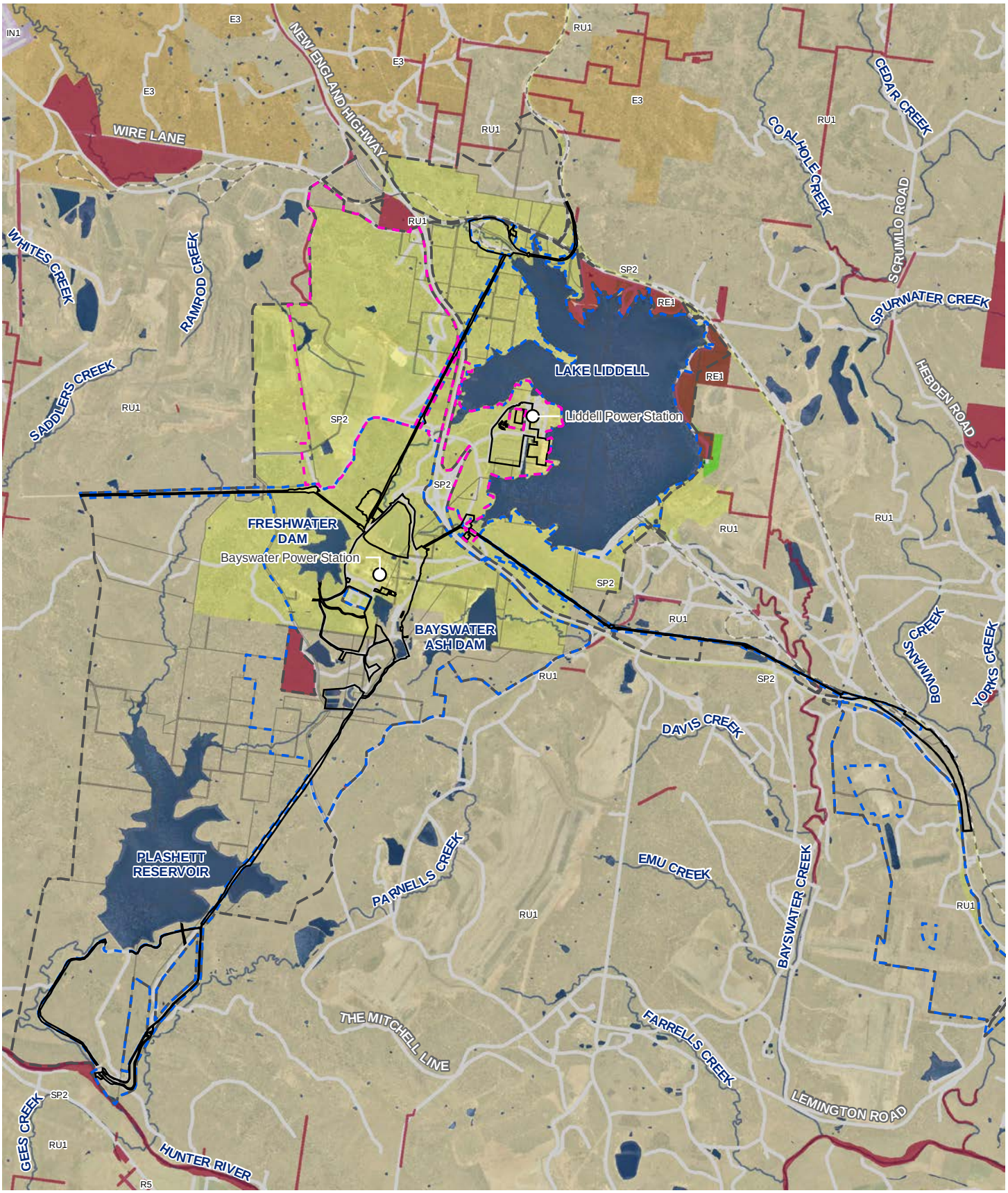
3.1.2 Permissibility

The Project is located within the Muswellbrook and Singleton LGAs.

Under Section 34 of the *State Environmental Planning Policy (Infrastructure) 2007* (**ISEPP**), development for the purpose of electricity generating works may be carried out by any person with consent any land in a prescribed rural, industrial or special use zone. The RU1 Primary Production zone and SP2 Infrastructure are prescribed for the purposes of Section 34. The Project is as such permissible with consent through the application of the ISEPP.

The Battery and Decoupling components of the Project would be within the application area of the Muswellbrook LEP and an area zoned SP2 Infrastructure (Power Station) (Refer to **Figure 3-1**). The only development types permitted within the SP2 zone are roads and the purpose shown on the Land Zoning Map, in this case 'Power Generation', including any development that is ordinarily incidental or ancillary to development for that purpose. The Project meets the definition of Power Generation and as such is permissible with development consent under the Muswellbrook LEP.

The BAW and approvals to be surrendered and consolidated components of the Project extend across both the Muswellbrook and Singleton LGA. The subject land is zoned RU1 – Primary Production and SP2 Infrastructure (Refer to **Figure 3-1**). Electricity generation, and associated infrastructure for the purposes of electricity generation, are not listed as permissible with or without consent under the RU1 - Primary Production zone and would therefore be partially prohibited under the provisions of the Muswellbrook and Singleton LEPs. However, under clause 34 of ISEPP 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. Land which is zoned RU1 - Primary Production and SP2 Infrastructure are prescribed rural, industrial or special use zonesfor the purposes of clause 34 of ISEPP. Accordingly, the Project is wholly permissible.



Legend

- Project area
- AGL owned land
- Cadastre
- Crown Land
- Bayswater EPL
- Liddell EPL

LEP zone

- E2 Environmental Conservation
- E3 Environmental Management
- IN1 General Industrial
- R5 Large Lot Residential
- RE1 Public Recreation
- RU1 Primary Production
- SP2 Infrastructure
- Railway
- Road
- Waterway
- Waterbody

0 2 4 km

1:90,000 at A4

Data sources

Jacobs 2020
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AGL 2019
NSW DPE 2020

Imagery:
© Department of Customer Service 2020

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Figure 3 - 1 Land ownership, zoning and EPL boundaries

3.1.3 Other approvals

The following licences and permits would be required by the Project prior to commencement of construction where these licences and permits become relevant:

- Variation to Bayswater and Liddell EPL 779 and EPL 2122 under the *Protection of the Environment Operations Act 1997* (**POEO Act**) to accommodate additional scheduled activities and amend licence boundaries as described in **Section 3.5.1.1**.
- Approval under Section 15 of the *Coal Mine Subsidence Compensation Act 2017* (**CMS Act**) for the erection or alteration of an improvement or subdivision of land within a mine subsidence district
- A permit under Section 138 of the *Roads Act 1993* (**Roads Act**).

3.2 Consideration of provisions and objects of the EP&A Act and Regulation

The EP&A Act and EP&A Regulation establish the planning and approvals process in NSW. It provides for the making of EPIs including LEPs and State Environmental Planning Policies (**SEPPs**), which set out requirements for particular localities and/or particular types of development. The applicable EPIs and the EP&A Regulations determine the relevant planning approval pathway and the associated environmental assessment requirements for proposed development activities.

3.2.1 Objects of the EP&A Act

Section 1.3 of the EP&A Act outlines the objects of the EP&A Act as follows:

a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources

b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment

c) to promote the orderly and economic use and development of land

d) to promote the delivery and maintenance of affordable housing

e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats

f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)

g) to promote good design and amenity of the built environment

h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants

i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State

j) to provide increased opportunity for community participation in environmental planning and assessment.

Consideration of the objects of the EP&A Act is provided in **Section 9.2** and it is concluded that the Project is consistent with these objectives.

3.2.2 Relevant provisions of the EP&A Act

The relevant provisions of the EP&A Act are identified in **Table 3-1**.

Table 3-1: EP&A Act mandatory considerations

Statutory Reference Section	Consideration	Section in EIS
4.36 Development that is SSD	The Project is declared SSD through the application of Clause 8 and Schedule 1 of SEPP SRD being for the purpose of electricity generating works and having a capital investment value exceeding $30 million.	Refer to **Section 3.4.1**
4.37 Staged State significant development	The application does not seek consent for a concept DA.	Not applicable
4.38 Consent for SSD	The Independent Planning Commission or the Minister for Planning and Public Spaces (by delegate) is the consent authority for SSD under Division 4.7 of the EP&A Act. The Project is neither wholly or partly prohibited, is not partially permitted without consent. As such the consent authority may determine the DA by either granting conditional consent or refusing consent.	Refer to **Section 3.1**
4.39 Regulations—SSD	The regulations establish the form and content requirements for an EIS required to accompany an application for SSD and the advertising and consultation process.	Refer to **Table 3-2** for further detail
4.40 Evaluation of development application	Section 4.15 of the EP&A Act applies to the determination of a DA for SSD subject to Division 4.7. Consideration of how the requirements of Section 4.15 have been addressed is provided in **Section 9.3** based on the findings of the EIS.	Refer to **Table 9-2**
4.41 Approvals etc legislation that does not apply	The following authorisations are not required for SSD that is authorised by a development consent granted after the commencement of this Division (and accordingly the provisions of any Act that prohibit an activity without such an authority do not apply): ▪ A permit under Section 201, 205 or 219 of the *Fisheries Management Act 1994* (**FM Act**) ▪ An approval under Part 4, or an excavation permit under Section 139, of the *Heritage Act 1977* (**Heritage Act**) ▪ An Aboriginal Heritage Impact Permit (**AHIP**) under Section 90 of the *National Parks and Wildlife Act 1974* (**NPW Act**) ▪ A bush fire safety authority under Section 100B of the *Rural Fires Act 1997* (**Rural Fires Act**) ▪ 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* (**WM Act**). Consideration of the need for these approvals in the absence of the development being declared SSD is provided below.	**Chapter 3**

Statutory Reference Section	Consideration	Section in EIS
4.42 Approvals etc legislation that must be applied consistently	An authorisation of the following kind cannot be refused if it is necessary for carrying out SSD that is authorised by a development consent under this Division and is to be substantially consistent with the consent: ▪ An aquaculture permit under Section 144 of the FM Act ▪ An approval under Section 15 of the *Mine Subsidence Compensation Act 1961* ▪ A mining lease under the *Mining Act 1992* ▪ A production lease under the *Petroleum (Onshore) Act 1991* ▪ An environment protection licence under Section 3 of the POEO Act (for any of the purposes referred to in Section 43 of that Act) ▪ A consent under Section 138 of the Roads Act ▪ A licence under the *Pipelines Act 1967* (**Pipelines Act**). Consideration of the need for these approvals is provided below.	**Chapter 3**
4.63 Voluntary surrender of development consent	▪ The consent authority is not required to re-assess the likely impact of the continued development to the extent that it could have been carried out but for the surrender of the consent ▪ The consent authority is not required to re-determine whether to authorise that continued development under the new development consent (or the manner in which it is to be carried out), and ▪ The consent authority may modify the manner in which that continued development is to be carried out for the purpose of the consolidation of the development consents applying to the land concerned. AGLM are proposing to voluntarily surrender certain development consents where the operation of the Project would supersede these approvals.	Refer to **Section 2.7**

3.3 Environmental Planning and Assessment Regulation 2000

Schedule 2 of the EP&A Regulation stipulates the process to obtain SEARs is addressed in the preparation of the EIS and the general form and content requirements. **Table 3-2** identifies how this EIS addresses these form and content requirements. The SEARs for the Project are provided in full in **Appendix A**.

Table 3-2: General form and content requirements for the environmental impact statement

EIS Requirement	Where addressed
An environmental impact statement must contain the following information:	
a) the name, address and professional qualifications of the person by whom the statement is prepared	EIS Certification Page
b) the name and address of the responsible person	
c) the address of the land: ▪ in respect of which the development application is to be made or ▪ on which the activity or infrastructure to which the statement relates is to be carried out	

EIS Requirement	Where addressed
d) a description of the development, activity or infrastructure to which the statement relates	
e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule	
f) a declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates and (iii) that the information contained in the statement is neither false nor misleading.	
An environmental impact statement must also include each of the following:	
g) a summary of the environmental impact statement	Executive Summary
h) a statement of the objectives of the development, activity or infrastructure	**Section 1.2**
i) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure	**Section 1.5**
j) an analysis of the development, activity or infrastructure, including:	
▪ a full description of the development, activity or infrastructure	An overview of the Project is provided in **Section 1.1** and a full description is provided in **Chapter 2**
▪ a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected	A general description is provided in **Section 1.5.** Detailed description of each environmental aspect is provided in **Chapter 6** and **Chapter 7** and associated attachments.
▪ the likely impact on the environment of the development, activity or infrastructure	**Chapter 6** and **Chapter 7**
▪ a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment and	**Chapter 7**
▪ a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out	**Section 3.1.3**
k) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv)	**Chapter 7**

EIS Requirement	Where addressed
l) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4)	**Chapter 9**

3.4 Relevant environmental planning instruments

3.4.1 State Environmental Planning Policy (State and Regional Development) 2011

The aims of SEPP SRD are to identify development that is SSD, State Significant Infrastructure (**SSI**), Critical State Significant Infrastructure (**CSSI**) and regionally significant development. Section 8(1) identifies that development is declared to be SSD for the purposes of the EP&A Act if it is not permissible without development consent under Part 4 of the EP&A Act, and the development is specified in Schedule 1 or 2 of the SEPP SRD.

Section 20 of Schedule 1 identifies that development for the purpose of electricity generating works using any energy source that has a capital investment value of more than $30 million as SSD. The Project is for the purpose of 'electricity generating works' and has a capital investment value of more than $30 million. The Project is accordingly SSD.

3.4.2 State Environmental Planning Policy (Infrastructure) 2007

The ISEPP aims to facilitate the effective delivery of infrastructure across the State.

Section 34 of ISEPP permits as follows:

(1) Development for the purpose of electricity generating works may be carried out by any person with consent on the following land—

> *(a) in the case of electricity generating works comprising a building or place used for the purpose of making or generating electricity using waves, tides or aquatic thermal as the relevant fuel source—on any land*
>
> *(b) in any other case—any land in a prescribed rural, industrial or special use zone.*

(2A) Development for the purpose of the expansion of existing electricity generating works may be carried out by or on behalf of a public authority with consent on any land that is adjacent to the existing works.

(2B) Consent is not required to carry out any such development on land if the development could, but for subclause (2A), be carried out on that land without consent.

The Project works are for the purpose of electricity storage, to facilitate dispatchable electricity generation and is located within land zoned SP2 Infrastructure (Power Station) and RU1 Primary Production. Accordingly, the Project is prescribed for the purposes of Section 34 of ISEPP and is permissible with consent.

Under Section 101(2) of ISEPP the consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that:

(a) where practicable, vehicular access to the land is provided by a road other than the classified road, and

(b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of:

(i) the design of the vehicular access to the land, or

(ii) the emission of smoke or dust from the development, or

(iii) the nature, volume or frequency of vehicles using the classified road to gain access to the land, and

(c) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.

Access to the site would be provided via the existing dedicated access road which is not classified. **Section 6.5** identifies that traffic volumes would not affect the operation of the New England Highway and **Section 6.2** identifies that minimal dust impacts would occur off-site. The Project is not sensitive to traffic noise. As such Clause 101 is not considered to limit the ability of the consent authority to consent to the development.

Clause 104 of the ISEPP requires that prior to determining a development identified as a traffic generating development under Schedule 3, the determining authority is to give notice to TfNSW within seven days of the application being made and consider and submissions received within 21 days in addition to the accessibility of the site and any potential traffic safety, road congestion or parking implications. The Project can be considered an expansion of an existing facility that may exceed vehicle generation thresholds to be a traffic generating facility. TfNSW provided input into the preparation of the SEARs for the Project and the TTA (see **Appendix C**) has addressed accessibility and traffic safety.

3.4.3 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33)

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (**SEPP 33**) aims to ensure that measures are employed to reduce the impact of a development that is a hazardous or offensive industry. Section 13 of the SEPP 33 specifies that a consent authority must not consent to the carrying out of any development on land without considering:

k) current circulars or guidelines published by DPIE relating to hazardous or offensive development, and

l) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and

m) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and

n) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and

o) any likely future use of the land surrounding the development.

The SEARs require the preparation of a Preliminary Hazard Analysis (**PHA**), the results of which are summarised in **Section 6.1**. The Project involves the expansion of existing operations on a site that is appropriately zoned and isolated from sensitive receptors. The Project would not introduce the storage of substances classified under the dangerous goods code.

The extensive buffer lands are owned by AGLM and are appropriately zoned to prevent encroachment of development incompatible with the ongoing operations of the AGLM site.

3.4.4 State Environmental Planning Policy No. 55 – Remediation of land (SEPP 55)

State Environmental Planning Policy No 55 – Remediation of Land (**SEPP 55**) provides a State-wide approach to the remediation of contaminated land. The aim of SEPP 55 is to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. Section 7 of SEPP 55 provides guidelines to be considered by the consent authority when determining DAs.

Under Section 7 of SEPP 55 a consent authority must not consent to the carrying out of any development on land unless:

a) *It has considered whether the land is contaminated*

b) *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*

c) *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.*

The Project represents a continuation of the current electricity generation uses of the AGLM landholding, being a form of industrial development. **Section 6.7** and **Appendix D** confirms that potential contamination risks present in the development site is not an impediment to the implementation of the Project.

3.4.5 State Environmental Planning Policy (Koala Habitat Protection) 2020

The *State Environmental Planning Policy (Koala Habitat Protection) 2020* **(Koala SEPP**) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas. By supporting a permanent free-living population over their present range of habitats it is hoped that the current trend of koala population decline would be reversed.

Muswellbrook and Singleton LGAs are listed in Schedule 1 of the Koala SEPP, and there are no current Koala Plans of Management in either LGAs.

The BDAR assesses the Project in relation to Koala habitat. The BDAR concludes that as no evidence of Koala activity was identified during surveys conducted across the Project area, the limited extent of habitat and the patchy occurrence of feed trees, it is unlikely that the study area represents Core Koala Habitat. As such, no further assessment under the SEPP is required. Further details are provided in **Section 6.6** and **Appendix E.**

3.4.6 Muswellbrook Local Environmental Plan 2009

The Battery and Decoupling works would be within the application area of the Muswellbrook LGA. Relevant provisions of the Muswellbrook LEP for the purpose of Section 4.15 of the EP&A Act are as follows:

- Objectives and land use for the SP2 zone
- Part 4 principal development standards
- Section 5.10 - Heritage conservation
- Section 7.1 - Terrestrial biodiversity
- Section 7.6 – Earthworks.

Zoning

The land is zoned as SP2- Infrastructure. The objectives of the SP2 zone are:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or that may detract from the provision of infrastructure
- To recognise existing railway land and to enable future development for railway and associated purposes

- To prohibit advertising hoardings on railway land
- To recognise major roads and to enable future development and expansion of major road networks and associated purposes and
- To recognise existing land and to enable future development for utility undertakings and associated purposes.

The Project is considered compatible with the objectives of the SP2 zone.

The only development types permitted within the zone are roads and the purpose shown on the Land Zoning Map, in this case 'Power Generation', including any development that is ordinarily incidental or ancillary to development for that purpose. The Project meets the definition of Power Generation and as such is permissible with development consent under the Muswellbrook LEP.

Principal Development Standards

The site is not mapped under the Muswellbrook LEP as subject to maximum building heights or floor space ratios. Principal Development Standards are therefore not applicable to the Project.

Heritage conservation

Clause 5.10 under the Muswellbrook LEP requires development consent for works that disturb archaeological or Aboriginal places of heritage significance. The site is not mapped under the Muswellbrook LEP in relation to heritage conservation. Aboriginal and non-Aboriginal heritage assessments have been undertaken and consultation carried out in accordance with the SEARs (see **Section 6.8** and **Section 6.9**).

Terrestrial biodiversity

The objective of Clause 7.1 is to protect, maintain and improve the diversity of landscapes, including:

- Protecting the biological diversity of native fauna and flora
- Protecting ecological processes necessary for their continued existence and
- Encouraging the recovery of threatened species, communities and populations and their habitats.

Land in the vicinity of the MA1B conveyor west of Bayswater is mapped as Biodiversity on the Muswellbrook LEP Terrestrial Biodiversity Map.

Development consent must not be granted for development on land to which this clause applies unless the consent authority is satisfied that the development satisfies the objective of this clause and:

- The development is designed and will be located and managed to avoid any potential adverse environmental impact or
- If a potential adverse environmental impact cannot be avoided, the development:
  - Is designed and located so as to have minimum adverse impact, and
  - Incorporates effective measures to remedy or mitigate any adverse impact caused.

The BDAR assesses the Project in relation to biodiversity and includes measures to avoid, mitigate and offset impacts to Biodiversity in accordance with the *Biodiversity Conservation Act 2016* (**BC Act**) and Biodiversity Assessment Method (**BAM**). Further details are provided in provided in **Appendix E** and summarised in **Section 6.6**.

Earthworks

Clause 7.6 (3) of the Muswellbrook LEP requires that before granting development consent for earthworks, the consent authority must consider the following matters:

- The likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality
- The effect of the proposed development on the likely future use or redevelopment of the land
- The quality of the fill or of the soil to be excavated, or both
- The effect of the proposed development on the existing and likely amenity of adjoining properties
- The source of any fill material or the destination of any excavated material
- The likelihood of disturbing relics
- The proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.

These mandatory considerations are addressed in the impact assessment chapters of this EIS.

3.4.7 Singleton Local Environmental Plan 2013

The BAW component of the Project is predominantly within the Singleton LGA, and some approvals to be surrendered and consolidated apply to land in the Singleton LGA. Potentially relevant provisions of the Singleton LEP for the purpose of Section 4.15 of the EP&A Act are as follows:

- Objectives and land use for the RU1 zone
- Part 4 principal development standards
- Section 5.10 – Heritage conservation
- Section 7.1 – Earthworks
- Section 7.2 – Flood planning
- Section 7.6 – Riparian land and watercourses.

Zoning

The land is zoned as RU1 Primary Production. The objectives of the RU1 zone are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- To encourage diversity in primary industry enterprises and systems appropriate for the area
- To minimise the fragmentation and alienation of resource lands
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

The Project is compatible with the objectives of the RU1 zone and would not restrict the future use of the site following closure of Liddell and Bayswater for permissible purposes under the LEP.

Electricity generation, and associated infrastructure for the purposes of electricity generation, are not listed as permissible with or without consent under the zone and would therefore be prohibited under the provisions of Singleton LEP. However, under clause 34 of ISEPP, 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. Land which is zoned RU1 - Primary Production is a prescribed rural zone for the purposes of clause 34 of ISEPP. Accordingly, the Project is permissible.

Principal Development Standards

The site is not mapped under the LEP as subject to maximum building heights or floor space ratios. Principal Development Standards are therefore not applicable to the Project.

Heritage conservation

Clause 5.10 under the LEP requires development consent for works that disturb archaeological or Aboriginal places of heritage significance. The site is not mapped under the LEP in relation to heritage conservation. Detailed Aboriginal and non-Aboriginal heritage assessments have been undertaken and consultation carried out in accordance with the SEARs (see **Section 6.8** and **Section 6.9**).

Earthworks

Clause 7.1 (3) of the Singleton LEP requires that before granting development consent for earthworks, the consent authority must consider the following matters:

- The likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development
- The effect of the development on the likely future use or redevelopment of the land
- The quality of the fill or the soil to be excavated, or both
- The effect of the development on the existing and likely amenity of adjoining properties
- The source of any fill material and the destination of any excavated material
- The likelihood of disturbing relics
- The proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area
- Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

These mandatory considerations are addressed in the impact assessment chapters of this EIS.

Flood planning

The land is not mapped as being subject to flood planning controls of the Singleton LEP.

Riparian land and watercourses

The Project area includes a small area mapped as riparian land or watercourses which intersects, and has been previously altered by, the drainage channel below Plashett's reservoir. Clause 7.6 (3) requires that before determining a DA for development on land to which this clause applies, the consent authority must consider:

- Whether or not the development is likely to have any adverse impact on the following:
  - The water quality and flows within the watercourse
  - Aquatic and riparian species, habitats and ecosystems of the watercourse
  - The stability of the bed and banks of the watercourse
  - The free passage of fish and other aquatic organisms within or along the watercourse
  - Any future rehabilitation of the watercourse and riparian areas
- Whether or not the development is likely to increase water extraction from the watercourse, and
- Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Works, other than routine maintenance of the existing canal, are not proposed within the land mapped as riparian land or watercourses. Consideration of sensitive receiving environments, including watercourses, is provided in **Section 6.12**.

3.5 Other legislation

3.5.1 NSW legislation

3.5.1.1 Protection of the Environment Operations Act 1997

The principal legislation regulating pollution and waste management in NSW is the POEO Act which specifies the requirements for licences and regulates activities that have the potential to pollute or harm the environment. All scheduled activities as listed in Schedule 1 of the POEO Act require an EPL.

Liddell and Bayswater are operated under EPL 2122 and 779 respectively, and these would be varied to incorporate any new scheduled activity as required. EPL Licence boundaries may also be amended to transfer shared infrastructure required for the ongoing operation of Bayswater into EPL 779 in the future. The current EPL boundaries are shown on **Figure 3-1**. There are no plans to immediately amend EPL boundaries to accommodate the Project.

3.5.1.2 Waste Avoidance and Resource Recovery Act 2001

The objects of the Waste Avoidance and Resource Recovery Act 2001 (**WARR Act**) are to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development. The WARR Act outlines the requirement for the NSW Environment Protection Authority (**EPA**) to develop a waste strategy for the State.

Resource management for the Project has applied the resource management hierarchy specified in the WARR Act, being:

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

Waste management is discussed in **Section 6.11**.

3.5.1.3 Contaminated Land Management Act 1997

The C*ontaminated Land Management Act 1997* (**CLM Act**) aims to establish a process for investigating and, where appropriate, remediating sites where contamination presents a significant risk of harm to human health or an aspect of the environment.

Bayswater and Liddell have previously been notified to the EPA in accordance with the CLM Act and determined not to require regulation under that Act. Rather environmental issues at Bayswater and Liddell continue to be regulated via the site EPLs. Potential remediation requirements for any pre-existing contamination present at Bayswater and Liddell would be assessed and determined as part of the ultimate closure and rehabilitation of the sites in accordance with all relevant regulatory requirements at that time.

Section 6.7 and **Appendix D** consider the contamination status of the Project area and conclude that the site is suitable in its current state for the Project.

3.5.1.4 Biodiversity Conservation Act 2016

The BC Act introduced mandatory requirements for biodiversity assessment and reporting and established the BAM and Biodiversity Offsets Scheme (**BOS**), with the key principle of 'no net loss' where any impact of

development is assessed and offset, while demonstrating impact avoidance, minimisation and management measures prior to implementing offsets.

Under section 7.9 of the BC Act, any SSD application is to be accompanied by a BDAR, unless it is determined that the proposed development is not likely to have any significant impact on biodiversity values.

The BDAR assesses the Project on all potential direct, indirect and prescribed impacts in accordance with the BC Act and BAM. A BDAR has been prepared and is provided in **Appendix E** and summarised in **Section 6.6**.

3.5.1.5 National Parks and Wildlife Act 1974

The NPW Act seeks to protect natural and cultural heritage by prescribing offences and defences relating to, but not limited to, Aboriginal heritage and the preservation of native title within NSW. Under Part 6 Section 86 of NPW Act, it is an offence to harm or desecrate an Aboriginal object or Aboriginal place.

Section 87(1) of the NPW Act provides that it is a defence to these provisions if the harm or desecration act is authorised by an AHIP. Under Section 4.41 of the EP&A Act, an AHIP under Section 90 of the NPW Act is not required for SSD that is authorised by a development consent.

Nevertheless, the Project is required to comply with all legislative requirements under Part 6 of the NPW Act. The assessment of the potential impacts on Aboriginal cultural heritage and consultation undertaken are discussed in the Aboriginal Cultural Heritage Assessment Report (**ACHAR**) provided as **Appendix F** and summarised in **Section 6.8.**

3.5.1.6 Heritage Act 1977

The Heritage Act provides for the conservation of buildings, works, relics and places that are of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance to the State. Matters protected under the Act include items listed on the State Heritage Register, the heritage schedules of local council LEPs, and/or the conservation registers (or Section 170 Registers) of NSW State government agencies, as well as items subject to an Interim Heritage Order.

Section 139 of the Heritage Act prohibits a person from disturbing or excavating any land on which the person has discovered or exposed a relic, except in accordance with an excavation permit or a notification granting exception for the permit.

An approval under Part 4, or an excavation permit under Section 139 of the Heritage Act is not required for SSD that is authorised by a development consent (Section 4.41 EP&A Act). No known heritage items are located in or around the Project. The Project is not expected to impact on any known heritage items.

3.5.1.7 Crown Land Management Act 2016

The *Crown Land Management Act 2016* (**CLMA**) provides for the ownership, use and management of Crown land in NSW. Ministerial approval is required to grant a 'lease, licence, permit, easement or right of way over a Crown Reserve'. The Project area is adjacent to one area of Crown land and would not impact on it, as shown on **Figure 3-1**.

3.5.1.8 The Coal Mine Subsidence Compensation Act 2017

The CMS Act requires that certain development within mine subsidence districts must obtain approval from the Subsidence Advisory, to ensure new structures are built to an appropriate standard that reduces the risk of damage should subsidence occur.

Some of the BAW components and the ongoing maintenance of the Ravensworth coal conveyors are proposed within land mapped as mine subsidence district, refer to **Figure 6-1**. Approval under Section 21 of the CMS Act would be sought for any new infrastructure within this area.

3.5.1.9 Pipelines Act 1967

The Pipelines Act describes the approvals system for the construction and operation of pipelines in NSW, with exemptions including for the supply of water or pipelines constructed by a public authority. Part 3 of the Pipelines Act outlines licensing requirements for pipelines and, excluding exempt items a licence is required to construct, alter and operate a pipeline.

The pipelines associated with the Project are exempt under the Pipelines Act.

3.5.1.10 Rural Fires Act 1997

The Rural Fires Act facilitates the prevention, mitigation and suppression of bush and other fires in LGAs and parts of NSW considered to be rural fire districts. The Project would be located partially on Bush Fire Prone Land (**BFPL**).

Under the Rural Fires Act, the owner or occupier of land is obligated to take precautions to minimise the risk of bushfires starting or spreading within their land. Section 4.41 of the EP&A Act overrides the requirement for a bush fire safety authority to authorise the Project under Section 100B of the Rural Fires Act. Consideration of possible bush fire risks is however provided in **Section 6.1**.

3.5.1.11 Roads Act 1993

The Roads Act aims to establish the rights and procedures for using, opening and closing public roads. It also provides the classifications of roads and the declaration of TfNSW and other public authorities as roads authorities for classified and unclassified roads. A local council is the roads authority for public roads, excluding classified roads and those declared by the roads authority.

Under Section 138, consent of the roads authority is required to:

- Erect a structure or carry out a work in, on or over a public road
- Dig up or disturb the surface of a public road
- Remove or interfere with a structure, work or tree on a public road
- Pump water into a public road from any land adjoining the road
- Connect a road (whether public or private) to a classified road.

The Project may require ongoing maintenance of coal conveyors within the road reserve. A Roads Act approval cannot be refused if it is necessary for carrying out SSD that is authorised and is to be substantially consistent with the consent.

3.5.1.12 Water Act 1912 and Water Management Act 2000

The *Water Act 1912* (**Water Act**) governs the issue of new water licences and the trade of water licences and allocations. Surface licences are administered under Part 2 of the Water Act, whilst groundwater licences are administered under Part 5 of the Water Act. There are currently a number of areas to which an embargo on new applications under Part 2 and Part 5 of the Water Act applies.

The WM Act was introduced to provide a comprehensive singular piece of legislation to effectively manage and regulate access and use of the State's water resources. Section 3, Part 3 of the WM Act requires that approval be granted for works that are classified as "controlled activities" within waterfront land defined as 40 m from the bank of any river, lake, estuary or coastal waters of the State (Lake includes a wetland, a lagoon, a saltmarsh and any collection of still water, whether perennial or intermittent and whether natural or artificial).

A Water Sharing Plan for the Hunter Regulated River Water Source 2016 was made under Section 50 of the WM Act and the vision for this Plan is to provide for:

- The health and enhancement of this water source and its water-dependent ecosystems
- The productive and economically efficient use of water resources
- The social and cultural benefits to urban and rural communities that result from the sustainable and efficient use of water.

The construction and operation of the Project would not alter AGLM's overall water requirements with all necessary water to be drawn from within existing entitlements. AGL currently holds a number of water access licences (**WAL**) associated with the ongoing operation of Bayswater and Liddell. As no groundwater would be abstracted during construction of the Project and harvesting of surface water is covered by existing entitlements, a new WAL or modification to existing WAL/s would not be required.

While the Project involves works within waterfront land, 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 WM Act are not required for SSD.

3.5.2 Commonwealth legislation

3.5.2.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The EPBC Act is the primary Commonwealth legislation relating to the environment and provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places. Under Part 3 of the EPBC Act, referral for approval from the Australian Minister for the Environment is required for an action that:

- Has, will have, or is likely to have a significant impact on a matter of national environmental significance
- Is undertaken on Commonwealth land and has, will have, or is likely to have a significant impact on the environment
- Is undertaken by the Commonwealth and has, will have or is likely to have a significant impact on the environment
- Is undertaken outside Commonwealth land and has, will have or is likely to have a significant impact on the environment of Commonwealth land.

Under the EPBC Act proposed 'actions' that have the potential to impact on matters of national environmental significance (**MNES**) or the environment of Commonwealth land, or are being carried out by a Commonwealth agency, must be referred to the Australian Government. If the Australian Minister for the Environment determines that a referred project is a 'controlled action', the approval of that Minister is required for the project in addition to the approval from the NSW Minister for Planning and Public Spaces.

An EPBC Act referral (2020 / 8844) was made to the Department of Agriculture, Water and the Environment (**DAWE**) on 20 November 2020 to consider whether the Project would be considered to be a controlled action. On 8 January, DAWE determined the Project is not a 'controlled' action under the EPBC Act. Accordingly, the Project does not require assessment or approval under the EPBC Act.

Consideration of Commonwealth listed threatened species and ecological communities is provided in the BDAR provided in **Appendix E** and summarised in **Section 6.6**.

3.5.2.2 Native Title Act 1993

The Native Title Act (Commonwealth) seeks to recognise and protect native title. A successful native title determination results in the recognition of the rights, interests or uses claimed by the registered party, and any actions by Government on that land must be consistent with the claim.

Searches of the register maintained by the National Native Title Tribunal indicate that there are no native title claims registered with respect to the land within the Project area.

3.5.2.3 National Greenhouse and Energy Reporting Act 2007

The Federal Government uses the National Greenhouse Gas and Energy Reporting (**NGER**) legislation for the measurement, reporting and verification of Australian Greenhouse Gas (**GHG**) emissions. This legislation is used for a range of purposes, including being used for international GHG reporting purposes. Corporations which meet the thresholds for reporting under NGER must register and report their GHG emissions.

Under the NGER Act, constitutional corporations in Australia (including AGL) which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator on an annual basis. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* identifies a number of methodologies to account for GHGs from specific sources relevant to the Project. This includes emissions of GHGs from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction), and from consumption of electricity from the grid.

4. Strategic context

This chapter provides the strategic context and detailed consideration of the capability of the Project to contribute to the security and reliability of the electricity system in the NEM.

4.1 Strategic policy context

Based on the Project objective as identified in **Section 1.4.2**, the strategic context for the Project is wholly related to the context of AGLM within the NEM. Bayswater and Liddell are currently important contributors of reliable and dispatchable power into the NEM. This importance has been highlighted by the recent approval of the Bayswater Turbine Efficiency Upgrade project which was assessed as CSSI and recognised:

- Bayswater as being the second largest coal-fired power station in Australia producing approximately 15,000 GWh of electricity a year, which is enough to power 2 million homes
- Strengthening the energy security and reliability of the east coast electricity market.

The planned retirement of Liddell presents both a need within the NEM for new sources of dispatchable electricity and other network services, and an opportunity within the site to take advantage of the significant transmission network connection infrastructure associated with Liddell's existing connection.

4.1.1 AGL environmental policy and initiatives

The AGL Sustainability Report 2017 – Sustainable Business Strategy (AGL, 2017b) recognises that approximately three quarters of Australia's current thermal generation fleet is beyond its original engineering design life, and as such there is a concurrent need to modernise and decarbonise Australia's electricity generation sector. As the generator of approximately 25 % of the energy within the NEM, AGL has committed to playing a leading role in this transition.

As outlined below, the Project is in keeping with AGL's current policies.

4.1.1.1 Greenhouse Gas Policy

Twelve coal fired power stations have closed in Australia in recent years, and while some have been mothballed, and their closure anticipated, none were closed with more than one year's notice. In contrast, AGL has provided advanced notice of its intention to close its coal fired power stations, with its strategic approach presented in its Greenhouse Gas Policy (AGL, 2015). AGL makes the following public commitments as part of its Greenhouse Gas Policy:

AGL commits to being a transparent and constructive stakeholder. Our public policy advocacy and internal approach to GHG mitigation will be reported in our Annual Sustainability Report. AGL specifically makes the following commitments:

- AGL will continue to provide the market with safe, reliable, affordable and sustainable energy options.
- AGL will not build, finance or acquire new conventional coal-fired power stations in Australia (i.e. without carbon capture and storage). Note: The term conventional is used to refer to coal-fired power plants that have a higher lifecycle emissions intensity than a combined cycle gas turbine (**CCGT**).
- AGL will not extend the operating life of any of its existing coal-fired power stations.
- By 2050, AGL will close all existing coal-fired power stations in its portfolio.
- AGL will improve the greenhouse gas efficiency of our operations, and those in which we have an influence.
- AGL will continue to invest in new renewable and near-zero emission technologies.
- AGL will make available innovative and cost-effective solutions for our customers such as distributed renewable generation, battery storage, and demand management solutions.

- AGL will incorporate a forecast of future carbon pricing into all generation capital expenditure decisions.

AGL will continue to be an advocate for effective long-term government policy to reduce Australia's emissions in a manner that is consistent with the long-term interests of consumers and investors.

4.1.1.2 Climate Statement and Commitments

AGL also recently added to its Greenhouse Gas Policy (AGL, 2015) with an updated Climate Statement and Commitments (AGL, 2020) confirming AGL's target of net-zero emissions by 2050 and recognising three major forces driving Australia's energy transition: customer demand, how communities act, and how technology evolves. AGL's Climate Statement outlines five commitments:

1) *Offer customers the option of carbon neutral prices across all our products – we will match accelerating customer demand to support decarbonisation of the energy system with a growing range of carbon neutral options*
2) *Support the evolution of Australia's voluntary carbon markets – we will explore ways through which we can participate in mechanisms to generate and supply carbon credits*
3) *Continue investing in new sources of electricity supply – we will continue both direct investment and offtake agreements as we have with projects like Barker Inlet Power Station and Coopers Gap Wind Farm*
4) *Responsibly transition our energy portfolio – we will continue to run our coal-fired power stations responsibly, and support our people and communities during the transition*
5) *Be transparent – we will openly and transparently track our progress through our annual report and hold ourselves accountable through our remuneration structures.*

4.1.1.3 Powering Australian Renewables Fund

AGL is committed to investing in the generation required to meet its customers' demands. In 2016, AGL established the Powering Australian Renewables Fund (**PARF**), a landmark partnership to develop, own and manage approximately 1,000 MW of large-scale renewable energy infrastructure assets and projects. AGL announced QIC, on behalf of its clients the Future Fund and those invested in the QIC Global Infrastructure Fund, as its equity partner in the $2-3 billion PARF. AGL has sold the 102 MW Nyngan and 53 MW Broken Hill solar plants and the 200 MW Silverton and 453 MW Coopers Gap wind farms into the PARF.

4.1.1.4 NSW Generation Plan

In December 2017, AGL announced its NSW Generation Plan, which included plans for the retirement of Liddell in 2022, and the resulting changes to its portfolio to assist in meeting the potential electricity market gap that this would create. The Battery was identified in this document as part of the plan by which some of the power formerly generated by Liddell could be replaced.

In 2016 AGL committed to a detailed strategic review of their approach to rehabilitation, recognising the increasing need to inform stakeholders on the approach to managing the risks and opportunities associated with rehabilitation and the energy transition.

In 2017 AGL released Rehabilitation: AGL's approach to rehabilitation of power generation infrastructure (AGL, 2017c). The report summarises the outcomes of the strategic review of rehabilitation requirements, and understanding of the challenges associated with repowering, repurposing and rehabilitating large power generation sites. The report also outlines AGL's commitment to evidence based, best practice site transition. It serves as a foundation for engagement with stakeholders and policy makers and provides a methodology to identify options for generation sites post closure.

4.1.2 National Energy Market

It is widely recognised that electricity generation in Australia is undergoing a significant transition towards more distributed, intermittent generation sources. AGL recognises community and government concerns in relation to energy security, as highlighted in the Australian Energy Market Operator's (**AEMO**) *2017 Electricity Statement of Opportunities* (AEMO, 2017). AGL has released the NSW Generation Plan that outlines AGL's proposed investment response. This includes the requirement of Bayswater continuing to safely and reliably meet the market demand for baseload power until its scheduled closure in 2035.

As a response to the transition, The Council of Australian Governments (**COAG**) Energy Council has tasked the Energy Security Board (**ESB**) with developing advice on a long-term, fit-for-purpose market framework to support reliability that could apply from the mid-2020s. By the end of 2020, the ESB needs to recommend any changes to the existing market design or recommend an alternative market design to enable the provision of the full range of services to customers necessary to deliver a secure, reliable and lower emissions electricity system at least-cost. Any changes to the existing design or recommendation to adopt a new market design would need to satisfy the National Electricity Objective. This forward work plan was approved by the COAG Energy Council at its December 2018 meeting.

The ESB has recognised that any significant changes to the electricity market design would need to be well considered, include substantial input from stakeholders and detailed consideration of alternative market designs, as well as any changes telegraphed in advance to ensure there is minimal disruption to the forward contract markets for electricity. If changes are required to deliver a long-term, fit-for-purpose market framework by the mid-2020s, then consideration of any required changes should be concluded by the end of 2020 to enable sufficient time for the market to transition to the new market framework. AGL has expressed its support for this approach. AGL supports the Post 2025 Market Design project, which provides an opportunity to take stock of the evolution of the NEM market against key trends, and ensure the market is well placed to address challenges in the long term. Leading amongst these challenges is the need for ongoing investment to ensure reliable and affordable power during the transition to new generation.

The NSW Energy Security Taskforce Final Report identified that the increasing penetration of intermittent renewable sources of electricity requires systems to respond more rapidly and flexibly. As such energy storage has emerged as a key component of the decarbonisation of the Australian electrical system. Energy storage allows the greater penetration of intermittent renewable energy sources while maintaining network stability and security. This is aligned with the need identified by the *Independent Review into the Future Security of the National Electricity Market* (**the Finkel Review**) (Finkel, 2017), that the NEM requires stable, dispatchable generation to balance network requirements as renewable generation fluctuates depending on the predominate solar and wind resources available at the time.

The potential for unserved energy and not meeting current reliability standards is projected to increase in NSW and Victoria after Liddell closes. In worst case scenarios this could lead to controlled load shedding or loss of supply in NSW. There is also a need for dispatchable energy generation projects to be able to respond to carbon reduction policies such as the NSW Renewable Energy Action Plan (NSW Government, 2013).

The Finkel Review identified that "Enhanced system planning will ensure that security is preserved, and costs managed, in each region as the generation mix evolves. Network planning will ensure that new renewable energy resource regions can be economically accessed". The COAG endorsed this recommendation.

The AEMO operates the NEM and evaluates the expected supply and demand balance publishing advice to stakeholders in:

- An Integrated System Plan (**ISP**), most recently published in July 2020
- An Electricity Statement of Opportunities (**ESOO**), most recently published in August 2020.

The ISP guides governments, industry and consumers on investments needed for an affordable, secure and reliable energy future, while meeting prescribed emissions trajectories, and triggered the processes for actionable ISP projects. The ISP is a whole-of-system plan that provides an integrated roadmap for the efficient

development of the NEM over the next 20 years and beyond. Its primary objective is to maximise value to end consumers by designing the lowest cost, secure and reliable energy system capable of meeting any emissions trajectory determined by policy makers at an acceptable level of risk.

The ISP identifies investment choices and recommends essential actions to optimise consumer benefits as Australia experiences what is acknowledged to be the world's fastest energy transition.

The First ISP was released by AEMO in July 2018. According to the 2018 ISP (AEMO, 2018):

> *"The ISP modelling identifies investment portfolios that can minimise total resource costs and the targeted transmission investment, as well as the development of selected Renewable Energy Zones, necessary to achieve the lowest level of replacement investment costs.*
>
> *To support an orderly transition, ISP analysis demonstrates that, based on projected cost, the least-cost transition plan is to retain existing resources for as long as they can be economically relied on. When these resources retire, the modelling shows that retiring coal plants can be most economically replaced with a portfolio of utility-scale renewable generation, storage, DER, flexible thermal capacity, and transmission.*
>
> *Within the plan period, under AEMO's Neutral ISP planning scenario, the analysis projects the lowest cost replacement (based on forecasted costs) for this retiring capacity and energy will be a portfolio of resources, including solar (28 GW), wind (10.5 GW) and storage (17 GW and 90 GWh), complemented by 500 MW of flexible gas plant and transmission investment. This portfolio in total can produce 90 TWh (net) of energy per annum, more than offsetting the energy lost from retiring coal fired generation".*

The Project is wholly aligned with the 2018 ISP as it facilitates both retention of existing resources in the form of the ongoing operation of Bayswater and provides storage to assist replace a component of the retiring Liddell.

The ISP is updated every two years and in July 2020 AEMO released the 2020 ISP (AEMO, 2020) and identifies the following:

> *"The ISP modelling confirms that the least-cost and least-regret transition of the NEM is from a system dominated by centralised coal-fired generation to a highly diverse portfolio of behind-the-meter and grid-scale renewable energy resources that are supported by dispatchable firming resources and enhanced grid and service capabilities, to ensure the power system remains physically secure.*

The 2020 ISP identifies the following in relation to storage:

- Depending on the scenario, the NEM will need 6-19 GW of new flexible, utility-scale dispatchable resources to firm up the inherently variable resources. This will be supported by innovative power system services"
- Most initial investment will be in utility-scale pumped hydro (such as Snowy 2.0, already committed) or battery storage (assuming technology costs continue to fall, and the market arrangements sufficiently incentivise this development).
- Utility-scale energy storage can shift the timing of renewable energy production, reduce the magnitude of new intra-regional transmission required, and provide firming support during peak loads or when renewable production is low
- The growth in storage is broadly aligned with timing of coal-fired generation retirements. The type and depth of storage required will depend on the mix and location of renewable generation, and the ability of existing generators to smooth out short-term and seasonal renewable variability themselves.

Initially, relatively shallow 1- to 2-hour storage is needed to provide firming capacity and intra-day energy shifting. However, as more coal-fired generation retires, medium 4- to 12-hour storage comes into play to shift energy over longer time periods. The Battery is wholly aligned with the 2020 ISP as it would be developed in stages initially providing shallow supply and building to up 500 MW of dispatchable energy over a four hour duration.

The 2020 ESOO presents AEMO's outlook of supply adequacy to 2029–30 under a number of scenarios and sensitivities. It forecasts electricity supply reliability in the NEM over a 10-year period to inform decisions by market participants, investors, and policy-makers. It includes information on:

- Existing, committed, and proposed electricity supply and network capabilities
- Planned generating plant retirements
- Operational consumption, maximum and minimum demand forecasts
- Potential unserved energy (**USE**) in excess of the reliability standard and Interim Reliability Measure (**IRM**) that has been identified over a 10-year outlook period under a range of demand and supply scenarios.

Of most relevance to the Project, the ESOO identifies that:

> *Market and regulatory arrangements that effectively incentivise load to increase in the daytime and 'soak up' excess distributed PV generation will enable this generation to be more efficiently utilised and reduce the likelihood of extreme minimum demand conditions. There are opportunities for technical, market, and regulatory enablers to unlock value from:*
>
> - Load and storage flexibility, including storage and coordinated EV charging and demand response in daylight hours
> - Aggregators and third-party providers of active DER participation services, particularly those that can provide a reliable control of distributed PV capability at low cost to customers
> - Improving unit flexibility and reducing the minimum generation levels of synchronous generating units so they can continue to remain on-line during low demand periods
> - Fast active power response (FAPR) (sub-second response), with anticipated development of market frameworks that reward this capability".

The Battery would act as a load within the system in charging mode and is intended to be operated in line with the opportunities identified within the ESOO.

AGL will continue to engage on the challenges and opportunities within the NEM, working with the ESB and other stakeholders to ensure the future NEM meets the needs of customers, and the broader community. The Project facilitates the ongoing operation of Bayswater until planned retirement while the NEM further adjusts to increased intermittent energy generation and provides for energy storage to facilitate the ongoing transition.

4.1.3 UNFCCC Climate Conference COP 21 and the Paris Agreement

At the Paris Climate Conference COP21 (**COP21**) agreement was reached 'to achieve a balance between anthropogenic (human induced) emissions by sources and removals by sinks of greenhouse in the second half of this century'. Following COP21, international agreements were made to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius (based on temperature pre-industrial levels)
- From 2018, countries are to submit revised emission reduction targets every five years, with the first being effective from 2020, and goals set to 2050
- Define a pathway to improve transparency and disclosure of emissions
- Make provisions for financing the commitments beyond 2020.

Under the Paris Agreement adopted in 2015, a declaration was made to mitigate risks associated with climate change. This agreement was a commitment by participating countries to a goal of reducing carbon emissions in a manner consistent with limiting global warming to less than two degrees above pre-industrial levels, with a concerted effort to constrain warming to less than 1.5 degrees. The mechanism to achieve the Paris Agreement requires each participating country to set a Nationally Determined Contribution to the reduction of emissions.

The Nationally Determined Contribution is required to be reviewed and tightened every five years. Australia's current Nationally Determined Contribution comprises a reduction of Australia's emissions by 26-28 % of 2005 levels by 2030. Globally it is estimated that current Nationally Determined Contributions are not consistent with limiting warming to below two degrees above pre-industrial levels.

In response to COP21, the Commonwealth government has announced a priority of reducing energy prices including the potential for underwriting firm generation. As part of its priority of making energy more reliable, the government has recognised that:

> *"Energy storage is an increasingly important part of our electricity system as it allows us to ensure energy is always available even when the sun and wind are not".*

The Battery is consistent with the Commonwealth government's climate change initiatives and facilitates the continued expansion of renewable energy generation by providing rapidly dispatchable energy storage capacity to respond to times of reduced renewable energy generation.

As Australia's largest GHG emitter, AGL recognises it has a responsibility to be transparent about climate change and the risks and opportunities it poses to its business, the community and the economy more broadly. AGL's approach to transitioning to a low-carbon future is set out within the AGL Greenhouse Gas Policy. This policy acknowledges that Australia is moving to a carbon constrained future and provides a framework within which GHG reduction activities will be structured, presenting a pathway for the gradual decarbonisation of AGL's generation portfolio by mid-century. AGL's commitments within this policy are not inconsistent with the goal of the Paris Agreement to limit warming to below two degrees Celsius above pre-industrial levels.

To assist with strategic planning, during FY19 AGL modelled three scenarios aligned with various climate-related policy alternatives:

- A slow change scenario where the market is slow to adapt to a core carbon constrained future and governments do not introduce new measures to encourage renewable investment
- A State targets only scenario where State governments legislate already announced renewable energy targets
- A deep renewable scenario where consistent renewable policy targets of 50 % renewables across the NEM are achieved.

The results of the analysis indicate that AGL's generation assets will continue to play an important role under each of the three scenarios modelled. The scenarios analysed the thermal and cost efficiencies of AGL's Bayswater and Loy Yang A power stations compared to other (non-AGL) assets, with the modelling results showing that, on a sector basis, the policy constraints modelled are more economically met by the closure of non-AGL thermal assets in advance of the already announced closure dates for AGL's thermal assets.

AGL has committed to expanding their scenario analysis and report to include disclosing analysis of the impact of scenarios consistent with a 1.5 degree future. AGL is incorporating a range of climate change scenarios into this analysis. These scenarios have been developed with reference to leading methodologies including the Intergovernmental Panel on Climate Change, shared socioeconomic pathways and representative concentration pathways, and the AEMO ISP scenarios. AGL will continue to disclose under the Task Force on Climate-related Financial Disclosures framework.

The Project facilitates the transition towards a low-carbon future by providing network services not able to be otherwise provided by renewable energy projects.

4.1.4 Emissions Reduction Fund (ERF)

The Australian Government previously (2011) enacted the *Clean Energy Act 2011;* legislation to reduce carbon emissions. This legislation established an Emissions Trading Scheme (**ETS**), also referred to as a carbon price.

Under this ETS, approximately 370 companies were required to purchase a permit for every tonne of carbon equivalent they emit.

The *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* repealed the *Clean Energy Act 2011*. This abolished the carbon pricing mechanism from 1 July 2014 and is replaced with the Australian Government's Direct Action Plan, which aims to focus on sourcing low cost emission reductions. The Direct Action Plan includes an ERF; legislation to implement the ERF came into effect on 13 December 2014, and is now considered to be the centrepiece of the Australian Government's policy suite to reduce emissions.

Emissions reduction and sequestration methodologies are available under the ERF which could provide the opportunity to earn carbon credits as a result of emissions reduction activities (although note that whilst there is a method related to 'Industrial Electricity and Fuel Efficiency', this is not applicable to electricity generators over 30 MW).

4.1.5 State policy context

All States and Territories have committed to achieving net zero emissions by 2050 (NSW Climate Change Policy Framework, 2016). The policies indicate a strong shift towards decarbonisation goals at a regional level, supported by a growth in renewable energy technology.

The *NSW Climate Change Policy Framework* (OEH, 2016) represents the NSW Government position on responding to climate change and relates directly to how energy is generated and consumed in NSW. The NSW *Climate Change Policy Framework* aims to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. Its aspirational long-term objectives are to achieve net-zero emissions by 2050 and make NSW more resilient to a changing climate.

The *Net Zero Plan Stage 1: 2020-2030* (DPIE, 2020a) sets out how the NSW Government will deliver on the objectives to achieve net zero emissions by 2050 over the next decade.

The NSW Government released its electricity strategy, "Affordable, reliable power for NSW" on 22 November 2019. In announcing the strategy, the NSW Energy Minister highlighted the need for low-cost alternative sources of energy to replace the generating capacity that will be lost as existing assets are retired. The Minister also promoted a focus on reliability, and the need to ensure that the benefits of renewable energy sources are realised without sacrificing reliability of the NEM.

Within the strategy, it is noted that:

> *"Variable renewable energy needs to be complemented by firm and flexible power. Hydroelectricity meets these requirements by generating and storing electricity at scale. Standard hydro power generates electricity by releasing water from an elevated reservoir but does not involve pumping that water up again. Standard hydro is reliant on sufficient water supplies in the upper reservoir, as there is no capability to reuse this water. Pumped hydro involves pumping water into an elevated reservoir and releasing it to generate electricity. NSW has two pumped hydro projects – Shoalhaven (240 MW) and Tumut 3 (1,800 MW) – and numerous smaller, standard hydro projects.*
>
> *Gas-fired power stations generate electricity on demand with about half the level of emissions from coal but, given the current high input costs of gas, are typically only operated during periods of peak demand or when solar and wind are not generating. Gas generation can ramp up quickly, allowing it to dispatch quickly and currently is used to generate about 5 % of NSW's annual electricity.*
>
> *Batteries, as a form of electrical storage, also provide multiple grid services such as frequency regulation. The cost of batteries has fallen in recent years and is expected to continue to trend downwards making batteries a more feasible, commercial firming option for wind and solar farms."*

And:

> *"The NSW Government's Electricity Strategy will:*
>
> 1. *improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, Government caused delays and by encouraging investment in new price-reducing generation and energy saving technology;*
> 2. *prompt Government to act if there is a forecast breach of the EST which private sector projects are unlikely to address. This should be done in a way that minimises costs to consumers and taxpayers and does not give rise to moral hazard risk; and*
> 3. *ensure that there are appropriate powers available for Government to analyse and respond to electricity supply emergencies, if they arise"* (NSW Government, *NSW Electricity Strategy*, November 2019)."

The NSW Government's electricity strategy (NSW Government, 2019) is to be implemented through the NSW Electricity Infrastructure Roadmap (DPIE, 2020b). It envisions a modern electricity system in NSW built on the following five pillars:

> *"1. Driving investment in regional NSW: supporting our regions as the State's economic and energy powerhouse.*
>
> *2. Delivering energy storage infrastructure: supporting stable, long-term energy storage in NSW.*
>
> *3. Delivering Renewable Energy Zones: coordinating regional transmission and renewable generation in the right places for local communities.*
>
> *4. Keeping the grid secure and reliable: backing the system with gas, batteries or other reliable sources as needed.*
>
> *5. Harnessing opportunities for industry: empowering new and revitalised industries with cheap, reliable and low emissions electricity".*

The passage of the *Electricity Infrastructure Investment Act 2020* and the Electricity Infrastructure Investment Bill 2020 in late 2020 recognised the Hunter as a key part of the transition by establishing a fourth renewable energy zone. Further, the Project is wholly in keeping with the vision of the NSW Electricity Infrastructure Roadmap in that it represents a private regional investment, delivers energy storage, is appropriately zoned and uses existing transmission infrastructure, provides security to the NEM and provides cost effective and reliable electricity with no additional emissions, but with higher emissions intensity as a result of round trip efficiency.

AGL already has a clearly articulated plan to achieve decarbonisation of generation by 2050 wholly aligned with the *NSW Climate Change Policy Framework* and not inconsistent with the *Net Zero Plan*. The Project is a key component of AGL's plans to manage the transition to decarbonisation and net-zero emissions while responding to the requirements of the market in relation to reliable and affordable electricity.

4.1.6 Regional policy context

4.1.6.1 Hunter Regional Plan 2036

The *Hunter Regional Plan 2036* (Department of Planning and Environment, 2016) is a 20-year blueprint for the future of the Hunter region. The overall vision for the region is to be the leading regional economy in Australia with a vibrant new metropolitan city at its heart.

This vision is supported by a range of goals, directions and actions. Relevant to the Project is the direction to 'diversify and grow the energy sector' by among other things, promoting 'new opportunities arising from the closure of coal-fired power stations that enable long term sustainable economic and employment growth in the region'.

The *Hunter Regional Plan* recognises the role of the Hunter region as the predominant location for the State's power generation. The ongoing operation of Bayswater until its planned retirement is not inconsistent with this Plan. Additionally, energy and Battery storage align with the objectives of the Plan by further diversifying the energy sector in the Hunter Valley.

4.1.6.2 Muswellbrook Shire Council strategic plan

The *Muswellbrook Shire Council Community Strategic Plan 2017-2027* (Muswellbrook Shire Council, 2017) outlines the community's main priorities and vision for the future.

The Strategic Plan recognises the importance of the power industry to the Shire's economy and employment. Job creation and security was identified in the Strategic Plan as key economic issues for the Shire, with increased employment identified as important by local residents. The Project supports both direct and indirect job opportunities by the creation of jobs.

Supporting Commonwealth and State initiatives to reduce the human impact on climate change is a goal for the Strategic Plan. The Project does not alter the carbon intensity of the ongoing operation of Bayswater and facilitates the increased penetration of renewable energy supply into the NEM.

Muswellbrook Shire Council also commissioned a review of the Muswellbrook LEP 2009 with and published a Draft Discussion Paper in May 2017 for consultation. The stated purpose of the Muswellbrook LEP 2009 Review was:

> *"to investigate means in which the planning framework for the Muswellbrook Local Government Area (LGA) can facilitate economic diversification and economic development as well as providing a general overview that would seek to correct any current anomalies in the planning framework itself, ensure the statutory framework is consistent with the outcomes of existing strategy documents and also promote a planning framework that is reflective of best practice. The Review will inform amendments to the Muswellbrook LEP 2009 and its accompanying Development Control Plan".*

The Muswellbrook LEP 2009 Review recognised the significant change and new opportunities for Muswellbrook and the larger Upper Hunter district including AGL notifying their intentions to retire both of the major coal fired power generators – Liddell and Bayswater in 2022 / 2023 and 2035 respectively. The Review culminates in recommendations of strategic directions and actions of relevance to AGL lands as descried in **Table 4-1**.

Table 4-1: Muswellbrook LEP 2009 Review Strategic Directions and Actions of relevance

Strategic Direction	Actions	Project relevance
8. Sustainable Energy - Continue the production and distribution of sustainable energy from the AGL site, based on a shift to alternative energies such as biomass, gas and/or pumped hydro sources.	Council adopt a policy to proactively pursue energy production as a continuing industry of significance within the LGA.	The Project facilitates the continued use of AGL lands for energy production and storage.
	Engage with all relevant stakeholders to explore the opportunities for alternative energy production and adaptive reuse of the existing generation and distribution infrastructure.	AGL has established the Hunter Energy Transition Alliance to drive innovation in the energy sector and, where possible, support the development of alternative industries to foster economic diversification and resilience. The Hunter Energy Transition Alliance comprises a consortium of regional stakeholders representing industry, state and federal governments, research and development institutions, and new enterprise. The goal of the Alliance is to drive regional diversification

Strategic Direction	Actions	Project relevance
		and ultimately shift AGL's existing economic footprint, workforce, and community reliance on operations through: ▪ Repurposing existing assets and infrastructure ▪ Activating and intensifying productive and complementing land uses ▪ Innovating and diversifying agribusinesses ▪ Harnessing resources (e.g. water, wind, solar) and associated infrastructure to co-locate complementary enterprise.
13. Natural Areas and Biodiversity - The natural environmental values of the area will be protected, preserved, restored and managed to ensure high biodiversity values, and including improved public access to natural areas such as the local National Parks and the Hunter River.	Investigate means of including incentives for vegetation rehabilitation and conservation on mining rehabilitation lands – and negotiating and enabling amendments to DA consents and conditions as reasonable and applicable.	Opportunities to rehabilitate mining land within AGL's land holding would be considered in the Project offset strategy, if required, where it satisfies the NSW Government's Biodiversity Offset Policy.
	Biodiversity Offset Policy - as a matter of policy, Council adopt a position that any biodiversity off sets for mining projects occur within areas that have been identified as having regional biodiversity significance (such as the Upper Hunter Biodiversity Corridor that traverses the north western part of the LGA) instead of on site off sets, unless they can form part of an established and recognised local or regional biodiversity corridor.	The Project may involve limited vegetation clearing. These impacts would be offset in accordance with the BC Act and EPBC Act in accordance with any approval conditions.

4.1.6.3 Singleton Council strategic plan

The *Singleton Community Strategic Plan – 2017-2027* (**SC Strategic Plan**) (Singleton Council, 2017) outlines the community's long-term vision and aspirations for a vibrant, progressive, connected, sustainable and resilient community. The SC Strategic Plan outlines a number of outcomes relating to the five pillars of people, places, environment, economy and leadership.

Valuing, protecting and enhancing a sustainable environment is a key objective of the SC Strategic Plan with identified strategies including "collaborate to enhance, protect and improve our environment', "promote efficient water and waste management and increase reuse and recycling", and "manage and reduce risks from environmental pollution and disease". The Project is not inconsistent with these objectives and BAW component is likely to support an improved environment through enhancements and upgrades to existing infrastructure.

5. Stakeholder consultation

This chapter provides a summary of consultation undertaken by AGL with the relevant local, State or Commonwealth Government authorities, exploration licence and mining lease title holders, service providers, community groups and affected landowners. This section addresses the SEARs and provides:

- An appropriate and justified level of consultation with relevant parties during the preparation of the EIS must be undertaken, including with local, State and Commonwealth government authorities; relevant Aboriginal stakeholders, such as the Local Aboriginal Land Councils; utilities and service providers; and the public, including any relevant community groups and adjoining and affected landowners
- The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.

5.1 AGL Stakeholder Engagement standard

AGL maintains a stakeholder engagement standard which it applies across the development of new projects, expansions of existing infrastructure, and ongoing operations. The standard requires AGL to:

- Conduct consultation with stakeholders, including government groups, asset owners, local community groups, businesses, residents, and local media
- Establish constructive working relationships and communication channels with stakeholders
- Consider Aboriginal cultural heritage issues in the consultation process
- Seek community feedback
- Provide regular updates to interested communities on the progress of projects.

5.2 SEARs requirements for consultation

SEARs for the Project were issued to AGL on 23 September 2020. The SEARs require that AGLM undertake an appropriate and justified level of consultation with relevant parties during the preparation of the EIS, including:

- Local, State and Commonwealth government authorities
- Relevant Aboriginal stakeholders, such as the Local Aboriginal Land Councils (**LALCs**)
- Utilities and service providers
- Members of the public including any relevant community groups and adjoining and affected landowners.

The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed.

The summary of consultation undertaken, issues raised and where or how they are addressed is provided in **Table 5-1**.

5.3 Community consultation

AGLM maintains a community reference group known as the AGL Macquarie Community Dialogue Group (**CDG**) which meets quarterly. Membership of this group includes representatives from the surrounding community interest groups, Muswellbrook Shire Council, Singleton Council and Upper Hunter Shire Council, local business chambers and local Indigenous stakeholder groups.

The Project was initially presented to the CDG at a meeting on 28 July 2020, prior to the lodgement of the Scoping Report and no concerns were raised. Upon lodgement of the Scoping Report, subsequent updates have been presented and discussed at CDG meeting's on 29 September 2020 and 15 December 2020 and no concerns were raised. The Chair did however suggest that they will endeavour to align the first CDG for 2021

during the EIS exhibition phase (i.e. March/April 2021). In August 2020, the Project announcement, and Scoping Report was shared with the Hunter Business Chamber, and they were supportive of the Project.

AGLM has also made contact with the following community groups that have previously expressed an interest in operations at the site:

- Environmental Justice Australia
- Hunter Community Environment Centre
- Hunter Environment Lobby Inc.
- Nature Conservation Council of NSW
- Beyond Zero Emissions.

In response to AGLM's correspondence, Beyond Zero Emissions enquired as to the closing date for submissions on the Project. AGLM advised that submissions will be accepted through the planning portal once the EIS is lodged and a closing date would be advised. No further responses were received.

5.4 Government Authority Consultation

AGLM has corresponded with various stakeholders to introduce the Project. A summary of this, as well as responses to DPIE regarding the Environmental Assessment requirements provided in **Table 5-1.**

A summary of agencies who provided comments on the SEARs is listed below and their inputs are available on the DPIE website:

- Biodiversity Conservation Division (**BCD**)
- Water and the Natural Resources Access Regulator (**NRAR**)
- EPA
- Heritage NSW
- Muswellbrook Shire Council
- Singleton Council
- TfNSW.

These responses document each authority's key concerns and assessment requirements. The agency input into the environmental assessment requirements was provided to DPIE and incorporated at DPIE's discretion.

The following additional authorities are likely to have an interest in the Project and have been consulted:

- TransGrid
- Fire and Rescue NSW
- Subsidence Advisory NSW
- Crown Lands
- DPI Agriculture
- Division of Resources and Geoscience (DRG)
- DPIE Hazards Branch.

Outcomes of this consultation is provided in **Table 5-1**.

Table 5-1: Summary of agency consultation

Stakeholder	Date	Details	Issues raised	How addressed
CDG	28 July 2020	Two Project components introduced (Decoupling and BAW).	No concerns.	N/A
Hon Joel Fitzgibbon MP, Federal Member for Hunter	14 August 2020	Battery Announcement and Scoping Report lodged.	No concerns.	N/A
Michael Johnsen MP, State Member for Upper Hunter	14 August 2020	Battery Announcement and Scoping Report lodged.	No concerns.	N/A
CDG	14 August 2020	Battery Announcement and Scoping Report lodged.	No concerns.	N/A
TfNSW	15 September 2020	Battery Announcement and Scoping Report lodged.	▪ Recommendation for specific traffic and transport impact guidelines to be referenced in the EIS ▪ Requirements for a traffic and transport study to be prepared for the Project, in accordance with recommended guidelines ▪ The Project's impact on stormwater discharge and flooding, particularly on the New England Highway.	A TTA (**Appendix C**) has been prepared in accordance with the SEARs and relevant guidelines, and is summarise in **Section 6.2**. Appropriate drainage features will be incorporated into the design of the Project components by a suitably qualified and experienced professional. All Project components will be designed and constructed in accordance with relevant guidelines.
CDG	29 September 2020	Three Project components presented (the Battery, Decoupling and BAW).	No concerns.	N/A
Muswellbrook Shire Council:	27 November 2020	Three Project components presented (the Battery, Decoupling and BAW).	▪ Employment during the Battery construction and operation	▪ AGL advised up to 100 jobs would be created during construction of the Battery, with two to three jobs required for ongoing operation.

Stakeholder	Date	Details	Issues raised	How addressed
Martin Rush (Mayor), Fiona Plesman (GM) Sharon Pope and Rod Scholes			▪ Potential for landscaping around the Battery site, move away from heavy industrial and become more of a 'business park' ▪ What electricity will feed into the Battery ▪ Council questioned the difference between the Battery and synchronous condenser, which has been referred to by AGL in the past ▪ Are AGL proposing a section 93F contribution (voluntary planning agreement) given the Project is SSD.	▪ The Battery will be in modular form, or container, therefore will not be of a heavy-industrial appearance. ▪ The Battery will receive electricity from the NEM. It is expected that with increasing renewable energy projects in the Hunter, these would connect into the Battery and Liddell switchyard. The Battery will operate at 690 V, and transformers (one existing and one new) will convert to 33 kV. ▪ A grid-scale battery has the capacity to provide stability to the grid. Just as a synchronous condenser would, however the grid-scale battery also has the ability to store electricity for supply during peak demand. Also, with increases in technology the response from large-scale batteries is much faster. As such, AGL are not progressing with synchronous condensers at this time. AGL have not considered a voluntary planning agreement at this time and will assess internally.
Singleton Shire Council: Jason Linnane (GM), Mary-Anne Crawford	30 November 2020	Three Project components presented (the Battery, Decoupling and BAW).	Council put forward the request to be involved in AGL's ongoing planning for the Liddell and Bayswater site, including potential future use planning.	AGL acknowledged that Council would continue to be engaged and consulted during future planning for the Liddell and Bayswater sites.
DPIE – Biodiversity and Conservation Division	10 December 2020	Responding to Biodiversity and Conservation Division inputs into SEARS.	Comments relating to SEARS.	AGL acknowledged the inputs into SEARS and has addressed these as part of the EIS (and associated reports).

Stakeholder	Date	Details	Issues raised	How addressed
EPA	10 December 2020	Responding to EPA inputs into SEARS.	Comments relating to SEARS.	AGL acknowledged the inputs into SEARS and has addressed these as part of the EIS (and associated reports).
Heritage NSW	10 December 2020	Responding to Heritage NSW inputs into SEARS.	Comments relating to SEARS.	AGL acknowledged the inputs into SEARS and has addressed these as part of the EIS (and associated reports).
TfNSW	10 December 2020	Responding to TfNSW inputs into SEARS.	Comments relating to SEARS.	AGL acknowledged the inputs into SEARS and has addressed these as part of the EIS (and associated reports).
CDG	15 December 2020	Project update provided.	No concerns. The Chair suggested the next CDG is aligned with the EIS Exhibition period.	N/A
TfNSW	15 January 2021.	Preparation of the EIS.	No concerns.	N/A
DPIE Hazards Branch	27 January 2021, 9 February 2021 and 22 February 2020	Request further information outlined in the PHA report.	Footprint of the Liddell Battery, relating to heat radiation emitted from enclosures if on fire. Separation distances to adjacent infrastructure allows for enclosures to burn down without the need for external firefighting support.	Theoretical calculations provided to DPIE by Planager (Risk Management Consultants). DPIE agreed the calculations were reasonable for assessing if the proposed battery storage capacity can fit the development site when accounting for separation distances. The calculations of separation distances between enclosures can be removed from the final PHA, as AGL are committed to installing enclosures that have a minimum of 60 minutes fire resistance.

5.5 Commonwealth Government consultation

A referral was made under the EPBC Act as described in **Chapter 4**. The Project has been declared to not be a controlled activity.

AGL provided briefings for Federal Ministers regarding the Project prior to, and upon, lodgement of the Scoping Report. This included briefings to:

- Hon Joel Fitzgibbon MP, Federal Member for Hunter
- Hon Angus Taylor MP, Minister for Energy and Emissions Reduction.

5.6 Aboriginal stakeholder consultation

Aboriginal stakeholder engagement and involvement is important for the identification of Aboriginal cultural values relevant to the Project.

Consultation with Aboriginal groups was carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (**ACHCRP**) (DECCW, 2010a). During the consultation process, which commenced in September 2020, a total of 25 groups/individuals registered their interest in the Project. All Registered Aboriginal Parties (**RAPs**) were routinely consulted throughout the Project, including prior to and during the preparation of the ACHAR, and as part of the site surveys carried out.

The following Aboriginal community consultation was carried out:

The consultation carried out to date for the Project includes:

- Stage 1:
  - Seek the names of Aboriginal people with cultural knowledge by letter or notify native title holders - 26 August 2020
  - Newspaper advertisements in the Koori Mail and the Singleton Argus - 9 September 2020 and 3 September 2020 respectively
  - Notify Aboriginal people with cultural knowledge by letter, and invite input on cultural significance - 24 September 2020
  - Supply of the list of RAPs to DPIE and Wanaruah LALC - 26 October 2020.
- Stage 3
  - RAP review of proposed action information and methodology - sent on 21 September 2020
  - Engage Aboriginal stakeholders to undertake a site survey - 23 and 24 November 2020.
- Stage 4:
  - An archaeological survey and program was carried out on the 23 November 2020 with RAPs and LALC representatives
  - A draft ACHAR was prepared and provided to the ACHAR to RAPs for review and comment – sent on 15 January 2021.

Following the completion of fieldwork, the ACHAR was provided to RAPs for review and provision of comment for inclusion in the final ACHAR for the Project. The only comments received were in support of the findings and recommendations of the ACHAR.

The complete summary of the consultation carried out with the Aboriginal groups for the Project is outlined in the ACHAR provided in **Appendix F**.

5.7 Public exhibition of the EIS

During the public exhibition period, the community and other stakeholders will have the opportunity to review the EIS and make written submissions to DPIE regarding the Project.

5.7.1 Display of the EIS

The EIS will be available for review by the community and stakeholders on the DPIE Major Projects website (www.planningportal.nsw.gov.au/major-projects).

5.7.2 Consideration of community feedback

Engagement carried out after exhibition of the EIS will most likely focus on responding to any key and substantive issues raised in submissions. A submissions report would then be prepared by AGLM for submission to DPIE which would be available to the public via the DPIE Major Projects website (https://www.planningportal.nsw.gov.au/major-projects).

5.8 Ongoing community Feedback Strategy

AGL's Community Engagement Strategy enables community members to submit feedback through multiple channels, AGL also has a dedicated online forum, email address and a 24/7 contact number to ensure community members can provide feedback and raise any issues through a method that they are comfortable with.

AGL has developed a Community Complaints Framework to ensure AGLM employees manage feedback and complaints in a uniform way. The most common feedback methods are outlined in **Table 5-2.**

Table 5-2 Feedback Methods

Feedback Method	
Online Community Engagement Forum	The AGL website includes an AGL Community Engagement Forum with specific groups for each of AGL's assets and current projects.
24-hour Enquiries and Complaints Hotline	An Enquiries and Complaints Hotline is available for all stakeholders to contact with questions and is available 24/7. 1800 039 600
Email	The AGL Community email address allows stakeholders to provide feedback or ask questions. AGLCommunity@agl.com.au

6. Environmental impact assessment

This chapter provides an assessment of the predicted and potential impacts associated with the Project.

For each environmental aspect the existing environment is described, the potential impacts of the Project during construction and operation are assessed and the proposed management measures are described. The environmental management measures proposed in this chapter are consolidated and summarised in **Section 7.3**. Discussion of the acceptability of residual risks is provided in **Table 8-1** and has identified that while residual impacts exist, all impacts are able to be managed through the application of standard environmental management measures as documented in **Chapter 7**.

The key environmental issues for the Project are identified in the SEARs and the environmental risk assessment (see **Chapter 8**). Key issues identified in the SEARs are:

- Hazards and Risk including a PHA and consideration of bushfire and electromagnetic fields (**EMF**)
- Air including air quality impacts and GHG
- Noise and vibration including construction, operational and traffic noise impacts and vibration amenity and structural impacts
- Traffic and transport including traffic volumes, routes and likely impacts to capacity, condition safety and efficiency of the road network
- Biodiversity in accordance with the BAM including a strategy to offset residual impacts
- Land and Contamination including an assessment of impacts of the Project on soils, land capability and geotechnical stability
- Heritage including Aboriginal and non-Aboriginal heritage impacts
- Visual including assessment of impacts, amenity of the surrounding area, private residences and local road network
- Waste including identification, quantification and classification of likely waste streams
- Water including a description and assessment of impacts to water demand, water balance, flooding and water quality
- Social and Economic including consideration of impacts and benefits for the region and State
- Infrastructure including assessment of impacts to third party infrastructure including utilities
- Cumulative impacts particularly in relation to hazards and risks, air quality, noise and vibration, traffic and soil and water
- Long term management including assessment of impacts associated with the operation and maintenance of the proposed facilities.

The SEARs identify that the EIS must address the following specific issues with the level of assessment of likely impacts proportionate to the significance of, or degree, of impact on, the issue, within the context of the Project location and the surrounding environment. Where assessment of key issues are technical in nature and the level of likely impacts warrant detailed consideration, these assessments requirements are supported by detailed investigations that are documented in the specialist assessment reports in **Appendix C** to **Appendix K**. For other assessment requirements such as non-Aboriginal heritage, GHG, water, waste, infrastructure, cumulative and long term management, the level of assessment reflects the fact that for this Project these issues are commonly associated with construction and are appropriately addressed through the design process or by implementing best practice management and management measures.

6.1 Hazards and risk

This section provides an assessment of the potential hazards generated by the Project and measures to mitigate them. The potential hazards and risks have been informed by the *Preliminary Hazard Analysis for Liddell Battery and Bayswater Ancillary Works* (Planager Pty Ltd, 2021) (**PHA**) provided in **Appendix G.**

The PHA and this section addresses the following SEARs:

Hazards and Risk – including:

- *A preliminary hazard analysis (PHA) prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' and Multi-level Risk Assessment*
- *An assessment of potential hazards and risks including but not limited to bushfires, electromagnetic fields or the proposed grid connection infrastructure against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.*

This hazards and risks assessment does not take into account potential health and safety risks to on site workers associated with normal construction operations, as these are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011* (**WHS Act**)) and are not relevant to approval of the Project under Part 4, Division 4.7 of the EP&A Act.

6.1.1 Assessment methodology

The assessment of hazards and risks associated with the Project has involved review of information provided by AGLM's Battery technology provider and consideration of site and surrounding land-uses.

The PHA focussed on potential high consequence incidents that may affect the health and safety to people and the environment outside of the site boundaries. The risks considered included:

- Risk from fires associated with electrical infrastructure and flammable material
- Environmental risk from spills
- Risks from exposure to Magnetic and EMF
- Health and safety risks to staff and to contractors from major, high consequence incidents
- Health and safety risk to the community.

The contamination and flood hazards and risk are discussed in **Section 6.7** and **Section 6.12** respectively.

The PHA methodology included:

- Reviewing site context
- Hazard identification and incident screening
- Risk analysis, evaluation, classification and prioritisation and evaluation of risk treatment
- Identification of appropriate mitigation and environmental management measures.

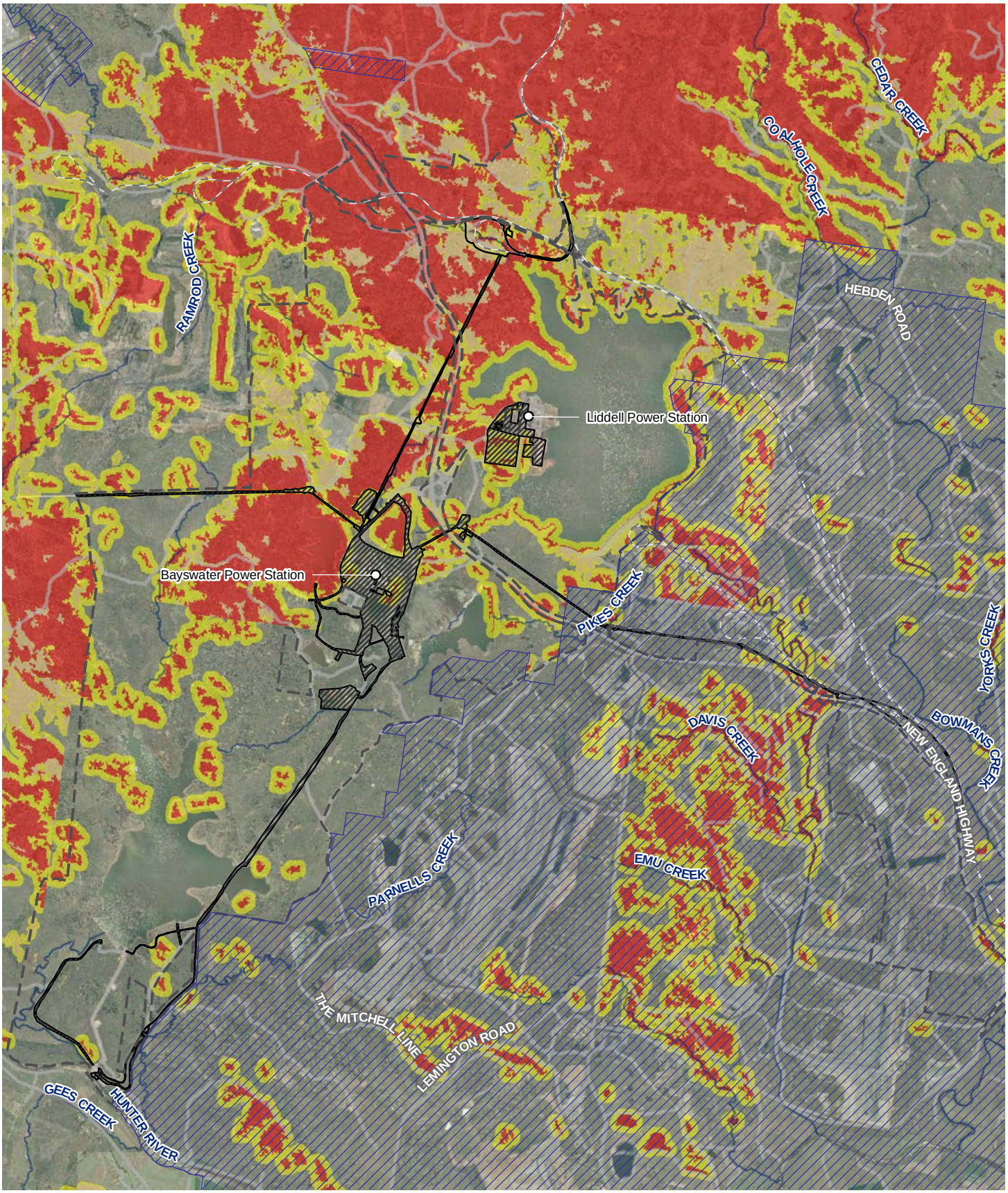
The PHA was prepared in accordance with DPIE's Hazardous Industry Planning Advisory Paper No. 6 (DPIE, 2011a) (**HIPAP**) and the Multi-level Risk Assessment guideline (DPIE, 2011b). Consultation with stakeholders, including with DPIE's Hazard Branch, was conducted as part of the establishment of the context and the hazard identification for the Project, as outlined in **Section 5.4**. Consultation with NSW Rural Fire Service (**RFS**) would be conducted in conjunction with the establishment of detailed design.

6.1.2 Existing environment

In relation to hazards and risks, the Project components would be located:

- Within areas mapped as bushfire prone land, refer to **Section 6.1** and **Figure 6-1**. There are areas of vegetation Category 1 and Category 2 mapped within and surrounding the Project area. This vegetation category is considered high risk for bush fire due to its high combustibility and likelihood of forming fully developed fires.
- In close proximity to energy generation and distribution infrastructure associated with Liddell and Bayswater and network connections to NSW which generate EMF. EMF is part of the natural environment and electric fields are present in the atmosphere and static magnetic fields are created by the earth's core. EMF is also produced wherever electricity or electrical equipment is in use. EMF are strongest closest to the wires and electrical equipment and their level reduces with distance. The higher the voltage, the stronger the field.
- Over 2 km from residential development in relation to the Battery and Decoupling footprint where the new electrical infrastructure would be located.
- At an elevation above where flooding could impact the Project, refer to **Section 6.12.**
- Within areas that have the potential to be impacted from contamination from power station activities conducted since Bayswater and Liddell were initially constructed, refer to **Section 6.7.2**. The contamation risk will be managed in accordance with the management measures provided in **Section 6.7.5**
- Within land mapped as mine subsidence district limited to BAW components where no new infrastructure is proposed and the ongoing maintenance of the M Series coal conveyors as shown **Figure 6-1** is required**.** The works associated with the BAW within the mine subsidence district would not involve excavations or major earthworks. As such the risk from mine subsidence are considered to be low and have not been considered any further.

The Project is in close proximity to existing Bayswater and Liddell infrastructure and operational areas and the PHA considers whether the new activities or components would alter the current level of hazards or risk.



Legend

- Project area
- Development site
- AGL owned land

Bushfire prone land

- Bushfire prone vegetation buffer
- Category 1: high risk
- Category 2: low risk
- Mine subsidence

- Railway
- Road
- Waterway

0 2 4km

1:90,000 at A4

Data sources

Jacobs 2021
AGL 2020
©Department of Finance, Service and Innovation Aug 2020

Imagery:
© Department of Customer Service 2020

GDA94 MGA56

Figure 6 - 1 Hazards

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6.1.3 Assessment of impacts

6.1.3.1 Preliminary hazard assessment

The objective of the risk screening in the Multi-level Risk Assessment guideline (DPIE, 2011) as well as in the Hazardous and Offensive Development Application Guidelines Applying SEPP 33 (Department of Planning, 2011) is to determine whether the Project is considered as *potentially hazardous'* in the context of SEPP 33 as per the definition:

> *'Potentially hazardous industry' means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*
>
> *(a) to human health, life or property; or*
> *(b) to the biophysical environment, and:*
>
> *includes a hazardous industry and a hazardous storage establishment.*

Development that is classified as potentially hazardous industry must undergo a PHA as per the requirements set in HIPAP to determine the risk to people, property and the environment. If the residual risk exceeds the acceptability criteria, the development is 'hazardous industry' and may not be permissible within NSW.

The PHA found that the risk profile for the Project, as per the definition by AGLM, is consistently between Moderate and Low risk. No High or Very High risks were identified. In addition, sufficient land is available to accommodate the Battery.

The worst-case consequence for the risk events identified is a fire event associated with the Battery initiated through a thermal runaway or an electrical fault inside the Battery. This would generate heat and toxic gas and combustion products.

A major fire associated with the Battery or the Decoupling works has the potential to propagate to areas outside of the site and initiate a bushfire. This presents the only potential impact to the community from the Project and, provided an Asset Protection Zone (**APZ**) is established and maintained, this risk is low. The available land is large and the Battery site would be laid out such that sufficient separation between the Battery and external boundaries can be achieved in order to minimise off-site risk. The details on internal separation requirements and need for active firefighting requirements at the Battery would be determined in detailed design, in consultation with RFS and DPIE. Detailed fire fighting response and any need for fire water containment would be assessed and reported (e.g. in the format of a Fire Safety Study) post development approval, for review by DPIE, Fire rescue NSW and the RFS.

With the implementation of the management measures provided in
Section 6.1.4, including a fire safety study and the effective implementation of the fire management plan (or an update of the existing plan), there is a low risk to society of a Battery system initiated fire event, and low risks to the environment.

Given the remote location of the Project and provided the APZ is established and maintained, it is unlikely that the Project would have an off-site impact on the community.

AGLM implements a bushfire management plan for its landholdings to meet the requirements of the Rural Fires Act and amendments and the Rural Fires Regulation 2013. Bushfire risks would be considered in the detailed design of each Project component and the bushfire management plan (PSSI-HSE-40) would be updated as required to address identified risks.

All new electrical components including the cabling infrastructure from the existing Liddell switchyard to the Battery are contained within non-publicly accessible areas. The Project may alter the EMF on the site and the potential exposure to EMF which would need to be considered for AGLM staff and contractors as part of health and safety management to ensure that the risk of EMF exposure is Low and managed to as low as reasonably

practicable (**ALARP**) principles. The Project risks would be considered in any future development of surrounding lands by AGLM or third parties as part of the approval process for those projects. The Project is not considered likely to restrict the types of development compatible with current zoning or likely future uses of AGLM lands from a hazard and risk point of view.

Environmental pollution is a possible risk and could occur in the unlikely event of a rupture or major spill from the brine return pipeline(s), from the emergency diesel generator, and potentially from a failure to contain pollutants at the Battery. If a spill is not contained, there is a potential to impact off-site sensitive receptors such as waterways, threatened vegetation and fauna. Management measures to prevent a leak from occurring and for secondary containment would be implemented as part of the detailed design phase for the Project. The Project will be designed so that a significant loss of containment event is Rare (i.e. the chance that the risk would happen is less than 0.01%) in accordance with AGL's Risk Management and Assessment Standard.

The PHA found that the Project can be managed in accordance with the established risk criteria and in accordance with ALARP principles.

Most hazards can be prevented by employing a combination of common measures, including following all applicable Standards, separation distances and setbacks, physical protection and control systems measures. Additional management measures to reduce the severity of the hazards should they occur, would include secondary containment.

6.1.4 Environmental management measures

Environmental management measures to manage hazards and risks are presented in **Table 6-1**.

Table 6-1: Environmental management measures for hazard and risks

Reference	Environmental management measures	Timing
HR1	During detailed design for the Project: ▪ A detailed bushfire threat assessment will be conducted for the Project, including establishment of an APZ, in consultation with the RFS ▪ The separation distance between infrastructure within the Battery will be determined in accordance with applicable Codes and Standards and manufacturer's recommendations so that the preferred strategy of allowing a fire in one Battery enclosure or inverter to burn without the risk of propagating to other infrastructure can be maintained without the need for external firefighting ▪ The separation distance within the Battery will be determined in accordance with applicable Codes and Standards and manufacturer's recommendations to allow safe escape in case of a fire ▪ The need for active firefighting requirements at the Battery will be determined in consultation with RFS and the DPIE. Detailed fire fighting response and any need for fire water containment will be assessed and reported (e.g. in the format of a Fire Safety Study) post development approval, for review by DPIE, Fire rescue NSW and the RFS ▪ The health and safety associated with EMF on the site and the potential exposure to EMF will be considered for AGLM staff and contractors as part of AGLM's obligations for their health and wellbeing under the Work Health and Safety Regulations ▪ Measures to prevent a leak occurring from the brine pipeline, the emergency diesel generators and at the Battery, and for secondary containment should a leak occur, will be be included as part of the detailed design of the Project. The likelihood of a significant loss of	Detailed design

Reference	Environmental management measures	Timing
	containment event associated with this Project (Level 4) will be designed to Rare in accordance with AGL's Risk Management and Assessment Standard. The register of commitments (Appendix 1 of the PHA (Planager Pty Ltd, 2021)) will be integrated into the management for the Project. This includes integration of 84 individual commitments, including for the design, installation and maintenance of the Battery automatic shutdown system on exceedance of safe limits; installation of deflagration venting and fire protection inside the Battery enclosures; design of the brine pipeline, waste oil facility, emergency diesel generators and the Battery such that the risk of pollution from a release is reduced to ALARP; installation of protective barriers, including at the transformers; and application of a rigorous and formal management of change process for the Project, including detailed hazard identification and risk assessment processes.	
HR2	Design and selection of all electrical equipment is to minimise EMF levels and comply with ICNIRP reference levels	Detailed design
HR3	Risks associated with the Project will be managed through a Management of Change process. AGLM implements an Asset Change Management Standard, and any major change (defined as a change that has major implications to the strength, stability, operation and design of the asset and/or health and safety of employees) must undergo a detailed risk assessment using the AGL Risk Management and Assessment Standard to assess the risks that may be introduced by the proposed change. This will be undertaken for all Project components and appropriate controls implemented to reduce the risk to an acceptable level.	Prior to construction
HR4	Storage and management of dangerous goods and hazardous materials (if required) will occur in a safe, secure location consistent with the requirements of applicable Australian Standards.	Construction/ operation
HR4	The need to store or handle additional dangerous goods or hazardous substances will be subject to additional risk consideration prior to being undertaken.	Construction/ operation
HR5	Refuelling will take place in a designated area within the works area, away from ignition sources and trees or vegetation and with appropriate controls to prevent any spills coming into contact with the ground.	Construction/ operation
HR6	Appropriately stocked emergency spill kits will be available at all work areas at all times. All staff will be made aware of the location of the spill kit and trained in its use.	Construction/ operation
HR7	Temporary construction compounds will be maintained in a tidy and orderly manner to minimise potential fuel loads in the event that any construction compounds are affected by fire.	Construction
HR8	Construction activities involving flammable materials and ignition sources (for example, welding) will be proactively managed to ensure that the potential for fire is effectively minimised. High risk construction activities, such as welding and metal work, would be subject to a risk assessment on total fire ban days and restricted or ceased as appropriate. Construction personnel will be inducted into the requirement to safely dispose of cigarette butts.	Construction

Reference	Environmental management measures	Timing
HR9	An emergency response plan for the Battery would be prepared for the Project and provided to the Local Emergency Management Committee.	Construction/ operation

6.2 Air quality

This section summarises the findings of the air quality impact assessment (**AQIA**) provided in **Appendix H**. The air quality assessment addresses the following SEARs:

Air – including:

- *An assessment of the likely air quality impacts of the project in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2016);*
- *Demonstrated ability to comply with the relevant regulatory framework, specifically the Protection of the Environment Operations Act 1997 and the Protection of the Environment Operations (Clean Air) Regulation 2010.*

6.2.1 Assessment methodology

The methodology for the AQIA included:

- A description of the existing environment including surrounding receivers, terrain and ambient air quality conditions
- A detailed review of meteorological data collected for WOAOW EIS
- An estimate of emissions to air associated with the Project
- Meteorological and dispersion modelling
- An assessment of potential impacts
- Identification of appropriate mitigation and environmental management measures.

The AQIA followed the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**Approved Methods**) (EPA, 2016). The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources. Air quality risks were qualitatively assessed using a risk-based approach based on guidance from AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines (Standards Australia, 2009). Further details on the methodology are provided in the AQIA (**Appendix H**).

6.2.2 Existing environment

Fifteen representative sensitive receivers were identified near the Project, the nearest of which is about 2 kms from the Battery footprint and 700 m from the BAW footprint. The representative sensitive receivers and nearby meteorological and ambient air quality monitoring stations are shown on **Figure 6-2**.

There are various classifications of particulate matter and the EPA has developed assessment criteria for:

- PM_{10} (particulate matter 10 micrometres or less in diameter) – to protect against health impacts
- $PM_{2.5}$ (particulate matter 2.5 micrometres or less in diameter) – to protect against health impacts
- TSP (total suspended particulates) – to protect against nuisance amenity impacts
- Deposited dust – to protect against nuisance amenity impacts.

The meteorological and ambient air quality data collected at monitors operated by AGLM, as well as a number of other local industrial operators and DPIE were reviewed to identify representative typical local meteorological conditions; these conditions showed annual prevailing winds blowing from the southeast and northwest. Data

from air quality monitoring stations indicated that the EPA's daily impact assessment criterion was occasionally exceeded, and that annual PM_{10} and $PM_{2.5}$ concentrations and deposited dust levels were also occasionally measured above the relevant criteria.

Measurement data from all monitoring stations represent the contributions from all sources that have at some stage been upwind of each monitor. The background concentration may contain emissions from many sources such as from mining activities, construction works, bushfires and 'burning off', industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds, domestic wood fires and so on. Measured exceedances against the impact assessment criterial outlined in the Approved Methods are expected to have been a result of widespread drought conditions (particularly in 2017 and 2018), with some exceedances also expected to arise from surrounding mining activities.

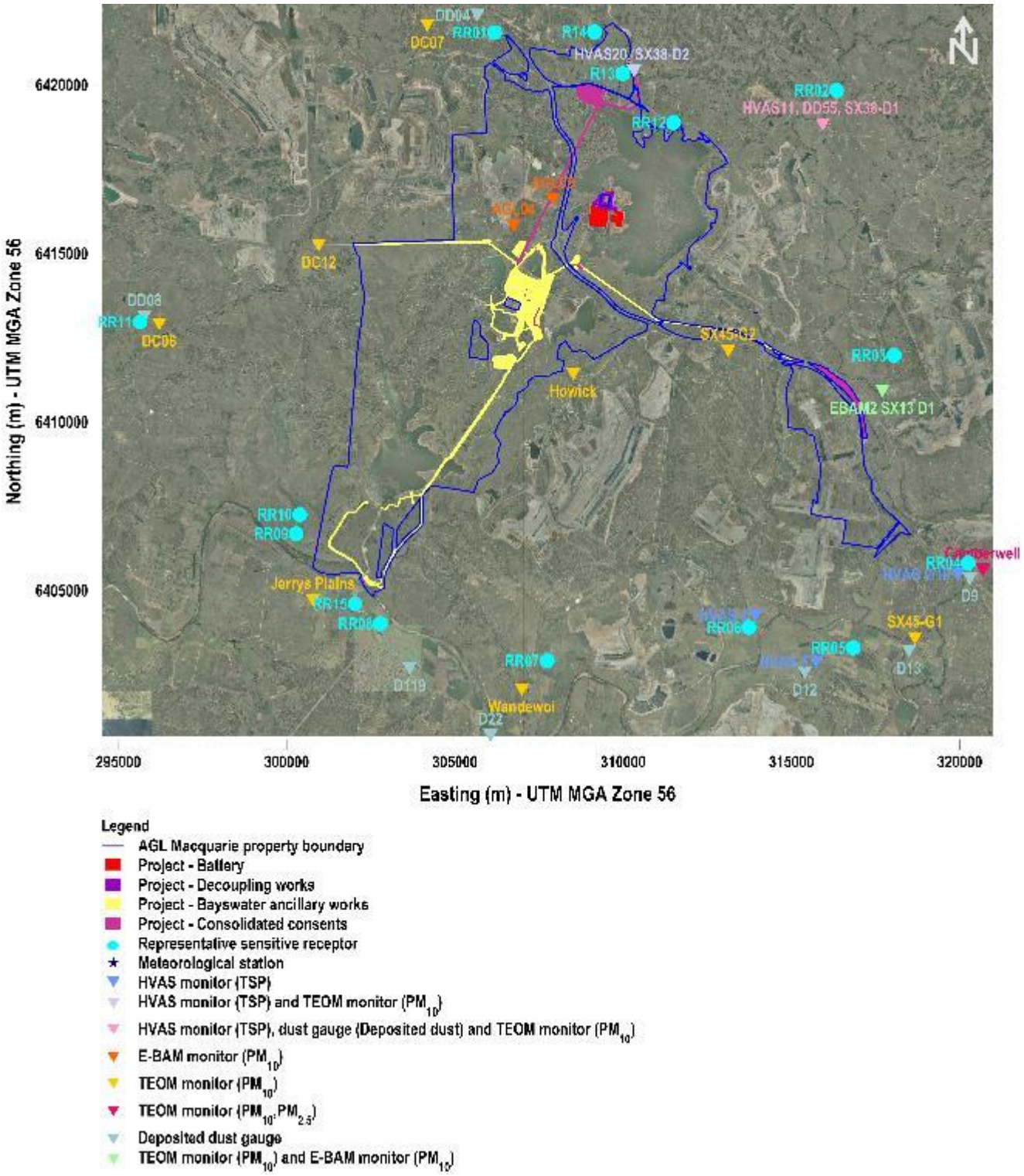


Figure 6-2: Project setting, surrounding representative sensitive receptors and meteorological stations

6.2.3 Assessment of impacts

6.2.3.1 Construction

During construction, the primary air quality risk would be dust generated from site clearing, materials excavation, handling, transport and placement, as well as from wind erosion of stored materials and exposed surfaces resulting in impacts at surrounding sensitive receivers. The intensity of dust-generating activities during construction is expected to be greatest at the Battery. Some dust is also expected to be generated during activities at the Decoupling site, and from the River Road refurbishment and environmental improvement projects as part of the BAW component. There would also be exhaust emissions from plant and equipment used during the construction and fugitive emissions from stored fuels and chemicals.

There is potential for these works to occur at the same time as the WOAOW project; as a result, cumulative impacts were evaluated.

Emission rates for key Project dust-generating activities were estimated from local and international guidance. Modelling was then carried out with these emissions to predict the potential for air quality impacts as a result of the Project, including cumulative impacts from the WOAOW project. This assessment determined that worst-case potential impacts as a result of the Project (and the WOAOW project) would not result in unacceptable changes to local air quality. Specifically, it was predicted that:

- The total overall annually averaged PM_{10} concentrations were predicted to remain below the EPA's 25 micrograms per cubic metre (**µg/m^3**) impact assessment criterion, except at except at RR04 where the 2017 background concentration already exceeded this limit. At this location, contributions from the Project were predicted to be less than 1 %
- The Project would not result in any additional days where PM_{10} concentrations were above the 50 µg/m^3 EPA assessment criterion at representative receivers
- The annual and daily $PM_{2.5}$ concentrations as a result of the Project would remain below EPA impact assessment criteria at surrounding representative receivers
- Cumulative total annually averaged TSP was predicted to remain below the EPA's 90 µg/m^3 impact assessment criterion at identified representative receiver locations
- Annual deposited dust: Negligible contributions (less than 1 %) were predicted from the Project, resulting in concentrations less than the 4 grams per square metre per month (**g/m^2/month**) assessment criterion at all representative receiver locations assessed except RR03 and RR04 where background levels already exceeded this value.

6.2.3.2 Operation

The Project would not result in any change to the existing air emissions arising from the combustion of coal at Bayswater and Liddell.

It is anticipated that there would be limited air quality-related risks during the operation of the Project. Exhaust emissions would arise from fossil fuels combusted in site vehicles, although impacts associated with this risk would not be expected given the anticipated intensity of emissions and setback distances to the nearest receivers. As part of the BAW, replacement of the temporary emergency power system with a new system including three emergency diesel generators is proposed. The generators would operate in the event of power loss and are otherwise tested on a routine basis. Given the limited scale of use of these assets, minimal change to location, nearest sensitive receiver being about 5 km away and that air quality provisions are made for the use of these assets in EPL 779, the temporary emergency power system is in keeping with existing conditions.

Chemicals stored in tanks that are being upgraded as part of the BAW component of the Project would be designed to meet relevant standards listed in the NSW Protection of the Environment Operations (Clean Air) Regulation 2010, such that fugitive tank emissions are not expected to present a risk to air quality.

6.2.4 Environmental management measures

Environmental management measures for air quality are presented in **Table 6-2**. No operational management measures are required.

Table 6-2: Environmental management measures for air quality

Reference	Environmental management measures	Timing
AQ1	The following will be undertaken to manage fugitive emissions from stored chemicals: ▪ Limiting the quantity of chemical products stored at the site to the extent practical ▪ Ensure that all storage tanks are fitted with the appropriate controls in-line with the Protection of the Environment Operations (Clean Air) Regulation 2010.	Design, operation
AQ2	During loading and unloading of materials, the following will be undertaken: ▪ Water sprays as applicable ▪ Minimising drop heights ▪ Reviewing and where necessary modifying or suspending activities during dry and windy weather and elevated background air quality conditions.	Construction
AQ3	While hauling materials in trucks, the following will be undertaken: ▪ Regular watering of unsealed haulage routes ▪ Regular inspection and removal of debris from plant and equipment to avoid the tracking of materials onto the adjacent road network.	Construction
AQ4	The following will be undertaken to manage exhaust emissions from plant and equipment: ▪ Inspecting all plant and equipment before it is used on-site ▪ Ensuring that all vehicles, plant, and equipment are operated in a proper and efficient manner ▪ Switching off all vehicles, plant and equipment when not in use for extended periods ▪ Avoiding the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.	Construction
AQ5	Activities will be co-ordinated between the Project and the WOAOW project to limit the potential for cumulative dust impacts where possible.	Construction
AQ6	The following will be undertaken to manage wind erosion from stockpiles and exposed surfaces: ▪ Watering stockpiles and exposed surfaces ▪ Progressive rehabilitation of exposed surfaces (as feasible) that are no longer required for construction.	Construction

6.3 Greenhouse gases

This chapter presents a summary of the estimated emissions of GHG associated with the Project. It has been written to address the following part SEARs:

Air – including:

- *An assessment of the likely greenhouse gas impacts of the project.*

6.3.1 Assessment methodology

The methodology for the GHG assessment included:

- A description of the scope and assessment boundary, including a summary of construction and operational emission sources and activities to be considered
- Estimation and calculation of GHG emissions associated with construction and operation of the Project (GHG emission inventory)
- A description of the cumulative (combined construction and operation) emissions profile over the life of the Project
- Identification of appropriate mitigation and environmental management measures.

Creating an inventory of the likely GHG emissions associated with a project has the benefit of determining the scale of the emissions and providing a baseline from which to develop and deliver GHG reduction options. The GHG emissions that form the inventory for the Project can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol (WRI & WBCSD, 2004) can be summarised as follows:

- **Scope 1** – Direct emissions from sources that are owned or operated by a reporting organisation (examples – combustion of coal in onsite generation units or combustion of diesel in company owned cars)
- **Scope 2** – Indirect emissions associated with the import of energy from another source (*examples – import of electricity or heat*)
- **Scope 3** – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (*examples include emissions from activities used to make construction materials, or upstream emissions associated with raw material (e.g. coal extraction.*).
- The results of this assessment are presented in terms of the above-listed 'Scopes' to help understand the direct and indirect impacts of the Project.

A more detailed discussion on the GHG assessment methodology is provided in **Appendix I**.

6.3.2 Existing environment

GHG are gases that when released into the atmosphere effectively trap heat influencing global temperatures. The release of GHG into the atmosphere is caused by both natural processes (such as bushfires) and human activities (e.g. burning fossil fuels and land clearing).

Since the industrial revolution, the concentration of GHG in parts per million, has been rapidly increasing which has led to an increase in the earth's average surface temperature and has contributed to the phenomenon of 'climate change'.

The term 'climate' refers to the typical weather conditions for a specific geographical area, usually averaged over at least 30 years. Climate variability represents the 'normal' day to day seasonal and year to year variability in the components of climate (e.g. temperature, rainfall). However, climate variability may also generate extreme conditions such as flooding, heatwaves and hail which require management.

The world's leading climate scientists presented the following key findings in the Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5) (IPCC, 2014):

- Warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and sea level has risen
- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level will rise
- Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of GHG are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases
- In urban areas, climate change is projected to increase risks for people, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, water scarcity, sea-level rise, and storm surges
- Building adaptive capacity is crucial for effective selection and implementation of adaptation options.

6.3.3 Assessment of impacts

It is common practice to aggregate GHG emissions to the equivalent emission of carbon dioxide. This provides a simple figure for comparison of emissions against targets. Aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential (**GWP**). The resulting number is expressed as carbon dioxide *equivalents* (or CO_2e).

The construction and operation of the Battery is expected to contribute a total of 1.52 metric tons of carbon dioxide equivalent (**$MtCO_2e$**) over the course of its 20 year operating life. This assessment identifies the magnitude of these emissions and demonstrates how they are expected to change over time.

6.3.3.1 Construction

The emissions associated with construction, based on the methodology presented in **Section 6.3.1**, are presented in **Table 6-3**.

Table 6-3: Projected construction GHG emissions

Source	GHG emissions (tonnes CO_2e (tCO_2e)		
	Scope 1	Scope 3	Total
Construction Fuel	921	47	968
Construction Materials		2,656	2,656
Battery Components		306,028	306,028
Vegetation Clearing	12,339		12,339
Material Transport		3,007	3,007
Total	**13,260**	**311,738**	**324,998**

As shown in **Table 6-4**, the emissions are dominated by those relating to the manufacture of the Battery components. The transport of the components to site is relatively small in comparison, and the construction

process itself is not an energy intensive process. Vegetation clearance (which represents 42.3 ha) is the second largest source of emissions and much of this clearing is unlikely to occur as discussed in **Section 6.6**.

A breakdown of emissions associated with the manufacturing of Battery components is shown in **Table 6-5**.

Table 6-4: Projected Battery manufacture GHG emissions

Battery Component Source	**GHG emissions (tCO_2e) Total (Scope 3)**
Battery Modules	247,085
Battery Racks	11,537
Inverters	17,952
Transformers - large	3,264
Transformers - small	73
Battery Containers	25,832
Cables	285
Total	**306,028**

6.3.3.2 Operation

The Project will not result in any change to the existing air emissions arising from the combustion of coal at Bayswater and Liddell.

The operation of the Battery does not generate emissions nor does it generate electricity. Instead, it increases the GHG intensity of the electricity supplied to the NEM as a result of system losses. The purposes of the operational assessment that follows is to document the GHG intensity implications for the NEM of the Project. While the assessment benefits from the predicted decarbonisation of the NEM (which is facilitated by the use of storage technology), it does not offset GHG intensity of the Project with these savings to justify the Project. The justification of the Project is based on the energy policy setting which establishes that storage technology is a key component of the least regret investment in the NEM.

It is further noted that the assessment that follows is considered conservative as it is based on charging the Battery based on average NEM intensity. It is considered likely that the Battery would be charged during the day when the NEM is dominated by solar energy generation and carbon intensity is likely to be lower than the average.

The emissions associated with operation of the Project are presented in **Table 6-5**. While **Figure 6-3** shows that the GHG emissions associated with the Battery peak in 2026 during the first year of operation of the complete 2 GWh solution. Emissions are then projected to reduce to the end of the forecast life of the Battery as a result of the degradation of the Battery, and the reduction in the GHG intensity of the NSW NEM. This peak would come forward in the event that the operation of complete system is brought forward. Were this to eventuate, the carbon predicted carbon intensity may increase slightly but would be offset with more rapid decarbonisation of the NEM than current modelled scenarios.

In line with its commitments (as identified in **Section 4.1.1**); AGL will continue to improve the carbon intensity of its operations, and seek to close all coal fired generation in its portfolio by 2050.

Table 6-5: Operational emissions

Year	Scope 2 GHG Emissions (tCO_2e)	Scope 3 GHG Emissions (tCO_2e)	Total GHG Emissions (tCO_2e)
2022	9,385	1,306	10,691
2023	8,822	1,228	10,050
2024	17,034	2,371	19,405
2025	16,661	2,319	18,980
2026	114,811	15,982	130,793
2027	110,069	15,322	125,392
2028	105,999	14,756	120,755
2029	102,436	14,260	116,696
2030	97,777	13,611	111,389
2031	88,908	12,377	101,284
2032	77,861	10,839	88,700
2033	65,486	9,116	74,602
2034	53,899	7,503	61,402
2035	42,452	5,910	48,362
2036	36,973	5,147	42,120
2037	26,903	3,745	30,648
2038	20,405	2,841	23,246
2039	12,988	1,808	14,796
2040	12,216	1,701	13,916
2041	11,606	1,616	13,222
2042	6,267	872	7,139
2043	6,029	839	6,868
2044	3,882	540	4,422
2045	2,801	390	3,191
Total	**1,051,669**	**146,399**	**1,198,068**

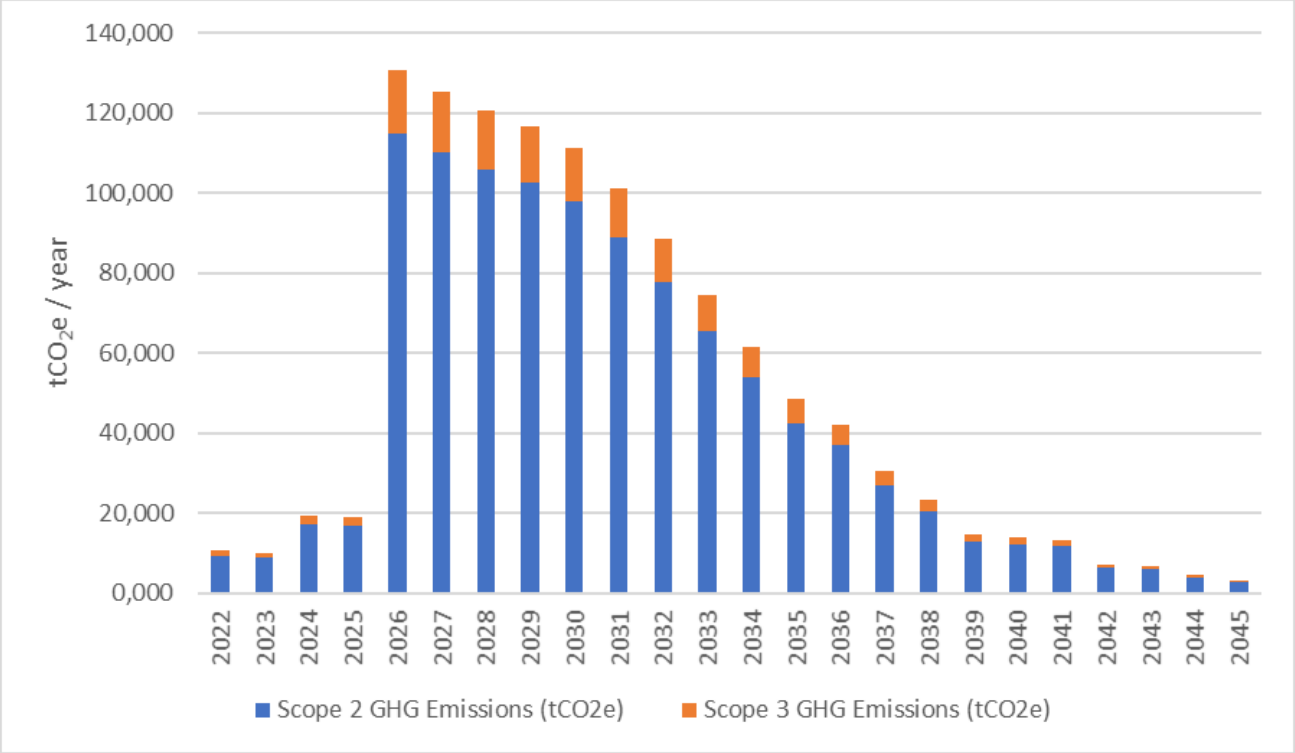


Figure 6-3: Operational emissions summary (Indicative only)

GHG intensity

The assessment shows the loss factors involved in charging and then discharging the Battery increase the intensity of the NEM when in operation. However, over its life this impact decreases significantly as the NEM becomes less carbon intensive. During the first year of full operation (2026), the Battery would increase the carbon intensity of electricity supplied to the NEM by approximately 0.23 tCO_2e / MWh, but this would drop to approximately 0.01 tCO_2e / MWh during the final year of operation when renewables are expected to form the majority of generation in NSW.

During its first year of full operation (2026) the Project would contribute approximately 130.79 $ktCO_2e$. This would contribute to an increase in state and national emissions inventories (AEGIS, 2020) as follows:

- NSW - 0.1 % (of a state total of 131,684.88 kilo tonnes CO_2e (**$ktCO_2e$**) – 2018 data)
- Australia - 0.02 % (of a state total of 537,446.39 $ktCO_2e$ – 2018 data).

6.3.3.3 Cumulative

The cumulative emissions profile for the Project is shown in **Figure 6-4** which shows the combined construction and operation emissions over the life of the Project.

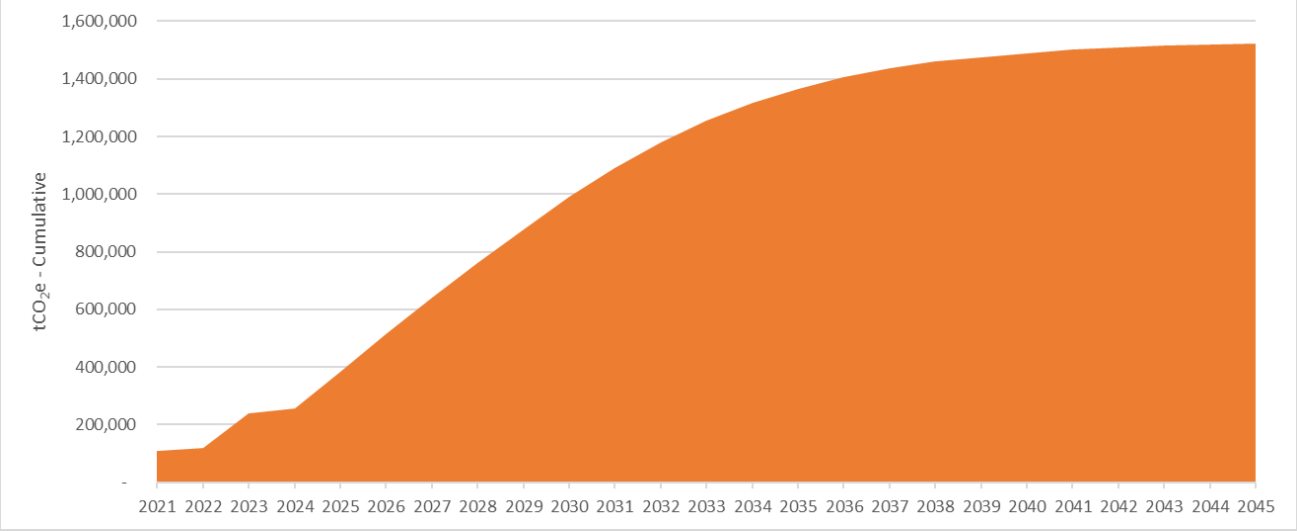


Figure 6-4: Cumulative emissions profile

Figure 6-4 shows that the Project would contribute approximately 1.52 $MtCO_2e$ over its 20-year lifetime. The construction emissions (at 0.32 $MtCO_2e$) represent approximately 21 % of the total emissions.

6.3.4 Environmental management measures

Environmental management measures for GHG's are presented in **Table 6-6**. No operational management measures are required.

Table 6-6: Environmental management measures for greenhouse gases

Reference	Environmental management measures	Timing
GHG1	The CEMP will include requirements for identification and minimisation of GHG during construction.	Construction

6.4 Noise and vibration

This section summarises the findings of the NVA provided in **Appendix J**. The NVA addresses the following SEARs:

Noise and vibration – including:

- *An assessment of the likely construction noise impacts of the project under the Interim Construction Noise Guideline* (DECCW, 2009)*;*
- *An assessment of the likely operational noise impacts of the project under the NSW Noise Policy for Industry* (EPA, 2017)*;*
- *An assessment of the likely road noise impacts of the project under the NSW Road Noise Policy* (DECCW, 2011)*; and*
- *An assessment of the likely vibration amenity and structural impacts of the project under Assessing Vibration: A Technical Guideline* (DEC, 2006) *and German Standard DIN 4150-3 Structural Vibration – effects of vibration on structures* (German Institute for Standardisation, 1999)*;*

6.4.1 Assessment methodology

The NVA assessment included:

- Identification of noise sensitive receivers and background noise levels
- A construction and operational noise assessment to predict noise levels that may be generated by the Project; including airborne noise, construction traffic noise and vibration
- Assessment of noise and vibration impacts, summarising the assessment results at sensitive receivers
- The identification of management measures required to minimise impacts.

Noise impacts during construction and operation were quantitatively evaluated by using the Noise Calculator tool Construction and Maintenance Noise Estimator Tool (Roads and Maritime Services, 2017) (**CNE**). Cumulative noise predictions at surrounding sensitive receivers were compared against criteria developed using guidance from the *Interim Construction Noise Guideline* (DECCW, 2009) (**ICNG**) and *Assessing Vibration: a technical guideline* (DEC, 2006), as well as other relevant standards to evaluate the potential for impacts.

6.4.2 Existing environment

6.4.2.1 Sensitive receivers

A noise sensitive receiver is considered to be any location where inhabitants or users may be impacted by noise generated by the Project. The nearest sensitive receivers are shown on **Figure 6-5** and listed in **Table 6-7**. As shown in **Table 6-7**, there are 20 sensitive receivers within the vicinity of the Project, 15 of these are residential receivers.

The nearest sensitive receiver to the Battery is Lake Liddell Recreation Area (R17), approximately 2 km north of the Battery and Decoupling areas, on the north side of Lake Liddell. The nearest residential receiver is the Lake Liddell Recreation Area's owner's residence (R12), located approximately 2km north of the Battery and Decoupling areas.

The nearest sensitive receiver to BAW Project sites is along Jerrys Plain Road, Jerrys Plain (R15), approximately 700 m to the south of the Project, where only environmental improvement works, and maintenance works have been proposed as part of the construction program.

Table 6-7: Nearby noise sensitive receivers

Receiver	Receiver type	Address/Location
R01	Residential	1 Hassall Road, Muswellbrook
R02	Residential	135B Scrumlo Road, Hebden
R03	Residential	Hebden Road, Ravensworth (southwest of Project)
R04	Residential	24 Dawson Street, Camberwell
R05	Residential	Archerfield Road, Warkworth (south-southwest of Project)
R06	Residential	Off Lemington Road, Ravensworth (south of the Project)
R07	Residential	1561 Lemington Road, Lemington
R08	Residential	2718 Jerrys Plains Road, Jerrys Plains
R09	Residential	388 Jerrys Plains Road, Jerrys Plains
R10	Residential	388B Jerrys Plains Road, Jerrys Plains (Edderton Rd)
R11	Residential	1020 Edderton Road, Jerrys Plains
R12	Residential	Lake Liddell Recreation Area owner's residence (north of Project)

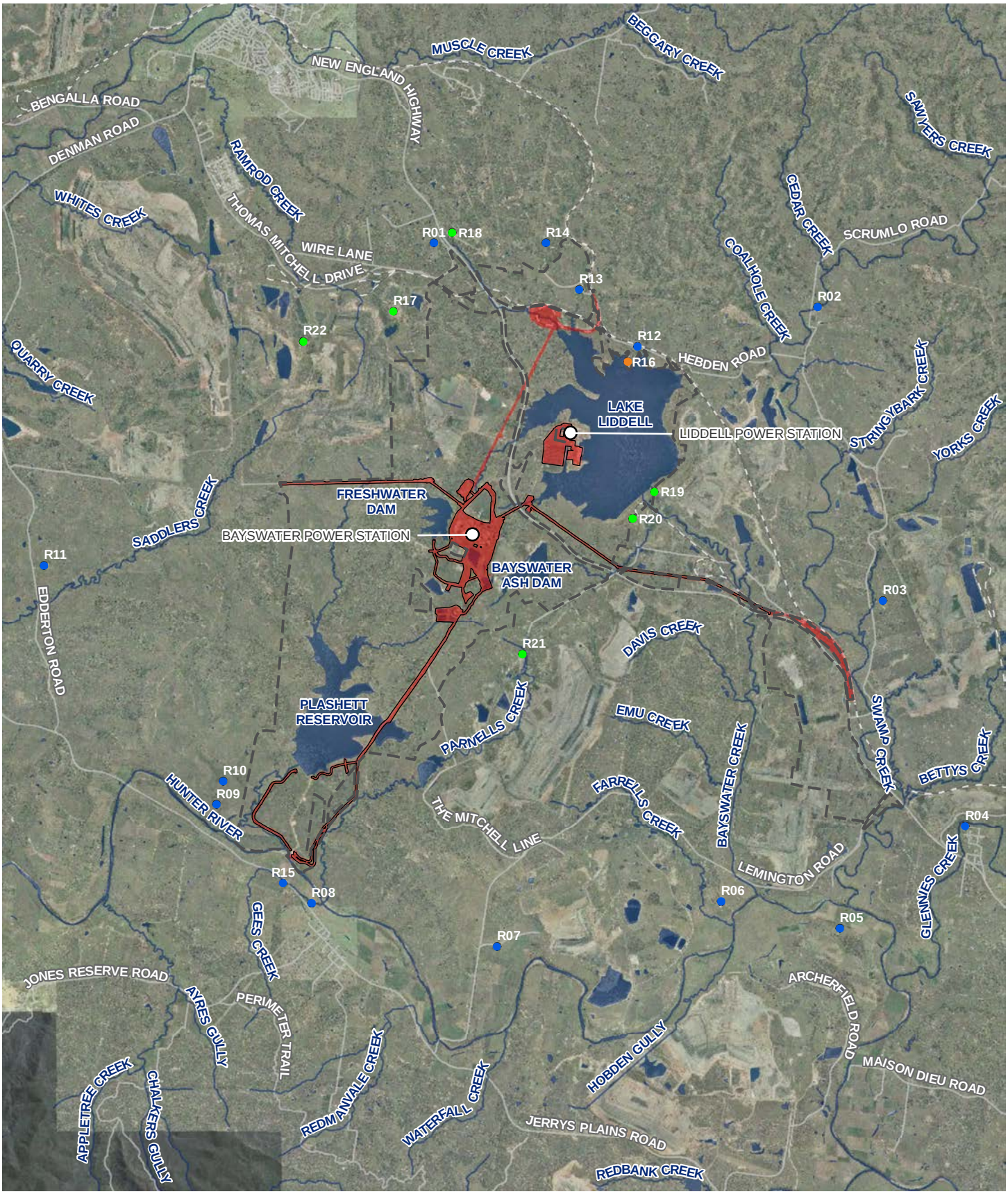
Receiver	Receiver type	Address/Location
R13	Residential	60 Antiene Railway Station Road, Muswellbrook
R14	Residential	240 Antiene Right of Way, Muswellbrook
R15	Residential	2799 Jerrys Plains Road, Jerrys Plains
R16	Passive Recreational	Lake Liddell Recreation area
R17	Industrial	Industrial/mining facility northwest of Project
R18	Industrial	Hunter Valley Concrete – 8440 New England Hwy
R19	Industrial	Liddell Coal Operations – southeast of Project
R20	Industrial	Liddell Coal Operations – southeast of Project
R21	Industrial	Hunter Valley Operations – JV Howick – south of Project
R22	Industrial	Bengalla Mining operations - west of Project

6.4.2.2 Background levels

Existing background noise conditions around the identified nearby noise-sensitive receivers were established using recent background noise monitoring data collected for AGLM in 2018 for the Bayswater Turbine Upgrade Project. These measured levels are considered indicative representations of the Rating Background noise Levels (**RBLs**) in the surrounding area and presented in **Table 6-8**.

Table 6-8: Adopted RBLs dB(A)

Receiver	Measured noise level (2018) (L_{A90} dB(A))		
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
R01	37	36	36
R02	37	36	36
R03	37	36	36
R04	23 (35)	26 (30)	28 (30)
R05	23 (35)	26 (30)	28 (30)
R06	23 (35)	26 (30)	28 (30)
R07	23 (35)	26 (30)	28 (30)
R08	23 (35)	26 (30)	28 (30)
R09	23 (35)	26 (30)	28 (30)
R10	23 (35)	26 (30)	28 (30)
R11	23 (35)	26 (30)	28 (30)
R12	37	36	36
R13	37	36	36
R14	37	36	36
R15	23 (35)	26 (30)	28 (30)



Legend

- Development site
- Project area
- AGL owned land

Sensitive Receivers

- Industrial
- Passive Recreation
- Residential

- Railway
- Road
- Waterway
- Waterbody

0 2 4km

1:140,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
©Department of Finance, Service and Innovation Aug 2020

Imagery:
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Figure 6 - 5 Noise sensitive receivers around the Project

Date: 17/02/2021 Path: \\jacobs.com\ANZ\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F022_SensitiveReceivers_r1v1.mxd
Created by : NT | QA by : SR

6.4.3 Criteria

6.4.3.1 Construction noise criteria

Construction noise criteria have been established for the Project in accordance with the **ICNG**, in the form of construction Noise Management Levels (**NMLs**). Considering the adopted RBLs presented in **Table 6-8** and the guidance from the ICNG, the NMLs listed in **Table 6-9** were established to assess potential construction noise impacts at the identified sensitive receivers.

Table 6-9: Construction NMLs for residential receivers

Receiver	NML $L_{eq\ 15\ min}$ dB(A)			
	Day (during standard hours)	Day (outside standard hours)	Evening	Night
R01	47	42	41	41
R02	47	42	41	41
R03	47	42	41	41
R04	45	40	35	35
R05	45	40	35	35
R06	45	40	35	35
R07	45	40	35	35
R08	45	40	35	35
R09	45	40	35	35
R10	45	40	35	35
R11	45	28	31	33
R12	47	42	41	41
R13	47	42	41	41
R14	47	42	41	41
R15	45	28	31	33

The ICNG also provides construction NMLs for non-residential land uses. **Table 6-10** presents the NML for passive recreation areas and industrial facilities.

Table 6-10: ICNG NMLs for non-residential receivers

Non-residential receiver type	Noise management level, $L_{Aeq(15min)}$ (applies when properties are being used)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level – 60 dB(A)
Industrial	External noise level – 75 dB(A)

6.4.3.2 Construction traffic noise impacts

In accordance with the *Road Noise Policy* (**RNP**) (Department of Environment, Climate Change and Water (DECCW, 2011)), for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB(A).

6.4.3.3 Operation noise

The operational noise limits were derived in accordance with the *NSW Noise Policy for Industry* (EPA, 2017) and shown in **Table 6-11**.

Table 6-11: Project operational noise criteria

Receiver type	Time of day	Recommended L_{Aeq} Noise Level dB(A)
Northern residential receivers	Day (7 am to 6 pm)	42
	Evening (6 pm to 10 pm)	40
	Night (10 pm to 7 am)	35
Southern residential receivers	Day (7 am to 6 pm)	40
	Evening (6 pm to 10 pm)	35
	Night (10 pm to 7 am)	35
Passive recreational area	When in use	45
Industrial	When in use	65

6.4.3.4 Sleep disturbance

Operational and construction noise during the night has the potential to disturb people's sleep patterns.

The sleep disturbance awakening criterion is the threshold at which an awakening reaction is likely to occur. A sleep disturbance screening criteria of 41 and 40 dB(A) for the northern and southern residential receiver groups respectively has been adopted for the Project.

6.4.3.5 Construction vibration criteria

Vibration arising from construction activities can result in impacts on human comfort or damage to physical structures such as dwellings. These two outcomes have different criteria levels, with the effects of vibration on human comfort having a lower threshold.

The recommended safe working distances for the most vibration intensive plant and equipment are as follows:

- Cosmetic damage: 25 m
- Human comfort: 100 m

These safe working distances are indicative only and would vary depending on the particular item of plant and local geotechnical conditions. This is discussed further in the NVA provided in **Appendix J**.

6.4.4 Assessment of impacts

6.4.4.1 Construction

Construction noise

Construction would require the use of heavy machinery, which can generate high noise and vibration levels at nearby receivers. The potential impacts may vary greatly depending on the intensity and location of construction activities, the type of equipment used, existing background noise levels, intervening terrain, and prevailing weather conditions.

Potential noise and vibration sources during construction include:

- Operation of mobile and stationary construction plant and equipment
- Operation of construction compounds and other ancillary facilities (known as fixed sources)
- Construction vehicle movements.

In accordance with the assessment guidelines, potential noise impacts were predicted with a focus on those activities with the highest potential to cause noise impacts. As a result, the predictions identify worst-case construction noise levels, which may not be reached, or only reached infrequently.

The noise levels at sensitive receivers were predicted from cumulative noise generated during each construction stage of the Project combined with ash dam augmentation works from the WOAOW project which may occur concurrently.

The NVA assessment found that:

- Noise levels were not predicted to exceed standard hours, evening hours or night-time NMLs in any stage
- Noise levels at all residential receivers are predicted to comply with day, evening and night NMLs during each construction stage. Noise levels would be perceived as negligible at all residential receivers during each construction stage
- The non-residential receivers R16, R20 and R21 are predicted to encounter noise levels above 20 dB(A) during certain construction stages. However, these noise levels are well below NMLs
- The construction stage which is predicted to result in the highest noise levels at sensitive receivers is River Road refurbishments, assuming ash dam augmentation works for the WOAOW project is concurrently operating.

Noise resulting from construction traffic

- The NVA determined using worst-case estimate of construction vehicle movements per day, that noise from road traffic would increase by around 0.4 dB(A) during standard hours and by 0.8 dB(A) during night-time works. Therefore, it was predicted that the 2 dB(A) criterion would not be exceeded.

Sleep disturbance

The construction sleep disturbance criteria for residential sensitive receivers is not predicted to be exceeded during any construction stage.

Vibration

Considering the distances of the nearest sensitive receivers to the construction site is greater than the recommended safe setback distances, the NVA concluded that vibration impacts would be unlikely.

6.4.4.2 Operation

The NVA predicted that during operation of the Battery there would be negligible noise levels at all residential and non-residential sensitive receivers. In addition, the sleep disturbance criteria is not predicted to be exceeded during the operation of the Battery.

6.4.5 Environmental management measures

Environmental management measures for noise and vibration are presented in **Table 6-12**. No operational management measures are required.

Table 6-12: Environmental management measures for noise and vibration impacts

Reference	Environmental management measures	Timing
NV1	The CEMP would identify project construction activities with the potential to have noise impacts and the controls required to avoid, minimise and mitigate these impacts. The standard techniques for controlling noise impacts during construction are presented in the ICNG. During construction, relevant standard measures as outlined in Section 6 of the ICNG will be implemented.	Construction

6.5 Traffic and transport

This section summarises the findings of the TTA provided in **Appendix C**. The TTA addresses the following SEARs:

Traffic and Transport – including:

- *Details of traffic types and volumes likely to be generated by the project*
- *Details of the proposed transport routes, site access, safety issues and requirements for road works or upgrade*
- *An assessment of the likely impacts of the project on the capacity, condition, safety and efficiency of the road network, in particular heavy vehicles, oversize / over-mass vehicles*
- *Details of measures to mitigate and / or manage potential impacts during construction, developed in consultation with the relevant road and rail authorities (if required).*

6.5.1 Assessment methodology

The methodology for the TTA included:

- A review of the existing transport network including access, traffic volumes and generation and crash history
- Assessment of the potential transport and traffic impacts during construction and operation of the Project
- Identification of appropriate mitigation and environmental management measures.

TfNSW were consulted as per **Section 5.4**, however on the basis of traffic impacts predicted being insignificant no specific consultation in relation to the development of mitigation measures was required.

6.5.2 Existing environment

6.5.2.1 Road network and access

The AGLM landholding is connected to the surrounding road network via an access road and grade-separated interchange to and from the New England Highway, as shown in **Figure 6-6**.

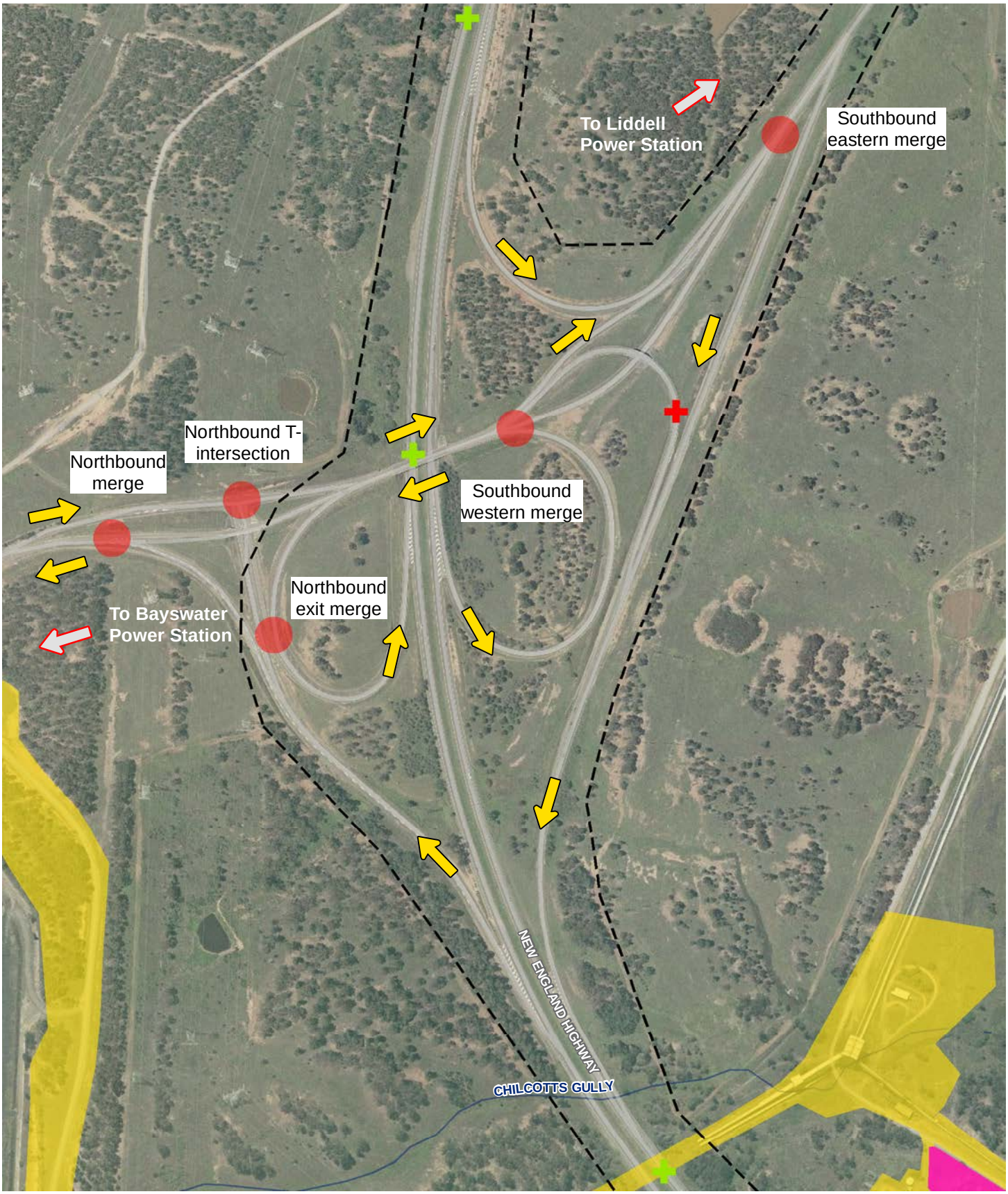
The key surrounding road is the New England Highway, which is a national highway linking Newcastle to Brisbane. Near the Project area, the New England Highway is dual carriageway with two lanes in each direction and a central median. The speed limit in the vicinity of the Project area is 100 kilometres per hour (**km/h**).

Liddell and Bayswater are accessible from the New England Highway via an interchange with an unnamed east-west access road. The access road is a single carriageway road with one lane in each direction. The road has a sign posted speed limit of 60 km/h.

No public transport services operate, and no formal off-road pedestrian or cycling facilities are provided on the road network near the Project.

6.5.2.2 Heavy vehicle access

Between the Project area and Port of Newcastle where main Project components are expected to originate, the road network also consists of a number of motorways and state roads, carrying moderate volumes of traffic, including heavy vehicles. These form part of the approved 25 / 26 m B-double network and OSOM load carrying vehicle networks, and include the New England Highway, the unnamed east-west access road, Maitland Road, John Renshaw Drive and the Hunter Expressway.



Legend

Project area
- Bayswater Ancillary Works
- Consolidated consent
- AGL owned land

Crash location and type
- Moderate Injury
- Non-casualty (towaway)

Model Location

0 50 100 150 200 250m

1:6,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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Imagery:
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Figure 6 - 6 Liddell and Bayswater interchange with the New England Highway

6.5.2.3 Traffic volumes and generation

New England Highway

Traffic volumes for the New England Highway were obtained from the TfNSW permanent count station (ID 6153) located to the south of the Project, approximately 200 m north of Rix's Creek Lane, Rix's Creek. In 2019, the average weekday traffic volumes were approximately 14,500 vehicles per day, with 24 % of this volume being heavy vehicles. The hourly traffic volume profile for an average weekday in 2019 is shown on **Figure 6-7.** As shown on **Figure 6-7,** the peak hour traffic volume on the highway was about 1,037 vehicles per hour in each direction across the two lanes. The peak traffic hours occurred in the hours starting 5:00am and 5:00pm for the morning and evening peaks respectively. Traffic volumes on the New England Highway were similar in the morning and evening peak hours.

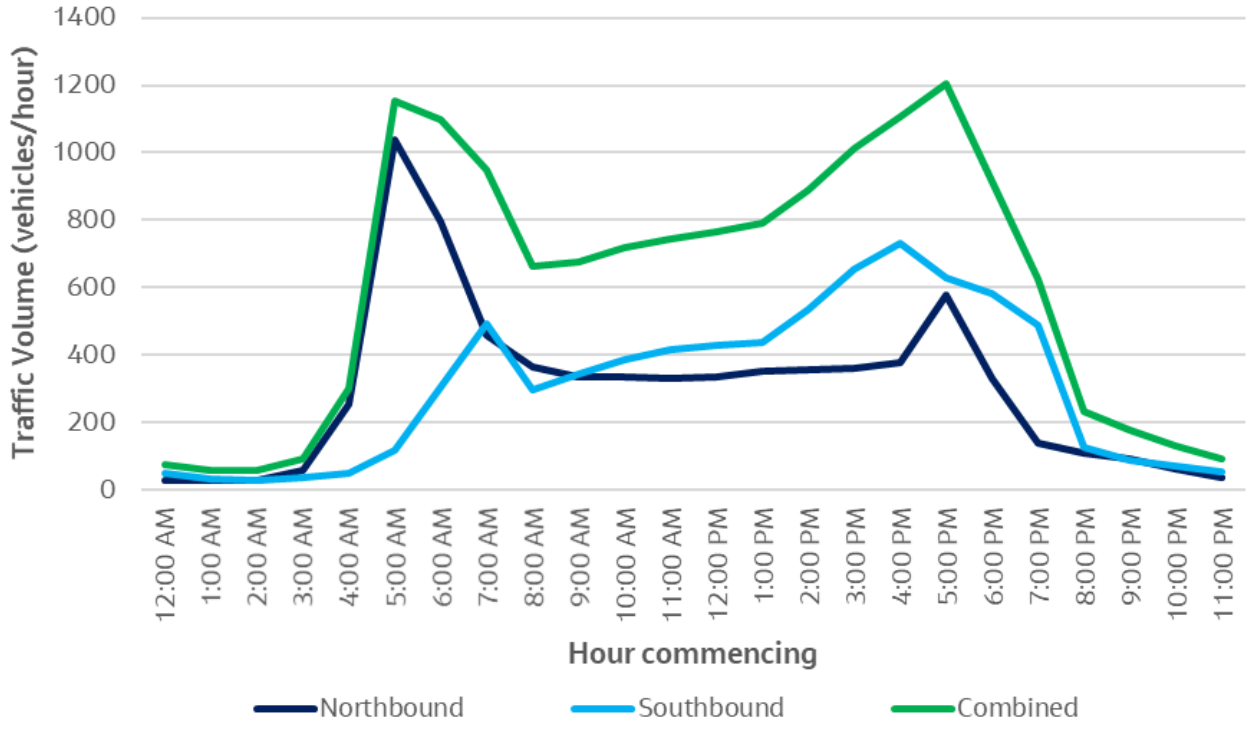


Figure 6-7: Hourly traffic volumes (2019) average weekday

Liddell and Bayswater Interchange and Access Road

Traffic volumes for the Liddell and Bayswater interchange and access road were obtained from traffic surveys undertaken on 22 May 2018. At the time, Bayswater was operating during its annual maintenance shutdown period where up to an additional 400 staff were on site. It has been conservatively assumed for the purposes of this assessment that the recorded traffic volumes are indicative of typical operations at Bayswater. In addition, consultation with AGLM identified that typical staff numbers at Liddell increased between 2018 and 2020 to approximately 560 in 2020. Therefore, the 2018 traffic surveys were scaled up to match Liddell staff traffic generation in 2020.

At the interchange, the morning peak hour was 6:00am – 7:00am and the evening peak hour was 5:30pm – 6:30pm. **Figure 6-8** shows the Bayswater and Liddell access road daily traffic volumes. The majority of the traffic generated by the site travels to and from the south, with only a small volume of traffic travelling between Bayswater and Liddell.

Heavy vehicle volumes at the interchange make up between 5 and 10 % of the total volume of traffic.

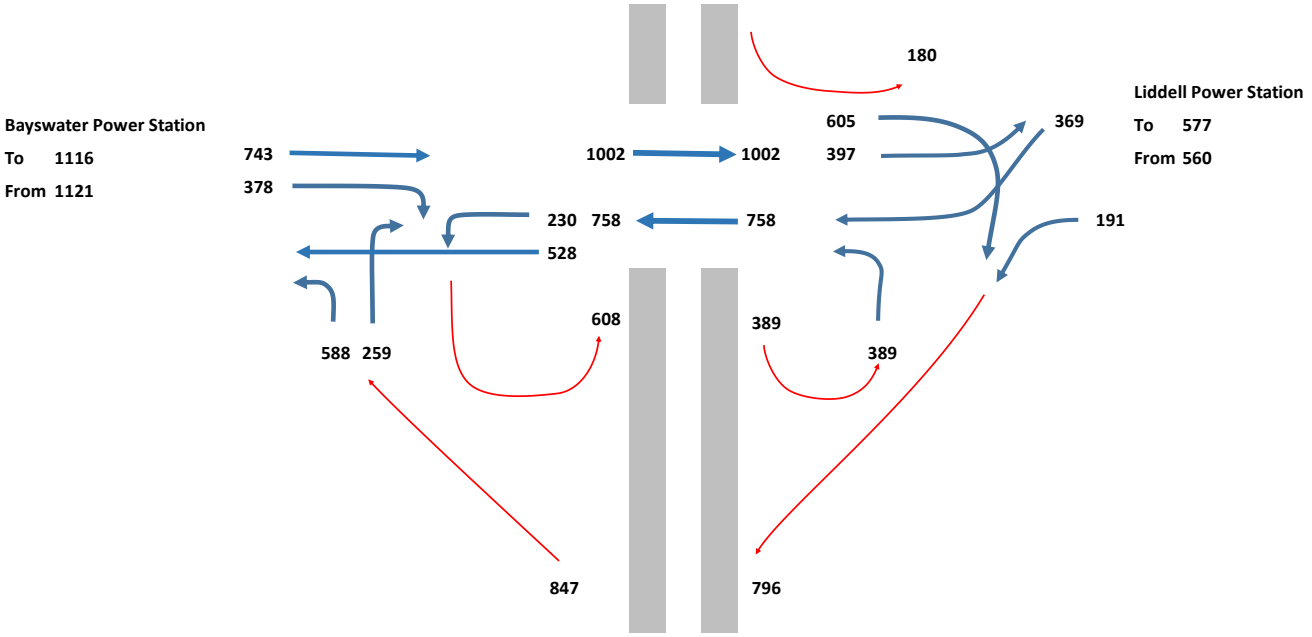


Figure 6-8: Liddell and Bayswater access road daily traffic volumes

Table 6-13 summarises the existing traffic generated by Liddell and Bayswater during the morning and evening peak hours.

Table 6-13: Existing traffic generation during morning and evening peak hours

Period	Liddell		Bayswater		Total
	To the site (vehicles)	From the site (vehicles)	To the site (vehicles)	From the site (vehicles)	
Daily	577	560	1,116	1,121	3,374
Morning peak hour (6:00am – 7:00am)	142	27	387	14	570
Evening peak hour (5:30pm – 6:30pm)	20	30	58	246	354

6.5.2.4 Crash history

Crash data was provided by TfNSW in November 2020 for the most recent full five-year period of available data from January 2015 to December 2019. During this period, three crashes occurred on the New England Highway and one crash occurred at the interchange. Two crashes involved striking a kangaroo or straying stock (most common crash type), and the other two crashes occurred in darkness while raining.

6.5.3 Assessment of impacts

6.5.3.1 Construction

6.5.3.1.1 Traffic generation and distribution of the Project

Traffic generation

Traffic generated by the Project includes transportation of personnel, plant, equipment and materials. As a worst-case scenario, it is assumed that all light vehicle movements would occur within one hour before shift start and one hour after shift end. The majority of heavy traffic movements would occur between 6:00am to 7:00pm. It is assumed that heavy vehicle movements would be distributed evenly throughout the day across standard

construction hours. The expected maximum additional traffic generated by each component of the Project is presented in **Table 6-14**.

Table 6-14: Traffic generated by the Project during construction

Project component	Timing[1]	Liddell		Bayswater	
		Daily light vehicle movements[2]	Daily heavy vehicle movements	Daily light vehicle movements	Daily heavy vehicle movements
The Battery	Stage 1 and Stage 2 (between project start to 2023)	200	40	-	-
	Stage 3 (2024 and 2026)	200	40	-	-
Decoupling	Between Project start and 2023	100	20	-	-
BAW	Between Project start and 2035	-	-	200	100

Note 1: Anticipated commencement timing only, subject to construction planning.

Note 2: Vehicle movements are each way (ie a heavy/light vehicle arriving at a site and leaving a site counts as two movements).

Traffic distribution

The traffic distribution of vehicles generated by the Project is assumed to be similar to the existing proportion of vehicles travelling to the site each day. As shown in **Figure 6-8**, 847 vehicles (approximately 60 %) accessed the site from the south and 569 vehicles (approximately 40 %) accessed the site from the north. All light and heavy vehicles would travel to the Project area via the New England Highway and the Liddell and Bayswater interchange.

Intersection level of service and queue length

The criteria for evaluating the operational performance of intersections is defined in **Table 6-15** and comes from the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). For priority (sign-controlled) intersections, the criteria for evaluating the performance of intersections is based on the worst delay across all legs of the intersection during the peak hour. This average vehicle delay is equated to a corresponding level of service (**LoS**) from A (best) to F (worst). For rural roads, the desired LoS is LoS C. This LoS was adopted for the modelled intersections.

Table 6-15: Level of service definitions

LoS	Average delay (seconds/vehicle)	Give way and stop signs
A	Less than 15	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity and accident study required
E	57 to 70	At capacity, requires other control mode
F	Over 70	Extreme delay, traffic signal or other major treatment required

SIDRA Intersection 8 software was used to model the existing and future Project scenarios of the four key constraint intersections on the New England Highway exit ramps at the interchange, as shown on **Figure 6-6**. The modelled existing and future peak year traffic modelling results are shown in **Table 6-16**. The modelling indicates that the interchange currently operates at LoS A with abundant spare capacity. The modelled future year peak scenario queue lengths are also expected to be very low and are not expected to extend into, nor impact motorway operation. In addition, there is excess capacity to accommodate the cumulative additional traffic generation on the New England Highway without having a large impact on the operation of the highway.

Table 6-16: Modelled SIDRA intersection performance

Scenario	Intersection	Peak period	Degree of Saturation	Intersection delay (seconds)	LoS	Maximum queue length (m)
Existing scenario	Northbound merge	Morning peak	0.13	7.6	A	0
		Evening peak	0.02	7.7	A	0
	T-intersection	Morning peak	0.06	8.3	A	1.4
		Evening peak	0.09	9.1	A	0.2
	Western southbound merge	Morning peak	0.11	7.4	A	3.2
		Evening peak	0.02	7.7	A	0.6
	Eastern southbound merge	Morning peak	0.04	7.6	A	0
		Evening peak	0.01	7.6	A	0
Future peak year scenario (including cumulative impacts)	Northbound merge	Morning peak	0.24	7.7	A	0
		Evening peak	0.02	7.7	A	0
	T-intersection	Morning peak	0.28	8.5	A	8.6
		Evening peak	0.17	10.8	A	0.4
	Western southbound merge	Morning peak	0.19	7.4	A	6.4
		Evening peak	0.10	8.3	A	0.6
	Eastern southbound merge	Morning peak	0.19	7.6	A	0
		Evening peak	0.01	7.6	A	0

Impacts of OSOM vehicles

The following OSOM vehicles are expected to be generated from the Port of Newcastle throughout the Project:

- Stage 1: three one-way movements to transport one new transformer to the Project area, and one refurbished transformer from and to the Project area
- Stage 2 onwards: up to eight one-way movements to transport up to four transformers to the Project site.

Furthermore, an additional 32 OSOM vehicle deliveries may be required including:

- Six transformer component deliveries to end of 2023
- Six transformer component deliveries between 2024 – 2026
- Ten deliveries of 33 kV equipment to end of 2023
- Ten deliveries of 33 kV equipment between 2024 – 2026.

The proposed OSOM vehicle routes from the Port of Newcastle have been assessed against the *NSW OSOM Load Carrying Vehicles Network Map* (TfNSW, 2020a), which shows the network for eligible vehicles operating under the following Heavy Vehicle National Law notices:

- Multi-State Class 1 Load Carrying Vehicles Mass Exemption Notice 2020, which authorises the use of Class 1 load carrying vehicles that are up to 5.5 m wide, 35 m long and 5 m high
- Multi-State Class 1 Load Carrying Vehicles Dimension Exemption Notice 2020, which authorises the use of Class 1 load carrying vehicles that are up to 115 t.

The two proposed OSOM vehicle routes from the Port of Newcastle and the relevant restrictions from the *NSW OSOM Load Carrying Vehicles Network Map* are described in **Table 6-17** and shown on **Figure 6-9**. It is noted that physical constraints may exist on each route and would be determined via a detailed route survey as part of a traffic management plan, prior to construction.

Table 6-17: Proposed OSOM vehicle routes and restrictions

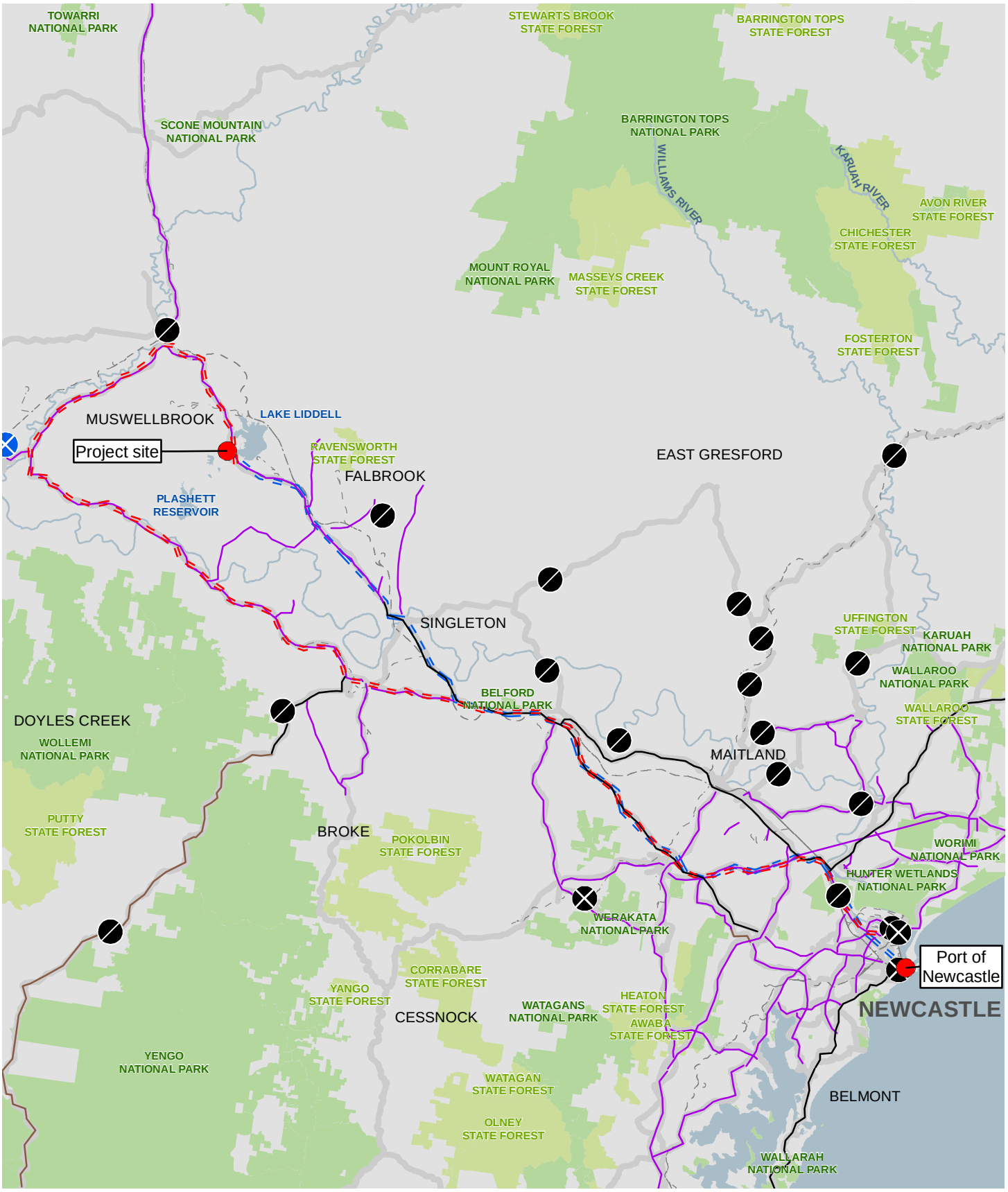
No.	Proposed routes	Distance (km)	Restrictions
1	From Port of Newcastle: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway via Jerrys Plains, Denman Road, Thomas Mitchell Drive, New England Highway and Power Station Access Road to the site	168	▪ **New England Highway between Hexham and John Renshaw Drive**: vehicles or combinations exceeding 3.5 m wide or 25 m long are not permitted to travel between 8:30am and sunset on weekends, or a state-wide public holiday ▪ **Hunter Expressway between John Renshaw Drive and New England Highway**: vehicles or combinations exceeding 3.2 m wide are not permitted to travel from Monday to Friday from 5:00am to 9:00am and from Monday to Friday from 4:00pm to 6:00pm (except on state-wide public holidays) ▪ **New England Highway between Hunter Expressway and Golden Highway**: vehicles or combinations exceeding 3.2 m wide are not permitted to travel from Monday to Friday from 5:00am to 9:00am and from Monday to Friday from 3:00pm to 6:00pm (except on state-wide public holidays)
2	From Port of Newcastle: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway and Power Station Access Road to the site	111	▪ **New England Highway between Hexham and John Renshaw Drive**: vehicles or combinations exceeding 3.5 m wide or 25 m long are not permitted to travel between 8:30am and sunset on weekends, or a state-wide public holiday ▪ **Hunter Expressway between John Renshaw Drive and New England Highway**: vehicles or combinations exceeding 3.2 m wide are not permitted to travel from Monday to Friday from 5:00am to 9:00am and from Monday to Friday from 4:00pm to 6:00pm (except on state-wide public holidays) ▪ **New England Highway between Hunter Expressway and Singleton**: vehicles or combinations exceeding 3.2 m wide are not permitted to travel from Monday to Friday from 5:00am to 9:00am and from Monday to Friday from 3:00pm to 6:00pm (except on state-wide public holidays)

To manage these OSOM vehicles, a permit would be sought from the National Heavy Vehicle Regulator (**NHVR**). This permit would undergo a separate approval process and a suitable contractor would be engaged for transportation. As part of the permit, the subcontractor would develop a construction traffic management plan (**CTMP**) and determine a suitable route based on the required OSOM vehicle dimensions and mass, in consultation with AGLM and the NHVR. These traffic movements would be undertaken under police escort and in accordance with any OSOM permit conditions.

Due to the low number of OSOM vehicle movements, combined with the fact that these OSOM vehicles would be likely to travel outside of peak periods, it is expected that the traffic impact of OSOM vehicles on the road network would be minimal.

Impacts on road safety

The additional traffic generation by the construction of the Project is unlikely to have an impact on future crash frequency. In addition modelled future year peak scenario queue lengths are expected to be very low and are not expected to extend into nor cause safety issues on the New England Highway.



Legend

- Point of interest
- Restricted structures - bridges
- Restricted structures - railway level crossings
- Restricted structures with conditional access - railway level crossings

OSOM Network

- NSW oversize overmass load carrying vehicles network approved roads

- Approved routes with travel conditions
- Limited access locations
- Route 1
- Route 2

- Railway
- Road
- Waterway
- Waterbody
- National Park
- State Forest

0 10 20 km

1:600,000 at A4

Data sources

Jacobs 2021
AGL 2020
NSW Spatial Services 2019
Transport for New South Wales 2020

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Figure 6 - 9 Proposed OSOM vehicle routes

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6.5.3.2 Operation

Battery and Decoupling operations require negligible vehicle movements. BAW operations would be consistent with existing Bayswater operations. As such, the overall operation of the Project would not result in impacts to the performance of the road network.

6.5.4 Environmental management measures

Environmental management measures for traffic and transport impacts are presented in **Table 6-18**.

Table 6-18: Environmental management measures for traffic and transport impacts

Reference	Environmental management measures	Timing
TT1	The haulage contractor will prepare and implement a CTMP for oversized overmass vehicle movements, which will include: ▪ Identification of the routes ▪ Measures to provide an escort for the loads ▪ Times of transporting to minimise impacts on the road network ▪ Communication of strategy and liaising with emergency services and police.	Pre-construction and construction
TT2	An oversized vehicle permit will be sought for all OSOM vehicle movements where required. The OSOM movements would be in accordance with the permit requirements and be. outside of peak traffic periods where possible.	Pre-construction and construction
TT3	The Construction Environmental Management Plan (**CEMP**) and general site induction will inform construction and operational personnel of the risk of collisions, particularly with animals during rain or periods of low light.	Construction and operation

6.6 Biodiversity

This section summarises the findings of the BDAR provided in **Appendix E**. The BDAR addresses the following SEARs:

Biodiversity – including:

- *An assessment of the biodiversity values and direct and indirect biodiversity impacts of the development throughout its life in accordance with the Biodiversity Conservation Act 2016 (NSW), the BAM, and documented in a BDAR, including a strategy to offset any residual impacts, unless a BDAR waiver is granted;*
- *The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and*
- *A detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time;*

6.6.1 Assessment methodology

The method for the biodiversity assessment included:

- Desktop review of available databases, regional mapping, assessment reports and other relevant environmental and strategic planning documents, to identify threatened species requiring further assessment and consideration

- A habitat and likelihood of occurrence assessment to determine the likelihood of a particular species occurring within the study area. A likelihood ranking was assigned to each species, including 'recorded', 'high', 'moderate', 'low' and 'none'. The likelihood of occurrence assessment was used to guide and inform the field surveys carried out for the project
- Field surveys to identify the biodiversity values within the study area including:
  - Identification and mapping of plant community types (PCT) and stratification of native vegetation into survey units (vegetation zones). A plot-based full floristic survey and vegetation integrity assessment
  - Targeted survey for threatened flora species using parallel transects undertaken across suitable habitats within required survey periods (seasons). Targeted surveys for orchids were conducted from 9 – 11 September 2020
  - A mixture of targeted fauna survey techniques including live trapping, remote sensor camera monitoring, ultrasonic call recording (bats), harp trapping, reptile survey (tile arrays), spotlighting, call broadcasting and timed area searches. Surveys were conducted over 5 days in December 2020. Cameras were active onsite for 23 consecutive nights between 7-30 December 2020. The reptile survey tile arrays were set on 11 November 2020 and checked three times (final check was conducted on 30 December 2020). Three additional tile arrays which remained from surveys for the WOAOW project surveys (Kleinfelder, 2020) were considered close enough to the development site to be incorporated into this survey (within 300 m of boundary). The three WOAOW project tile arrays were set up on 25 October 2019 and have remained in-situ for over a year (these were also checked three times). Man-made structures such as concrete culverts, pipes and empty shipping containers were searched for roosting bats. No hollow-bearing trees were recorded within the development site.
- Identification and assessment of potential impacts on biodiversity arising from the Project
- Management measures for avoiding, managing, or reducing impacts on biodiversity values during detailed design, construction and operation
- Identification of any residual impacts that cannot be avoided, minimised or mitigated which must be offset.

The BDAR has been undertaken in accordance with Stage 1 and Stage 2 of the BAM (OEH, 2017). The BDAR addresses potential impacts to biodiversity listed under the BC Act, FM Act and MNES identified in the EPBC Act.

Further detail about the assessment methodology, including field surveys undertaken is provided in the BDAR (**Appendix E**).

The biodiversity study area included a 50 m buffer from the edge of the development site. To assess the current extent of native vegetation within the broader landscape, a 1,500 m buffer was also placed around the development site in accordance with the BAM (OEH, 2017).

Database searches and desktop assessment was undertaken within 10 km from the Project area and is defined as the locality (refer to **Section 1.1.1**). This broader study area is used for the purposes of reviewing regional vegetation mapping and searches for previously recorded threatened species.

6.6.2 Existing environment

6.6.2.1 Landscape features

The landscape features of the study area were determined in accordance with the requirements of the BAM. **Table 6-19** summarises the biodiversity landscape features of the study area.

Table 6-19: Biodiversity landscape features of the study area

Landscape feature	Description
Interim Biogeographic Rationalisation for Australia (IBRA) (Thackway, 1995)	The Project is located in the Sydney Basin IBRA Region, and within the Hunter IBRA sub-region.
NSW Landscape Regions (Mitchell landscapes)	The Project is within the Central Hunter Foothills landscape as mapped by the NPWS (2002) and described by DECC (2002).
Rivers, streams and estuaries	The Project is located within the Hunter River catchment. Numerous drainage lines and 1st or 2nd order creeks drain from the Assessment area directly into Lake Liddell or via Tinkers Creek. Other tributaries drain into Pikes Creek and into Bayswater Creek (which ultimately flows into the Hunter River to the south). These creeks, as well as Lake Liddell have been significantly modified to accommodate for the water needs and outputs of Liddell and Bayswater. All waterways within the development site are highly modified and the natural drainage has been interrupted by constructed dams and/or drainage infrastructure and contain only small amounts of fringing aquatic vegetation.
Wetlands	There are wetlands within the Project area, however none of these are identified as important wetlands (according to the BAM). The Coastal Wetland, Hunter River – Estuarine, listed under the State Environmental Planning Policy (Coastal Management) 2018 (**Coastal Management SEPP**), is the closest important wetland, which occurs approximately 65 km to the south east of the Project area.
Connectivity of habitat	The development site is mostly cleared and has had a long history of development associated with power generation, as well as grazing. The small vegetation patches remaining within the development site are already isolated from larger woodland areas occurring mainly to the west and north-west. Therefore, habitat connectivity within the development site is poor and the existing patches of vegetation are subject to a high disturbance regime from activities associated with the power station operation and maintenance activities, therefore would likely be avoided by most native fauna groups.
Areas of geological significance	The development site contains no areas of karst, caves, crevices or cliffs or other geological features of significance, significant soil hazard features, steep slopes, significant drainage features, or Acid Sulphate Soil (**ASS**) areas.
Areas of outstanding biodiversity value	The Project area does not contain any areas of outstanding biodiversity value listed on the DPIE register of declared areas of outstanding biodiversity value.
Native vegetation extent	The current percentage of native vegetation cover was calculated in the BDAR from regional vegetation mapping within the 1,500 m landscape buffer. The current percent native vegetation cover in the landscape buffer is 50 %.
Patch size	Patches of vegetation within the development site are generally small and isolated, however, based on aerial imagery and regional vegetation mapping, some of the PCT 1691 and PCT 1692 vegetation zones can be found to be less than 100 m away from the large woodland areas to the east or west of Bayswater, which are over 100 ha in size. The remaining vegetation zones associated with PCT 1071 and PCT 1731 were found to be isolated from large areas of surrounding native vegetation and were considered to have patch sizes of less than 5 ha.

6.6.2.2 Native vegetation

- The development site predominantly contains non-native vegetation, characterised by large expanses of exotic grasslands.

Plant community types

Following desktop review and ground truthing, four PCTs were identified within the development site as shown on **Figure 6-10**. These PCTs are:

- PCT 1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the Central and Upper Hunter
- PCT 1692: Bull Oak grassy woodland of the Central Hunter Valley
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
- PCT 1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion.

PCTs were also split up into vegetation zones based on broad condition classes. A detailed description of each PCT, vegetation zone and corresponding vegetation integrity score is provided in the BDAR (**Appendix E**) and the vegetation zone and amount of each PCT in the development site is provided in **Table 6-20**.

Table 6-20: Plant community types identified within the development site

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Vegetation zone area in development site (ha)
1	1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the Central and Upper Hunter	Moderate	4.3
2			Regrowth	21.6
3			Rehabilitation	11.4
4			Native Grassland	2.0
5	1731	Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley	Moderate	0.9
6	1692	Bull Oak grassy woodland of the Central Hunter Valley	Moderate_Good	1.2
7	1071	*Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate	3
N/A	-	Exotic Grassland	-	134.1
N/A	-	Pond / Dam	-	22.1
N/A	-	Planted trees (non-indigenous species)	-	3.9
N/A	-	Excluded / artificial surface	-	148.5

Threatened ecological communities

Vegetation zone 1 and 3 (Moderate and Rehabilitation condition) of PCT 1691 were considered to align with the BC Act listed 'Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions' Endangered Ecological Community (**EEC**). These vegetation zones total 15.7 ha in area within the development site, with one patch (2.04 ha) to the west of Bayswater meeting the condition thresholds for the Central Hunter Valley eucalypt forest and woodland Critically Endangered Ecological Communities (**CEEC**), listed under the EPBC Act.

Groundwater dependent ecosystems

There are no aquatic Groundwater Dependent Ecosystems (**GDEs**) and only low potential terrestrial GDEs identified within the development site by the *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* (DPI, 2012).

6.6.2.3 Threatened species

Habitat suitability for threatened species

The PCTs listed in **Section 6.6.2.2** and shown on **Figure 6-10** correspond with three broad habitat types, including:

- Coastal valley grassy woodlands (PCT 1691 and 692)
- Coastal swamp forests (PCT 1731)
- Coastal freshwater lagoons (PCT 1071).
- Given the highly cleared and disturbed nature of the development site, habitat for threatened fauna species is generally of low quality. The lack of structurally complex woodland ecosystems, along with hollow-bearing trees, hollow logs, wood debris and rock outcrops, limited roosting habitat combined with noise and light disturbance from the power stations and infrastructure means that only disturbance-tolerant fauna species persist within the development site. It was also noted that the habitats in the development site are not considered important habitats for migratory birds.

Threatened flora

No threatened flora species were recorded within the development site during the targeted field surveys. However, one threatened flora species *Eucalyptus glaucina* (Slaty Red Gum) was identified outside the development site during surveys. Two individuals of this species were recorded next to the western coal conveyor. The species polygon for these two trees does not overlap any PCTs within the development site.

Threatened fauna

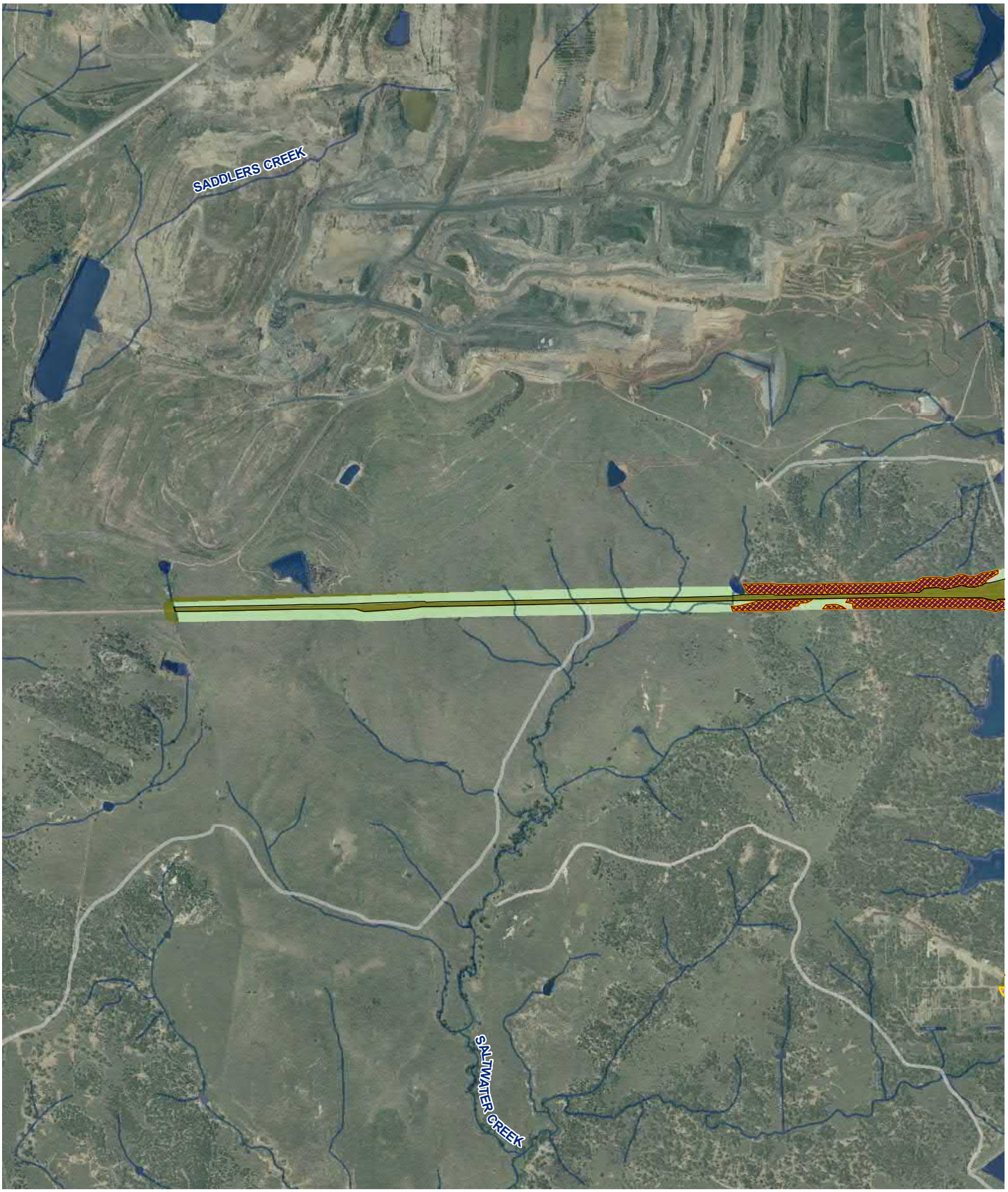
Given the highly cleared and disturbed nature of the development site, habitat for threatened fauna species is generally of low quality and only disturbance-tolerant fauna species persist within the development site.

During field surveys, the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) was observed multiple times within the development site and is likely to frequent the development site regularly, particularly when dispersing between larger woodland areas.

The *Myotis Macropus* (Southern Myotis) (listed as Vulnerable under the BC Act) is assumed to be present. The species was recorded within 100 m of the development site for the WOAOW project in 2019. This species is likely to forage in suitable habitats occurring within the development site. No hollow-bearing trees are present within the development site. Inspection of man-made structures such as concrete pipes, culverts and other structures did not identify roosting bats.

Miniopterus orianae oceanensis (Large Bent-winged Bat) and *Scoteanax rueppellii* (Greater broad-nosed bat) were also potentially recorded (both listed as Vulnerable under the BC Act). The *Scoteanax rueppellii* (Greater broad-nosed bat) has a similar call to non-threatened *Scotorepens orion* (Eastern Broad-nosed bat) and differentiation between species call data is difficult. Likewise, *Miniopterus orianae oceanensis* (Large Bent-winged Bat) has a similar call to non-threatened *Vespadelus regulus* (Southern forest bat). For the purposes of this assessment it is assumed that *Miniopterus orianae oceanensis* (Large Bent-winged Bat) and *Scoteanax rueppellii* (Greater broad-nosed bat) are occurring in the locality and would utilise the development site during foraging.

Despite targeted surveys, no other threatened species were recorded within the development site.



Legend

- Development site
- Road
- Waterway
- Waterbody
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC

Plant community type (PCT) and condition

- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

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Data sources

Jacobs 2021
AGL 2020
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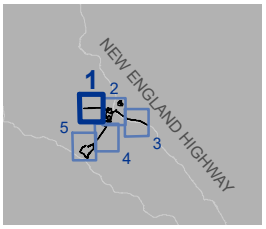

Figure 6 - 10 Biodiversity study area and habitat

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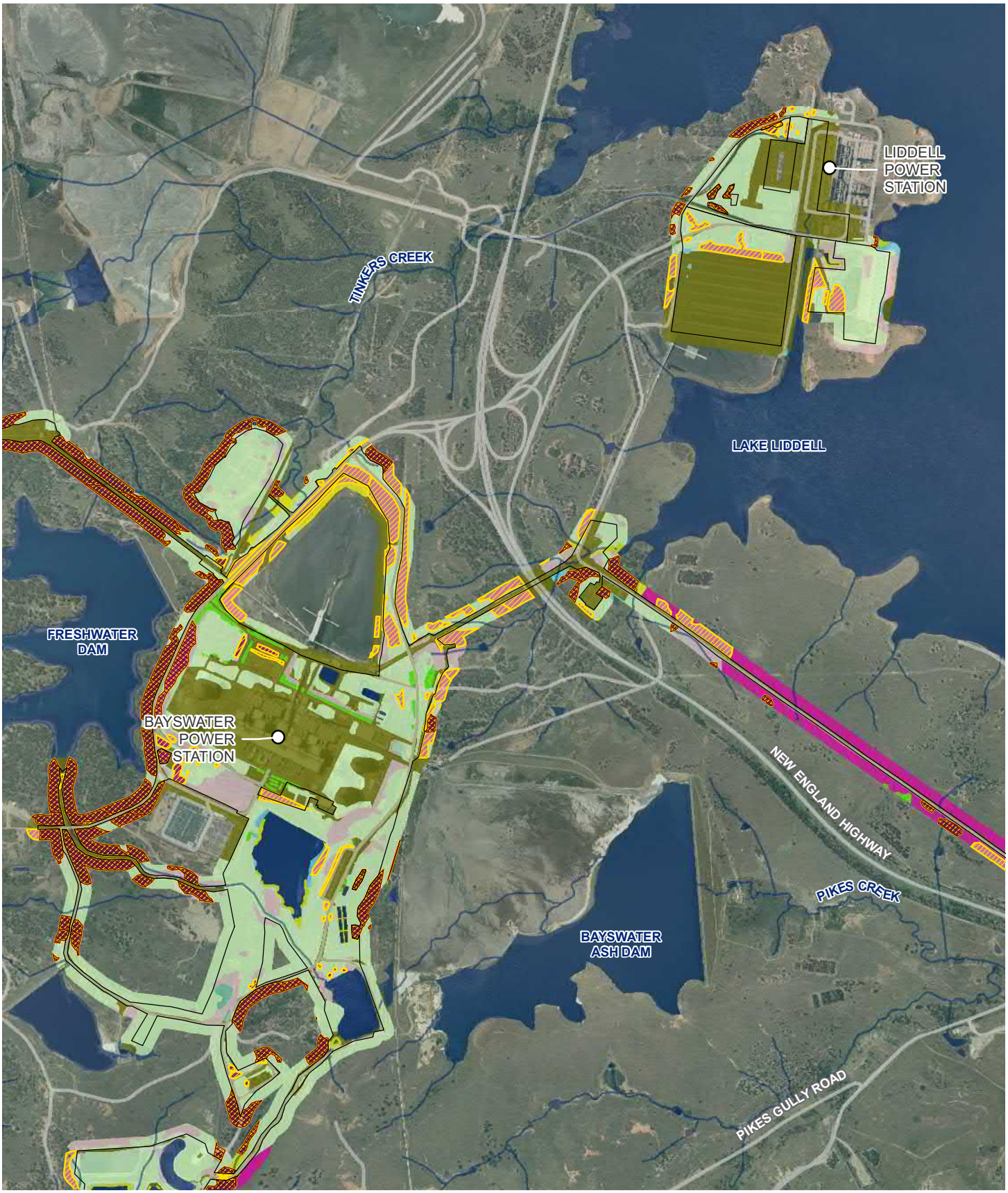

Legend

- Development site
- Road
- Waterway
- Waterbody
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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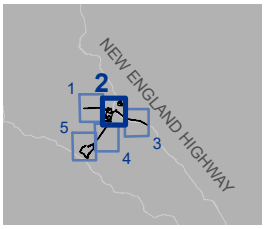

Figure 6 - 10 Biodiversity study area and habitat

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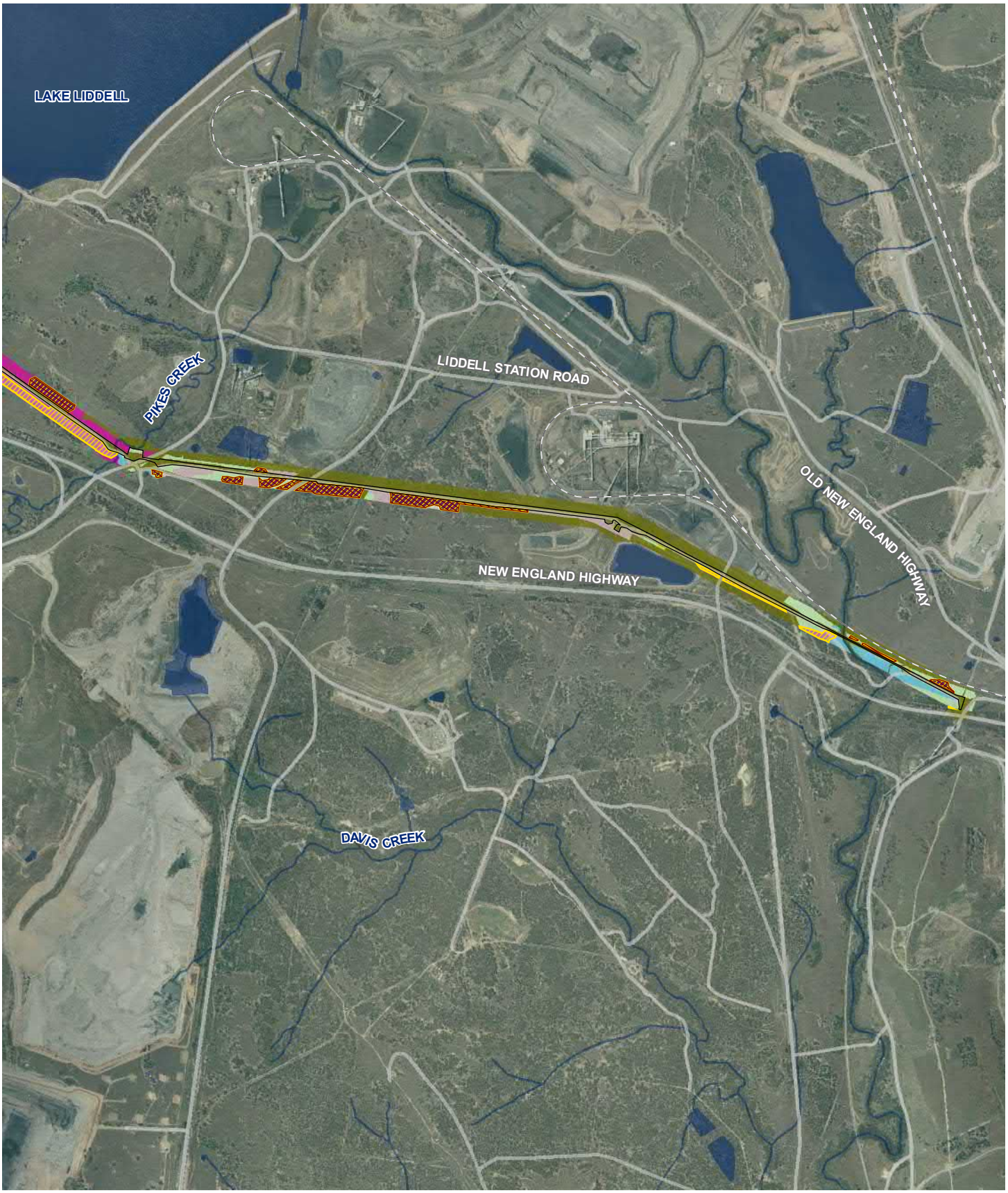

Legend

- Development site
- Railway
- Road
- Waterway
- Waterbody
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC

Plant community type (PCT) and condition

- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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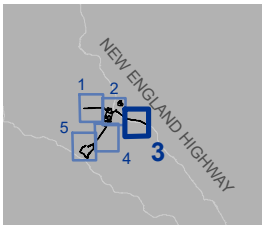

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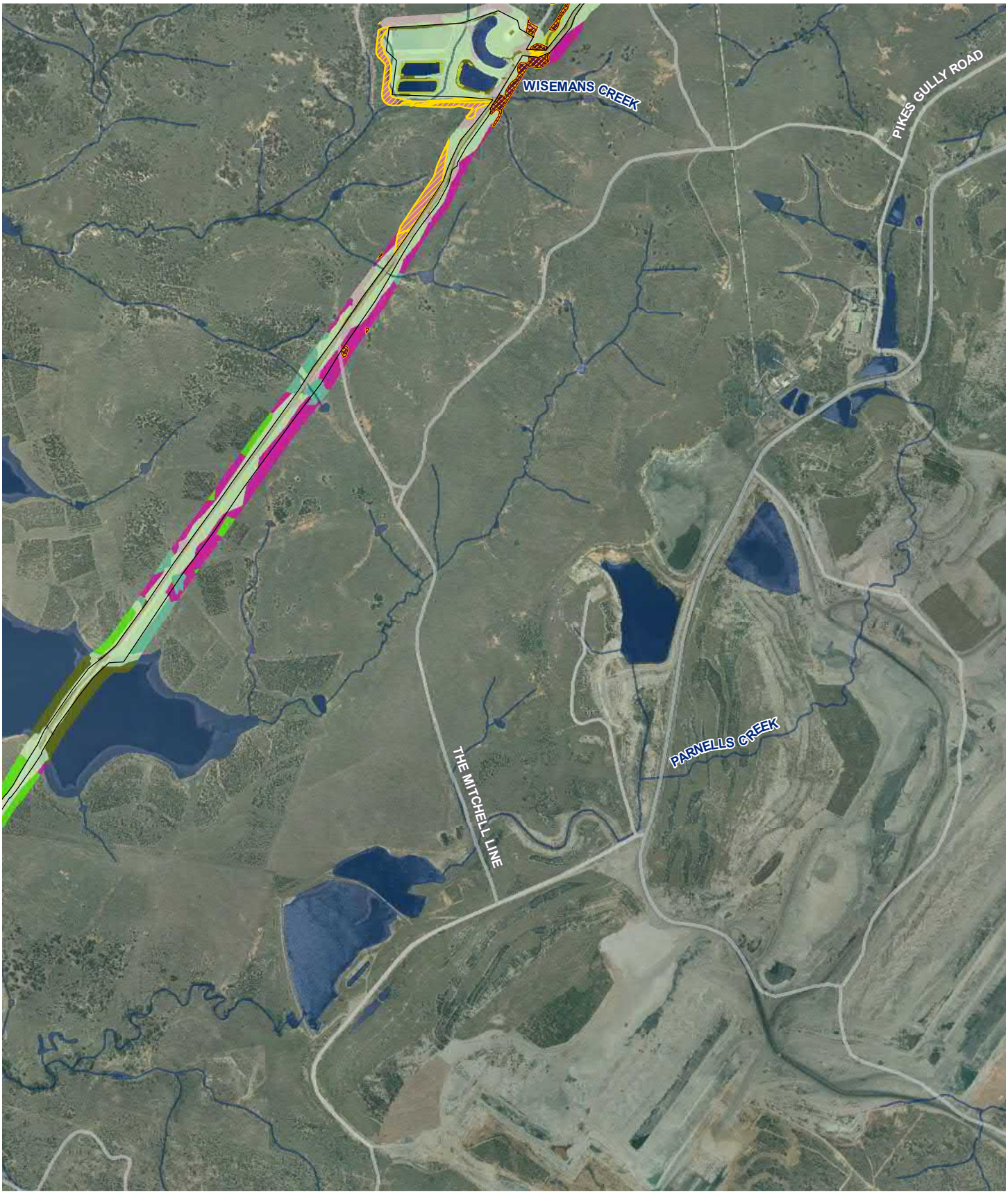

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- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Rehabilitation (Veg zone 3)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

N

Data sources

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AGL 2020
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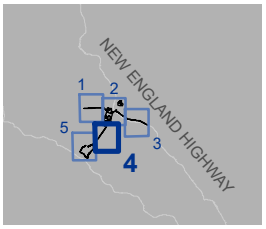

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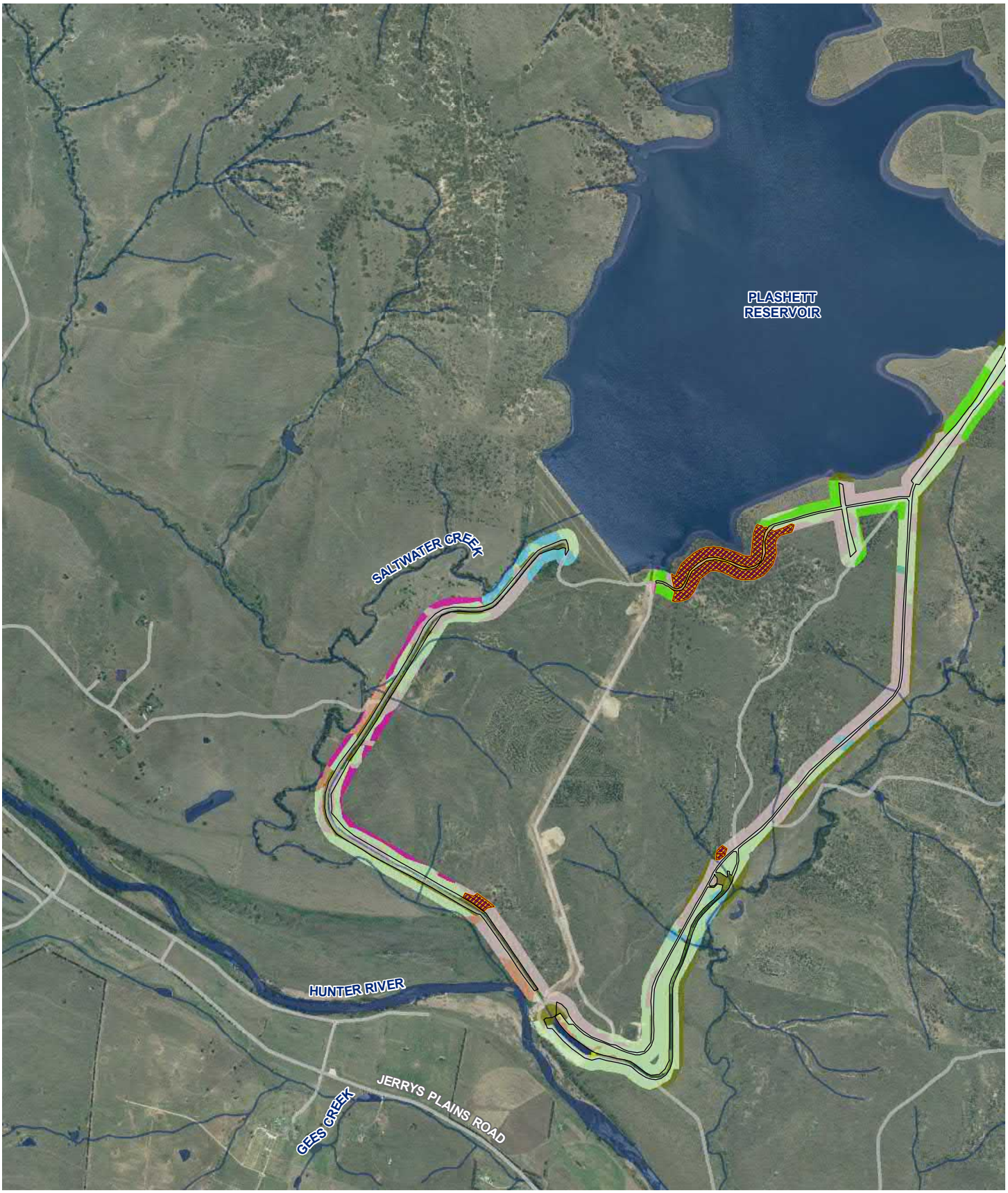

Legend

- Development site
- Road
- Waterway
- Waterbody
- Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC

Plant community type (PCT) and condition

- PCT 485 River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)
- PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion - Moderate (Veg zone 7)
- PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: Good
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Moderate (Veg zone 1)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Native Grassland (Veg zone 4)
- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter - Regrowth (Veg zone 2)
- PCT 1692 Bull Oak grassy woodland of the central Hunter Valley - Moderate-good (Veg zone 6)
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Moderate-good (Veg zone 5)

Non-Native

- Planted trees
- Exotic grassland
- Excluded/artificial surface

0 0.5 1 km

1:25,000 at A4

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Data sources

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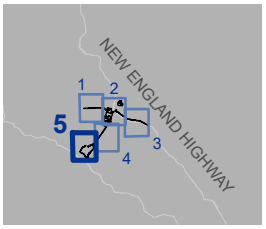

Figure 6 - 10 Biodiversity study area and habitat

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6.6.2.4 Aquatic habitats and threatened fish

Waterbodies within the development site are artificial having been constructed for the purposes of Bayswater and Liddell and are isolated from natural creek lines by pipes, concrete culverts, gates, and canals (with constantly fluctuating water levels). Whilst the freshwater dam to the west of Bayswater (outside the development site) shows similarity to natural aquatic habitats, the remaining dams in the Bayswater area are degraded and are subject to discharges from the power station and many are highly saline, contain coal ash or are sewage management ponds. They are also subject to routine maintenance activities. Lake Liddell will not be affected by the Project.

No threatened species listed under the FM Act have potential habitat within these watercourses. There are no Coastal wetlands as defined by the Coastal Management SEPP close to the development site.

6.6.3 Avoidance and minimisation of impacts

Opportunities to avoid or minimise impacts on biodiversity values were considered as part of the Project planning process. For example, the location of the development site maximises the use of areas which contain existing infrastructure or have been previously cleared / disturbed and typically avoids remnant vegetation and significant ecological features in the landscape. Additionally, the Project only requires small amounts of clearing of lower quality fragmented vegetation or rehabilitation and regrowth vegetation, thereby avoiding and minimising impacts on native vegetation. Further, the patch of Central Hunter Eucalypt Forest and Woodland Ecological CEEC within the development site would be retained.

Following the completion of survey and identification of PCTs and vegetation zones, further efforts to locate the Battery and Decoupling to avoid significant ecological features will be undertaken during detailed design.

Environmental management measures to further avoid and minimise impacts, prior to and during construction are captured in **Section 6.6.5**.

6.6.4 Assessment of impacts

6.6.4.1 Construction

Impacts on native vegetation and habitat

Direct impacts have been calculated using the entire development site, apart from the 2.04 ha patch of PCT 1691 to the west of Bayswater which is to be retained. The development site covers a total of 352.9 ha of land, however of this, only 44.3 ha (12.6%) comprises native vegetation. Of this native vegetation mapped, around 21.6 ha (49%) is poor-condition regrowth Acacia salicina (growing amongst dense exotic grass) with low ecological value. The large majority of the development site contains existing cleared /disturbed areas with 134 ha of exotic grassland and 148.5 ha of existing infrastructure or artificial surfaces.

The Project would result in the direct removal of up to 42.3 ha of native vegetation as summarised in **Table 6-21**. These vegetation clearing amounts are a worst case scenario and the likelihood that the majority of vegetation can be retained within the development site during the pre-construction phase is highly possible. AGLM would continue to seek to avoid native vegetation patches during future design and any clearing areas would be carefully selected prior to construction. Furthermore, vegetation clearing would be staged to occur during different Project components.

Table 6-21: Summary of direct impacts to native vegetation within the development site

Vegetation Zone	PCT ID No.	PCT name	Broad condition class	Estimated vegetation zone area impacted (ha)
1	PCT 1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	Moderate	2.3
2			Regrowth	21.6
3			Rehabilitation	11.4
4			Native Grassland	2.0
5	PCT 1731	Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Moderate_Good	0.9
6	PCT 1692	Bull Oak grassy woodland of the central Hunter Valley	Moderate_Good	1.2
7	PCT 1071	*Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate	3
			Total	**42.3**

The Project may impact up to 13.7 ha of the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions TEC listed under the BC Act. This TEC comprising the combined extent of PCT 1691 (Moderate Condition) and PCT 1691 (Rehabilitation).

The Project may also result in a direct impact (associated with vegetation clearing) to about 10 ha of potential foraging / roosting habitat for the Southern Myotis. The Southern Myotis is the only species credit threatened species assumed to be present.

Indirect impacts are negative changes to the structure and function of retained vegetation as a result of factors such as increased light intensity and duration, increased exposure to wind, and weed invasion in edge habitats. These 'edge effects' can have a negative impact on flora and fauna species. The patches of native vegetation within the development site are already isolated from each other as are the larger woodland patches in the surrounding landscape. Edge effects from previous clearing and vegetation management already exist within the woodland patches adjacent to the development site. The future clearing or disturbance associated with the Project is unlikely to lead to the creation of new edges in any previously intact vegetation. It is also unlikely that vegetation within the study area would receive increased light or be exposed to more wind. Further, weed introduction associated with edge effects is unlikely to be exacerbated throughout the wider landscape.

Prescribed biodiversity impacts

Prescribed biodiversity impacts (as defined by the BAM) are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. The Project does have the potential to result in the following prescribed biodiversity impacts:

- Threatened species such as Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Little Bent-winged Bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*) that use human made structures as habitat that may be affected by the development. Searches of concrete culverts, pipes and empty shipping containers showed no evidence of potential roosting habitat for threatened microchiropteran bats. The highly fluctuating water levels of culverts and pipes in the development site would likely deter bats from roosting. In addition, the high levels of light pollution, noise and electricity around buildings would also deter bats.

- Up to 46.2 ha of native vegetation and planted native non-indigenous trees may be impacted by the Project. 21.6 ha of this amount is scattered regrowth *Acacia salicina* growing amongst dense exotic grass. Proposed clearing as a result of the Project would occur during different stages and timelines as relevant to each Project component. Nonetheless, if all vegetation within the development site (and non-retained areas) is removed, there would be a minor decrease of habitat connectivity in the locality caused by widening of existing gaps in vegetation. Threatened species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites.
- Construction activity in the vicinity of aquatic environments may temporarily increase disturbances such as increased noise, vibration and vehicle movement. Delineation and avoidance of aquatic and riparian areas would prevent direct impacts to these ecosystems.
- Increased vehicle movements from the Project have the potential to result in increased fauna mortality from vehicle strikes and this impact would be managed appropriately.

Noise, vibration, dust, light and contaminants

Construction activities would likely result in a small increase in ambient noise levels as well as potentially loud noises and vibration for short periods associated with construction. Noise and vibration from construction activities would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. Impacts from noise emissions would likely be temporary and localised to where construction is being undertaken at the time. These noise emissions are not considered likely to have a significant long-term impact on wildlife populations outside the disturbance area.

While some level of dust would likely be generated during construction, the deposition of dust on foliage would likely be highly localised, intermittent and temporary, and is not likely to be a major impact of the Project. Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the development site during construction. This has the potential to reduce photosynthesis and transpiration, and cause abrasion and radioactive heating, resulting in reduced growth rates and decreased overall health of the vegetation.

The development site is already affected by light spill associated with Liddell and Bayswater as well as lighting for roads, coal conveyors, heavy vehicles and pump stations. Construction would predominantly take place during standard construction hours and should not exacerbate the effects of light pollution from current operations within the development site or surrounds.

The Project is unlikely to cause large-scale soil disturbance at depth and is not proposed to interface with groundwater. Where the development may interact with surface water bodies, specific construction environmental controls (sediment erosion controls as part of the CEMP) will be implemented. The final layout of the Battery facility is likely to comprise large areas of hardstand that will minimise the potential for any direct contact with subsurface soil during operations. Similar scenarios are envisaged for BAW. Accordingly the Project is unlikely to result in any contamination related impacts to flora and fauna.

6.6.4.2 Operation

No adverse impacts on Biodiversity (either direct or indirect) are anticipated during operation of the Project.

6.6.5 Environmental management measures

Environmental management measures carried out during the construction would be outlined in a Flora and Fauna Management Plan to be developed post approval and implemented as part of a suite of environmental management documentation described in **Section 7.2**. Biodiversity management measures, including the proposed regime for minimising, managing and reporting biodiversity impacts, are presented in **Table 6-22**.

Table 6-22: Environmental management measures for biodiversity impacts

Reference	Environmental management measures	Timing
B01	Opportunities to limit the extent of vegetation clearance required would be considered as part of detailed design and construction planning. This would include: ▪ Detailed design to avoid PCTs with higher integrity scores to the extent practicable ▪ Confirmation of actual disturbance footprint for each Project component ▪ Recalculation of biodiversity credit requirements ▪ Provision of final layout plans and agreement of associated biodiversity credit requirements to DPIE and BCD ▪ Retirement of biodiversity credits prior to commencement of construction for each Project component (or sub-component).	Pre-construction
B02	The regime for managing biodiversity impacts would be documented and implemented through a Flora and Fauna Management Plan and include the following requirements: ▪ Clearly delineate the boundaries of the development site as refined through the detailed design process to prevent any unnecessary clearing beyond its extent. This would include delineation and protection of the 2.04 ha patch of PCT 1691 to the west of Bayswater which is to be retained ▪ Ensure vehicle and equipment parking areas and stockpile areas are identified and sited to avoid areas containing ecological value ▪ Install appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' ▪ Identify and communicate the location of any 'No Go Zones' in site inductions ▪ Speed limits within the Project area would be limited to 40 km/hr to minimise the risk of vehicle collision with fauna. The Flora and Fauna Management Plan would also consider measures to mitigate impacts on flora and fauna from noise, vibration, waste, and air pollution, in accordance with the mitigations identified in this EIS. The Flora and Fauna Management Plan would also include how impacts to biodiversity would be reported and is expected to include documentation of evidence of commitments and conditions of approval being implemented for inclusion in post approval compliance auditing and reporting.	Pre-construction
B03	The following measures will be established to manage impacts to vegetation adjacent to the development site: ▪ Materials, plant, equipment, work vehicles and soil/rock stockpiles will be placed to avoid damage to surrounding vegetation and outside tree drip-lines. Construction workers and vehicles will not access areas beyond the delineated development site. Detailed design will determine if further retainment of native vegetation is possible ▪ Erosion and sediment controls will remain in place until rehabilitation has been completed. Drainage lines will be protected from runoff and stockpiling of spoil ▪ Limits of the development site (only where native vegetation exists) will be accurately and clearly marked out prior to commencement of works. No activities including parking and turning of vehicles and plant / equipment will occur beyond the development site in association with the Project.	Design, pre-construction, construction

Reference	Environmental management measures	Timing
B04	An inspection of native vegetation to be impacted (within the development site) will be conducted by an ecologist immediately prior to vegetation clearing works (to confirm absence of fauna species). A Spotter/Catcher ecologist will supervise vegetation clearing. Construction machinery will be checked for sheltering fauna prior to use. In the unlikely event that fauna is present, works should cease until animals can be captured and removed from the development site. Construction crews will be made aware that any native fauna species encountered must be allowed to leave site without being harassed. Trenches / holes will be inspected each morning and any trapped fauna will be removed or a mechanism for fauna to escape will be provided, such as a soil or timber ramp.	Pre-construction, construction
B05	The following measures will be in place to manage impacts to soil and soil seed bank: ▪ Where native vegetation is removed, top soil will be retained from excavation areas within the development site (where possible). Top soil stockpiles must be delineated and protected from machinery compaction and contamination during construction. Following construction and infill, top soil will be re-spread over impacted native vegetation areas (to retain native seedbank and assist with natural revegetation). Stockpiling in the vicinity of drainage lines will be avoided ▪ Woody debris (logs and mulch) produced during vegetation clearing will be re-spread over any cleared areas to protect the soil surface from erosion and to aid habitat restoration where appropriate.	Construction
B06	If required, weed control will be undertaken by suitably qualified and / or experienced personnel. This may include: ▪ Manual weed removal in preference to herbicides ▪ Replacing non-target species removed / killed as a result of weed control activities ▪ Protecting non-target species from spray drift ▪ Using only herbicides registered for use within or near waterways for the specific target weed ▪ Not applying herbicide if it is raining or if rain is expected ▪ Mixing and loading herbicides and cleaning equipment away from waterways and drains. The CEMP will detail the procedures for management of weeds on the development site (which will be in accordance with the requirements of the *Biosecurity Act 2015*).	Construction
B07	Pathogen management measures will be in place to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi. The CEMP will provide a protocol for construction vehicles driving to and from site to prevent the spread or introduction diseases.	Construction

6.6.6 Biodiversity offsets

Offsets would be required for the direct and indirect impacts to native vegetation and threatened species habitats (refer to **Figure 6-11**). A framework for the Project's Biodiversity Offset Strategy has been completed (refer to Section 12 to Section 14 of the BDAR (**Appendix E**). The Biodiversity Offset Strategy would be further developed and would need to be approved by DPIE and any other decision making agency prior to commencement of any disturbance works.

Given the various components of the Project are expected to be carried out at different times, the credit retirement for biodiversity credits is likely to occur in a staged manner. Vegetation clearing for each part of the Project is not likely to occur immediately, therefore a staged approach is considered favourable. This approach would also allow for vegetation retainment during detailed design of the various Project components and elements.

A Project staging plan would be prepared prior to the commencement of works. This would recalculate the required biodiversity credits for each stage (based on areas of impacts to each vegetation zone). Retirement of biodiversity credits would occur prior to the commencement of each stage.

AGLM are likely to use a combination of options to retire biodiversity credits during each stage of the Project as follows:

- Payment to the Biodiversity Conservation Fund (the Fund) managed by the Biodiversity Conservation Trust (BCT)
- Purchase of credits from the open market, with consideration of applying the 'Like for Like' Variation Rules, where required
- Establishment of a Biodiversity Stewardship Site to generate credits to use for offsetting.

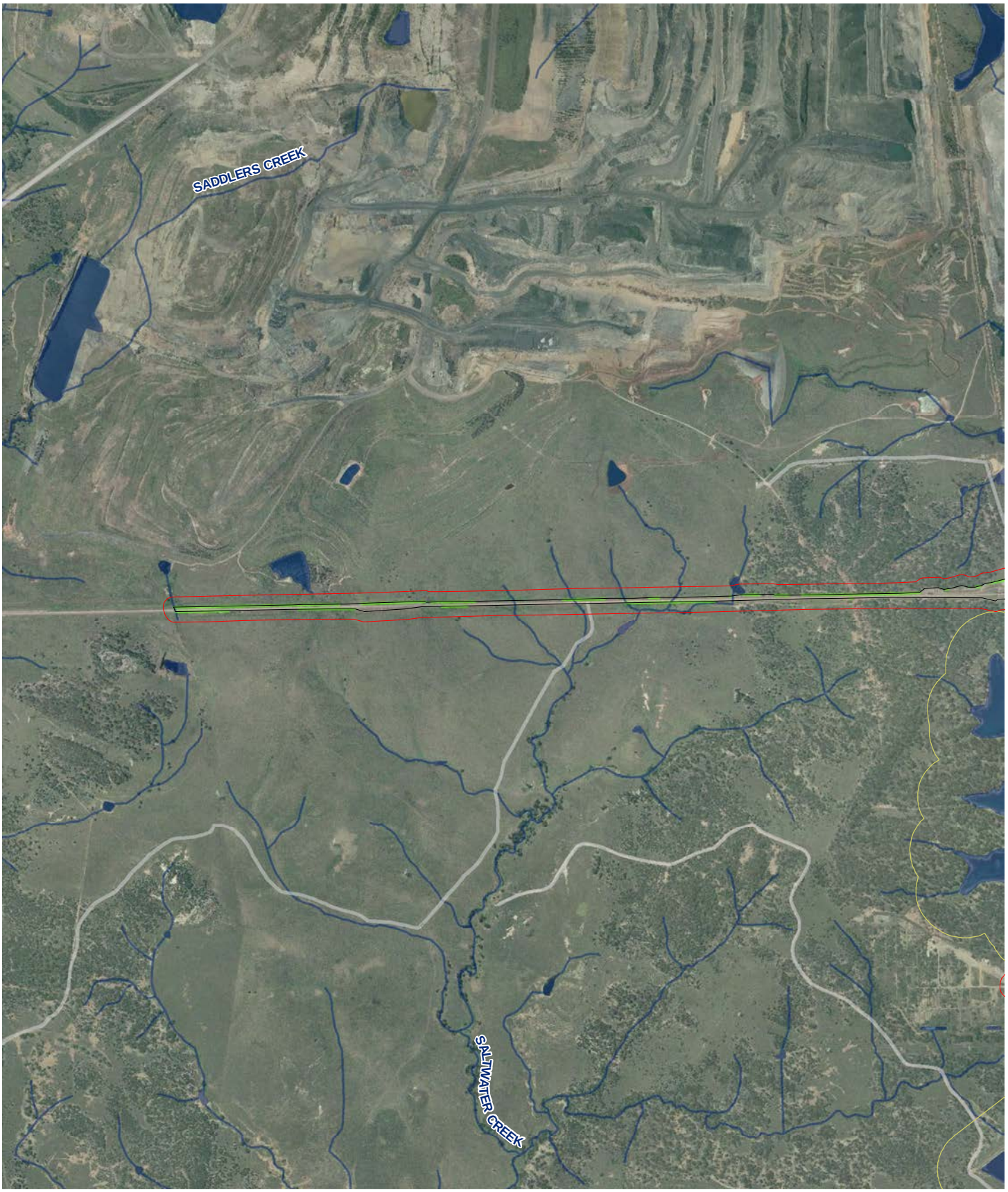
Impacts to biodiversity would be reduced where possible during each stage of the Project.

Total Offsets per credit type have been calculated for the potential clearing of native vegetation and a credit requirement has been calculated using the BAM-C. Offsets were also identified as being required for the Southern Myotis. The total number of credits to be retired for each stage of the development have been divided on a pro rata basis on a credit / ha (of impact) calculation as shown in **Table 6-23**. AGLM has further confirmed that much of the development site is highly unlikely to be impacted. Areas unlikely to be impacted are identified **Figure 6-11** and credits within these areas are calculated as presented in brackets in **Table 6-23**. The detailed design would confirm impacts requiring credits to be retired and AGLM would retire these credits prior to commencing each stage.

Table 6-23: Credit requirements for each stage of the Project

Stage of Development	PCT 1691 Moderate Credits	PCT 1691 Rehabilit-ation Credits	PCT 1691Native Grassland Credits	PCT 1731 Moderate_ Good Credits	PCT 1692 Moderate _ Good Credits	PCT 1071 Moderate Credits	Southern Mytois credits
Battery	-	57 (57)	-	1 (1)	-	-	37 (37)
Decoupling	2	3 (3)	-	-	-	-	2 (2)
BAW	36 (17.5)	126 (71.5)	24 (0)	6 (0)	17 (1.3)	82(0)	157 (32.9)
Total credits	**38**	**186**	**22**	**7**	**17**	**82**	**196**

More native vegetation is likely to be retained during later design or prior to construction, and to accommodate for this an amount of credits are grouped as 'unlikely' (ie. it is unlikely that these credits would be required to be offset). The BAM (and BAM-C) does not allow for segregation of credits like this and therefore 'unlikely' credits are calculated on a proportionate basis guided by ha of PCTs to be affected by clearing.



Legend

- Assessment area
- Development site
- 200m waterbody buffer
- PCT impacts
  - No offset required
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 11 Biodiversity offsets

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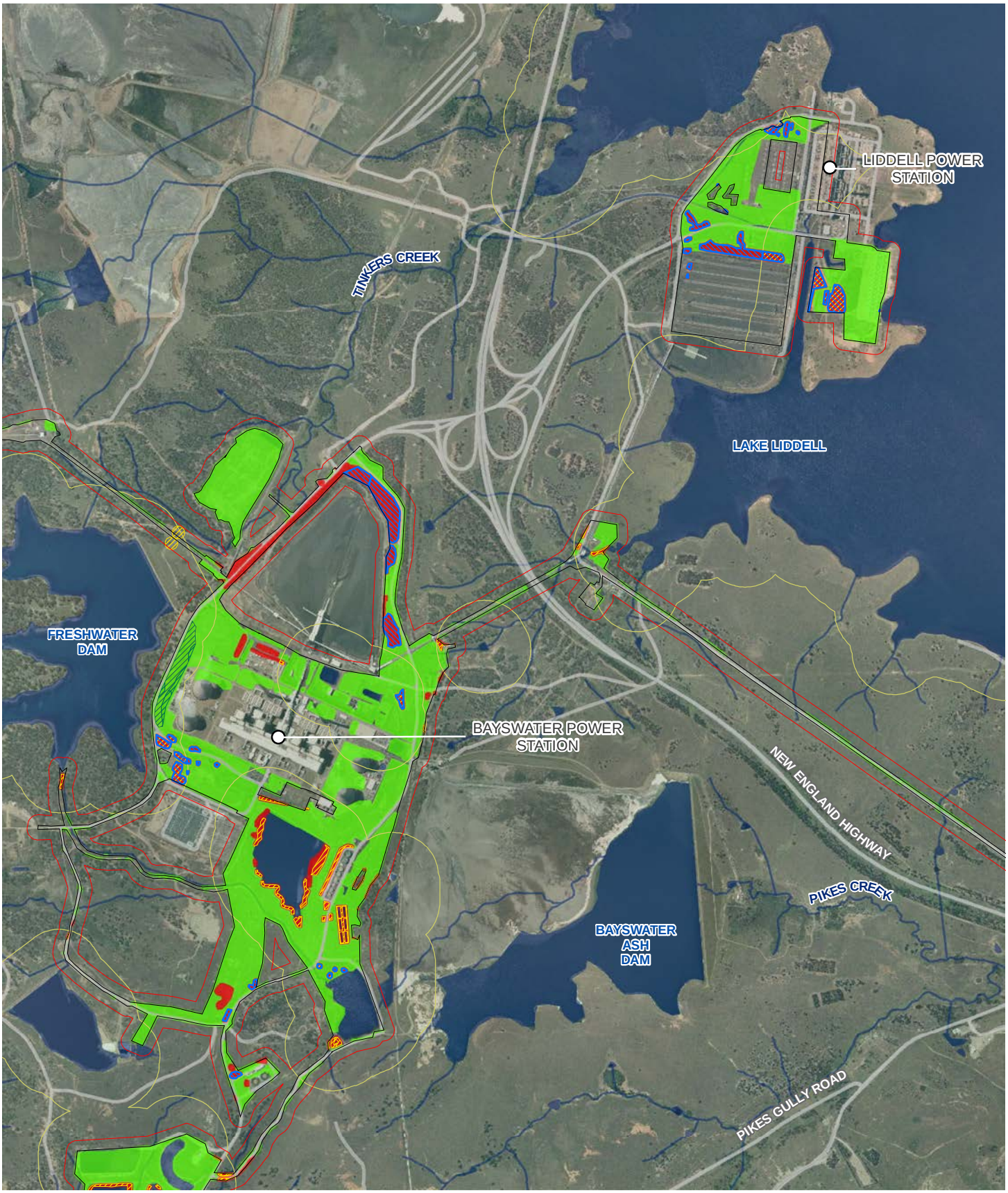

Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Vegetation to be retained
- Species impact
- Road
- Waterway
- Waterbody

PCT impacts

- No offset required
- Offset required
- Unlikely to be impacted

0 0.5 1 km

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Data sources

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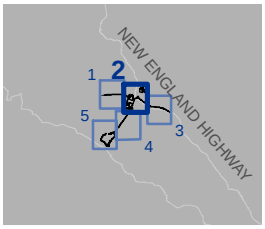

Figure 6 - 11 Biodiversity offsets

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Legend

- Assessment area
- Development site
- 200m waterbody buffer
- PCT impacts
  - No offset required
- Road
- Railway
- Waterway
- Waterbody

0 0.5 1 km

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Data sources

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Figure 6 - 11 Biodiversity offsets

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Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Species impact
- PCT impacts
  - No offset required
  - Offset required
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

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Data sources

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Figure 6 - 11 Biodiversity offsets

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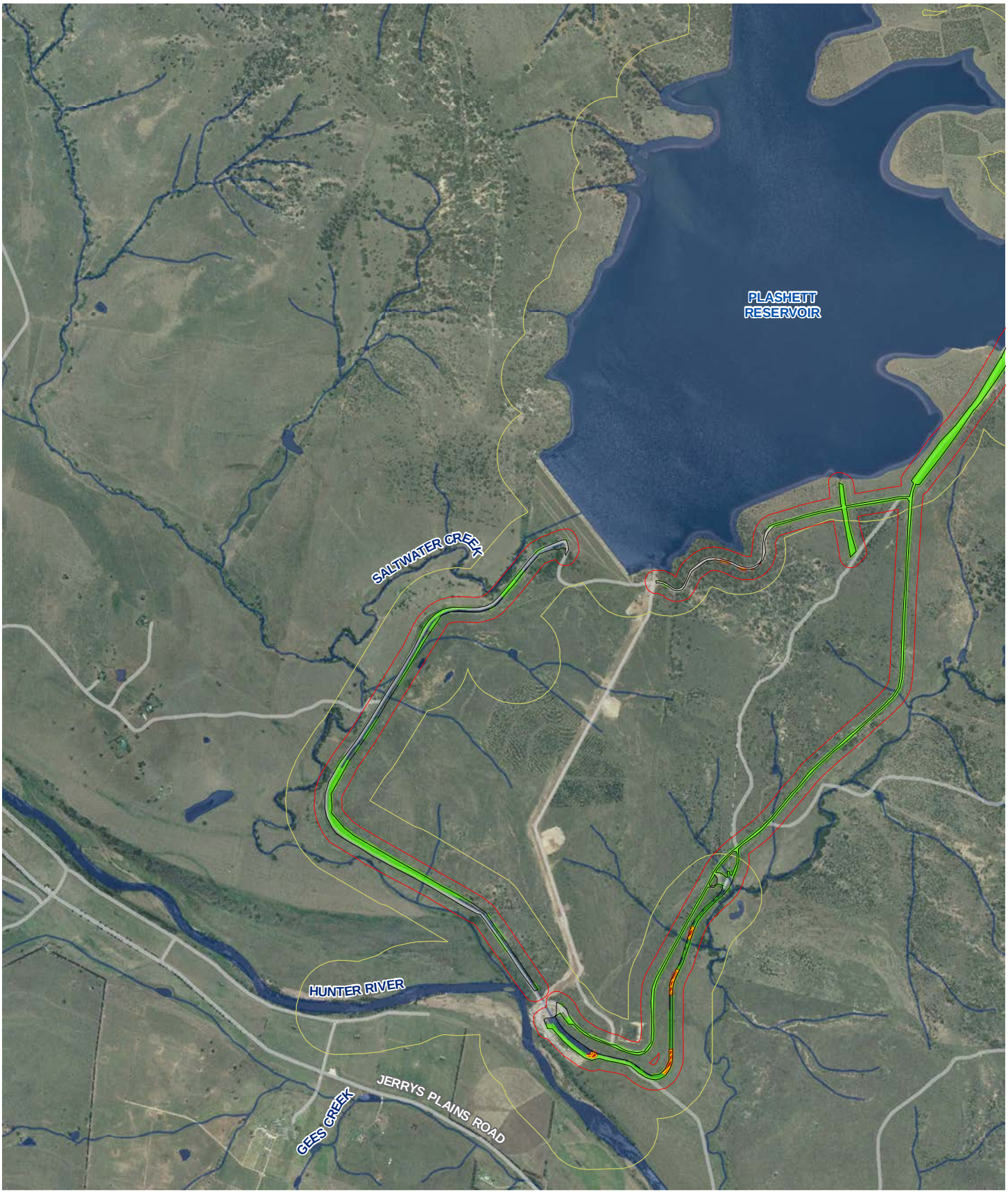

Legend

- Assessment area
- Development site
- 200m waterbody buffer
- Species impact
- PCT impacts
  - No offset required
  - Offset required
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

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Figure 6 - 11 Biodiversity offsets

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6.7 Land and contamination

This section provides an assessment of the potential land and contamination impacts of the Project and measures to mitigate them. The assessment of the potential contamination impacts associated with the Project is contained in the *Liddell Battery and Bayswater Ancillary Works: Contamination Assessment* (Kleinfelder, 2021) (**contamination assessment**) which is provided in **Appendix D**. The contamination assessment and this section addresses the following SEARs:

- ***Land and Contamination – including:*** *An assessment of impacts of the project on soils, land capability and geotechnical stability of the site and surrounds;*
- *An assessment of the extent and nature of any contaminated materials or acid sulphate soils on site;*
- *An assessment of potential risks to human health and the receiving environment; and*
- *A description of the measures that would be implemented to avoid or mitigate impacts;*

6.7.1 Assessment methodology

The methodology used for the land and contamination assessment included:

- A review of existing background information relevant to the Project area including available databases, regional mapping, and other assessment reports prepared for the WOAOW project EIS
- Identify potential contamination issues associated with the development site based on the previous contamination investigation reports
- Assess, to the extent practicable, human health and environmental risks associated with the potential contamination identified
- Assessment of the potential land impacts during construction and operation of the Project
- Identification of appropriate mitigation and environmental management measures.

The contamination assessment was prepared in accordance with the requirements of SEPP 55. As part of the contamination assessment, a conceptual site model (**CSM**) was developed, and consideration was given to potential source pathway receptor (**S-P-R**) linkages associated with the development site.

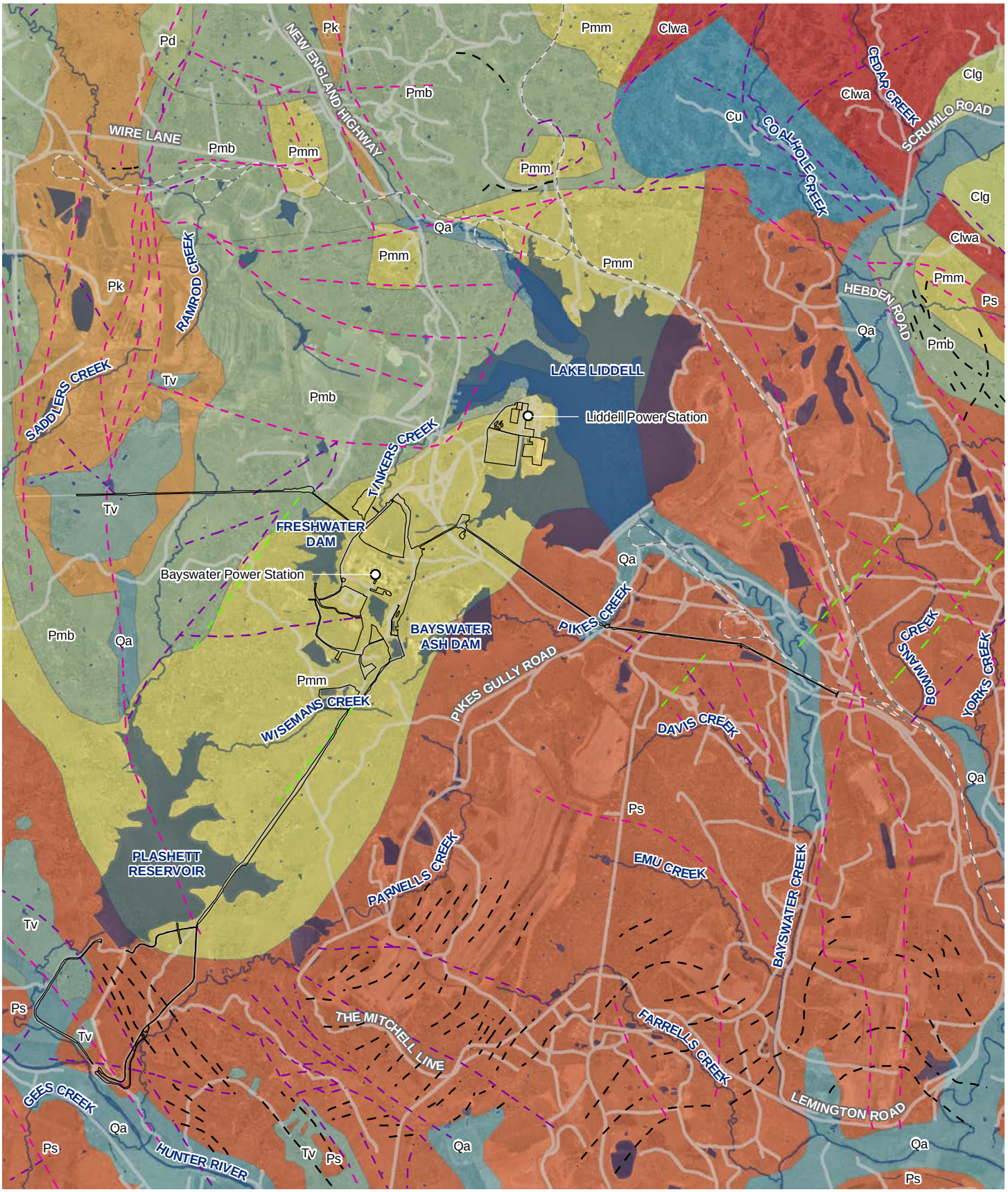
No detailed geotechnical assessment has been undertaken at this stage of the design process. Consideration of geotechnical stability is provided at a high level only on the basis that detailed design would need to address any geotechnical issues in accordance with relevant standards.

6.7.2 Existing environment

6.7.2.1 Soils, geology and geotechnical stability

Geology

The 1:100,000 Hunter Coalfield Regional Geology map (Glen, 1993) indicates that surface geology in the vicinity of the Project comprises sedimentary rock, with some limited areas mapped as Quaternary Alluvium. As shown on **Figure 6-12**, the majority of the development site is located within the Mulbring Siltstone -Maitland Group (Pmm) and Singleton Coal Measures (Ps) geological units. While the MA1B conveyor traverse Branxton Formation - Maitland Group (Pmb) and Muswellbrook Coal Measures.



Legend

Development site
Dyke
Fault
Fold
Structure

Geological unit

- Conglomerate, sandstone, shale, acid tuffs (Cu)
- Gravel, sand, silt, clay (Qa)
- Olivine basalt with occasional sediment interbeds, dolerite, trachyte, microsyenite (Tv)
- Branxton Formation - Maitland Group - Mudstone, sandstone and conglomerate (Pmb)
- Dalwood Group - Undifferentiated - sandstone, mudstone, tuff, shale, lava,conglomerate includes Gyarran Volcanics, may include some Carboniferous (Pd)
- Gilmore Group - Intermediate to acid crystal and vitric tuff and lavas,conglomerate, sandstone. Includes correlatives - Siltstone and sandstone (Clg)
- Mulbring Siltstone - Maitland Group - Siltstone and sandstone (Pmm)
- Muswellbrook Coal Measures - May not be strictly equivalent (Pk)
- Singleton Coal Measures - Sandstone, shale, mudstone, conglomerate and coal seams (Ps)
- Wallaringa Formation - Conglomerate,acid tuffs, lithic red siltstones. Includes correlatives (Clwa)

0 2 4km

1:90,000 at A4

Railway
Road
Waterway
Waterbody

Data sources

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Figure 6 - 12 Geology

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Soils

A review of NSW eSPADE (DPIE, 2019) soil profile data indicated soils in the vicinity of the Project generally compromise silty clay loams, clay loams and silty loams underlain by silty clays, medium clays, heavy clays. Regional soil landscapes are presented in **Figure 6-12**.

The Project is predominately situated across Liddell soils (SHld), with southern extent of the Project area located across Bayswater soils (CSBz). A description of the soil landscape groups is presented in **Table 6-24**. Information presented is based on Soil Landscapes of Central and Eastern NSW (Office of Environment and Heritage, 2019).

Table 6-24: Soil landscape groups across the Project area

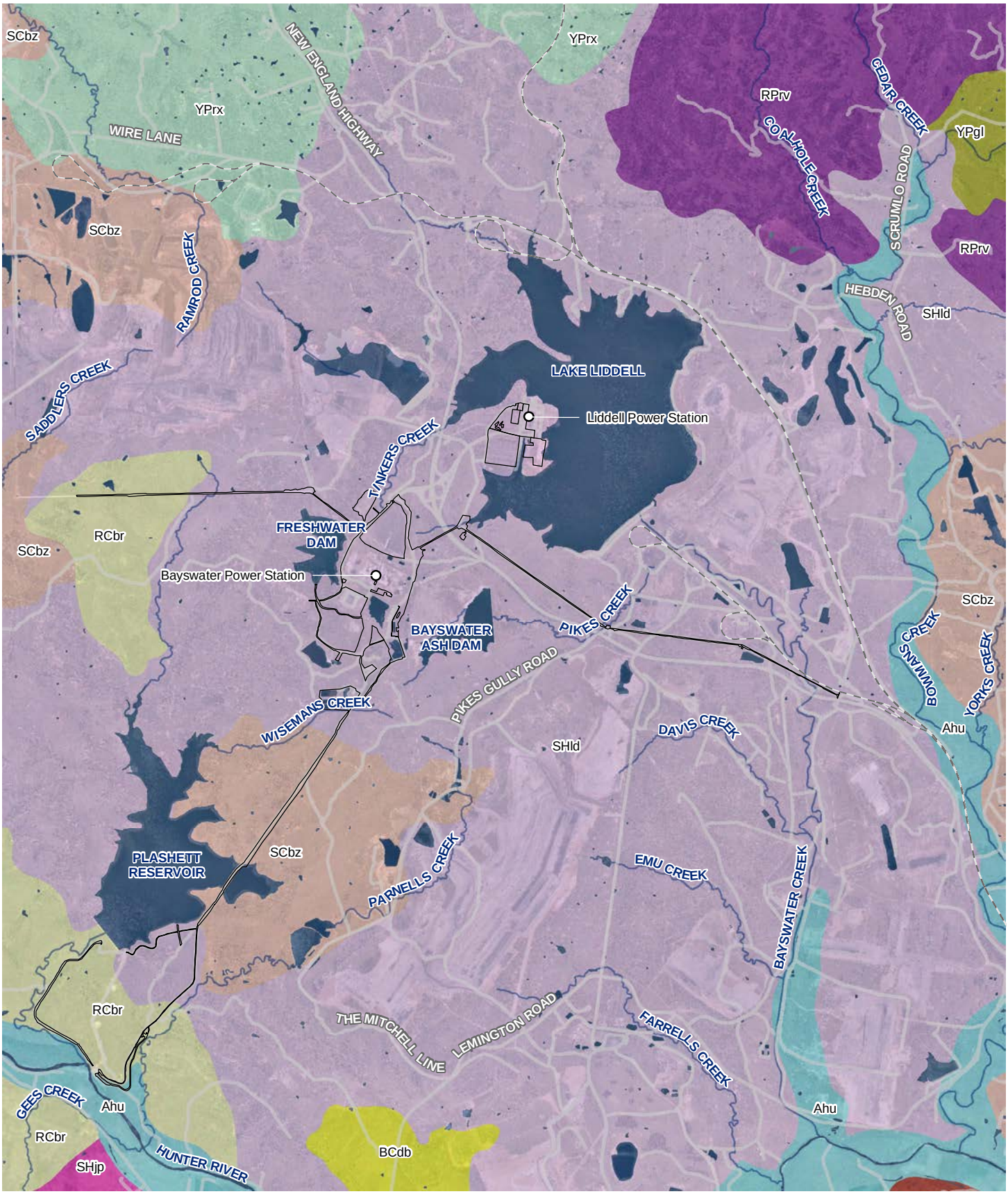
Soil landscape	Description
Liddell soil landscape (SHld**)**	**Landscape:** This soil landscape covers undulating low hills with a few undulating hills, ranging in elevation from 140 – 220 m. Slopes are 4 – 7 %, with long slope lengths (1200 – 2000 m). Local relief is 60 – 120 m. Drainage lines occur at 300 – 1000 m intervals. **Soils**: The main soils are Yellow Soloths on slopes with some Yellow solodic soils. There are Earthy and Siliceous Sands on mid to lower slopes where the parent material is more sandy. There are some Red Soloths, Red Solodic Soils and Red Podzolic Soils. Clayey subsoils or sandy loam at between 20 cm – 40 cm depths. **Limitations**: Minor to severe sheet erosion is common, with some minor rill erosion. Moderate gully erosion (to 1.5 m) in drainage line where salting may be a feature.
Bayswater soil landscape (CSBz)	**Landscape**: This soil landscape covers undulating low hills south-west of Muswellbrook ranging in elevation from 140 - 220 m. Slopes are 3 – 10 %, with slope lengths averaging 1,200 m. Local relief is 40 - 60 m. Drainage lines occur at 700 – 1,000 m intervals. **Soils:** Yellow solodic soils up to a depth about around 20 cm on slopes with Alluvial Soils, Brown and Yellow Earths and Prairie Soils in drainage lines. Subsoils of sandy clay loams or light to medium clay. **Limitations**: Moderate sheet and gully erosion is common on slopes. Gullies (to 3 m) are associated with the highly erodible yellow solodic soils. Salt scalds and associated erosion are common in some areas.

Acid sulphate soil

ASS is the common name for naturally occurring sediments and soils containing iron sulphides. The exposure of these soils to oxygen by drainage or excavation, oxidises the iron sulphides and generates sulfuric acid. The sulfuric acid can be readily released into the environment, with potential adverse effects on the natural and built environments. The majority of ASS are formed when available sulfate (which occurs widely in seawater, marine sediment, or saturated decaying organic material) reacts with dissolved iron and iron minerals forming iron sulfide minerals, the most common being pyrite. This generally limits their occurrence to deeper marine sediments and low lying sections of coastal floodplains, rivers and creeks where surface elevations are less than approximately five Australian Height Datum (**mAHD**).

The Australian Soil Resource Information System (CSIRO, 2019) mapping indicates the major water bodies in the vicinity of the Project to have 'high probability of occurrence' for ASS, with a 'very low' level of confidence. The majority of the land within the development site is mapped as a 'low probability of occurrence' for ASS, with a 'very low' level of confidence.

As the Project area has elevations ranging from approximately 90 and 250 m above sea level, ASS is not anticipated.



Legend

Development site

Soil landscape

- Bayswater (SCbz)
- Branxton (YPbx)
- Brays Hill (RCbr)
- Dartbrok (BCdb)
- Greenland (YPgl)
- Hunter (Ahu)
- Jerrys Plains (SHjp)
- Liddell (SHld)
- Rosevale (RPrv)
- Roxburgh (YPrx)

Railway

Road

Waterway

Waterbody

0 2 4km

1:90,000 at A4

Data sources

Jacobs 2020
©Department of Finance, Service and Innovation Aug 2020
AGL 2020
OEH 2020

Imagery:
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Figure 6 - 13 Soil landscapes

Date: 4/02/2021 Path: J:\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F013_SoilLandscape_r1v3.mxd
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Soil salinity

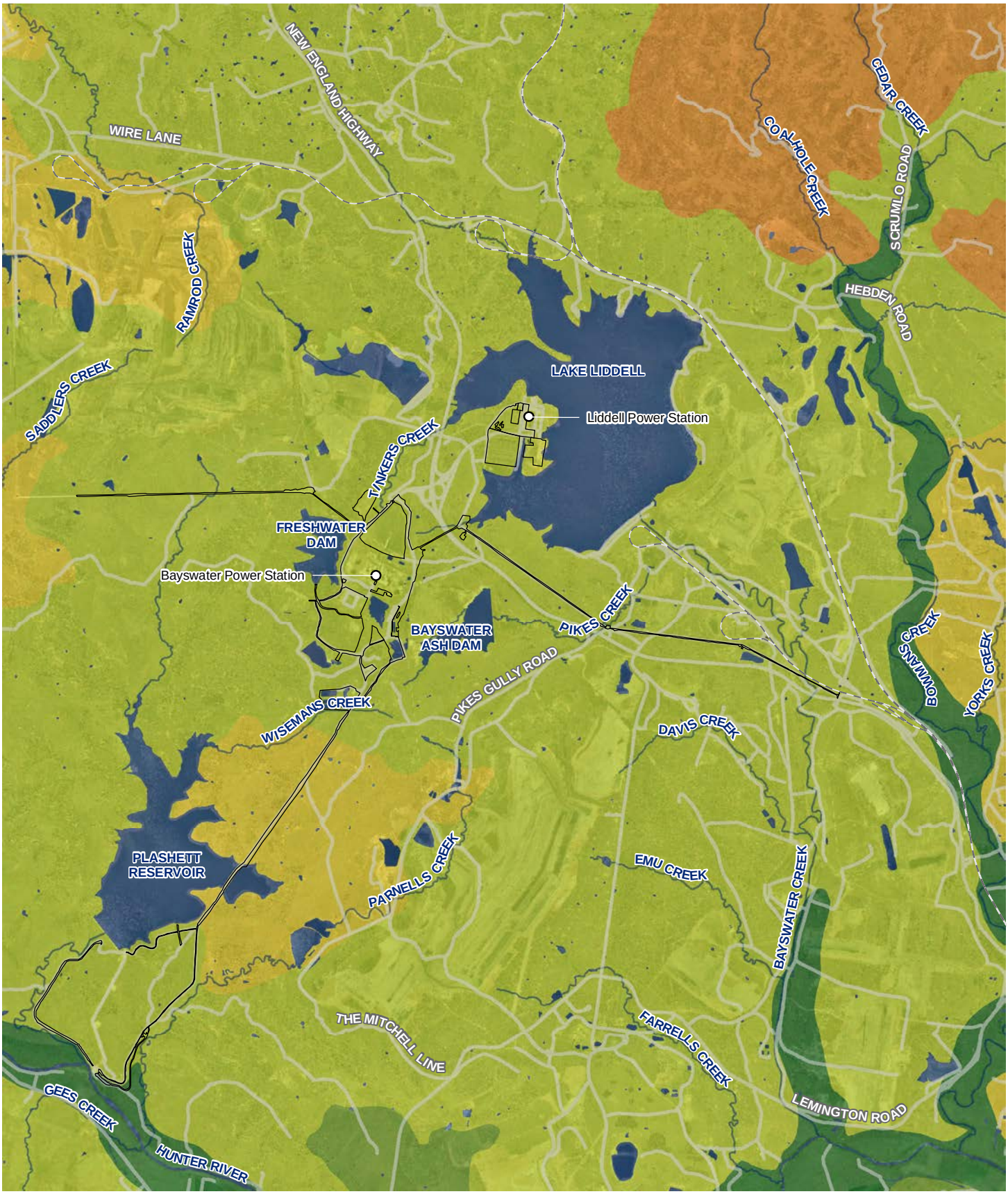
The eSPADE profile data in the broad vicinity of the Project indicates that soil salinity values range from 'non saline' to 'highly saline' as per the soil salinity class ranges provided by Agriculture Victoria.

Land and soil capability

Land in NSW is commonly classified according to the capability of land to remain stable under particular land uses. The Land And Soil Capability Assessment Scheme (OEH, 2012) classes land in terms of inherent physical characteristics or constraints, it considers the optimum use of land rather than the maximum use and in general would not change over time. Classification of land into classes on a scale of 1 to 8 identifies the types of land use that would be appropriate in each classification.

The land within the Project area ranges from 'Severe' to 'Very Severe' limitations, which corresponds to a land and soil capability (**LSC**) class 5 (Moderate–low capability land) and 6 (Low capability land), refer to **Figure 6-13**.

For soils with an LSC class of 5 and 6 the land has high limitations for high and very high impact land uses. The land uses are largely restricted land use to grazing, forestry and nature conservation (and some horticulture (orchards) for LSC class 5). The land limitations need to be carefully managed to prevent long-term degradation.



Legend

Development site

Land and soil capability

- Moderate limitations
- Moderate to severe limitations
- Severe limitations
- Very severe limitations
- Extremely severe limitations

- Railway
- Road
- Waterway
- Waterbody

0 2 4km

1:90,000 at A4

N

Data sources

Jacobs 2020
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Figure 6 - 14 Land and soil capability

Date: 4/02/2021 Path: J:\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F014_LandSoilCapability_r1v3.mxd
Created by : NT | QA by : KM

Geotechnical stability

General observations in relation to geotechnical stability of the Disturbance site are as follows:

- While the slope, soils and geology of the Project area as described above have implications for geotechnical stability the specific ground engineering requirements to facilitate the Project are not expected to present significant design or construction challenges given the site already supports a range of similar infrastructure associated with Bayswater and Liddell
- Locations of new infrastructure include areas where no prior disturbance has occurred, where construction of Bayswater and Liddell has involved cut and fill activities and significant ground engineering and also where past site uses may have resulted in unconsolidated fill being present, such as the coal stockyards
- The site is not mapped as subject to landslide risks
- Muswellbrook Council has previously raised the prevalence of regular low-level seismic activity (generally measuring less than four on the Richter scale) in the Muswellbrook LGA
- Subsidence Advisory NSW has previously raised that historic mining practices and mapping may be inaccurate in terms of extent of mining as well as the percentage of coal extraction and some areas may be at risk of either shallow mine failure (potholes) or pillar failure.

As noted in **Section 6.1.2**, land mapped as mine subsidence district is limited to BAW components where no new infrastructure is proposed and only the ongoing maintenance of the M Series coal conveyors as shown **Figure 6-1** is required. As such the risk from mine subsidence are considered to be low.

6.7.2.2 Contamination

Targeted contamination assessments have previously been conducted across "areas of environmental concern" (**AEC**) at the Bayswater and Liddell sites. These areas were identified as having the potential to be impacted from power station activities conducted since Bayswater and Liddell were initially constructed. The contamination assessment has considered the results presented in the previous contamination investigation reports in relation to the development site. Each of the Project areas are discussed below.

Liddell Battery

The Battery locations (refer to **Section 2.2.1** and **Figure 2-3**) were considered as three areas in the contamination assessment as summarised below.

Former coal yards area

The coal yards are located to the south of the main Liddell operational area and to the south of the main Liddell switchyard. The previous investigations targeted nine sampling locations in this area, with the majority of these restricted to the edge of the existing coal storage yards, for operational reasons, which limits delineation of fill / coal depth across the coal yards area (coal fines were identified to be present at depths up to 3 m). Results from each of these sampling locations confirmed that Contaminants of Potential Concern (**COPC**) were below the adopted commercial / industrial screening criteria. It is reasonable to expect that these boundary concentrations are likely to be similar across the wider coal yards area.

The solar array area

This area is located to the south of the main power generating infrastructure and to the east of the existing coal storage yards. A review of existing data confirms that, while some AECs have previously been identified in this area, analytical results from six targeted sample locations did not identify concentrations of COPC above the commercial / industrial health investigation levels which provide conservative screening criteria (commercial / industrial screening criteria). These results, together with the understanding of the historical use of this area, provides a line of evidence that widespread contamination is unlikely to be present notwithstanding the potential for unknown filling in this area.

Non-process development land (DL01 and DL02)

DL01 is located directly to the north of the Liddell switchyard and is not known to have been used other than as a construction laydown area (previously identified as an AEC) when Liddell was first constructed. Analytical results from two representative sampling locations were reviewed and did not identify any concentrations of COPC above the commercial / industrial screening criteria within the DL01 area. Results from one of the sampling locations in the vicinity of the ash pipeline, which is located adjacent to, and outside, the DL01 area, was found to contain asbestos.

DL02 is located directly to the north of the existing coal storage yards and to the south of the Liddell switchyard. A review of existing data confirms that, while some AECs have previously been identified in this area, analytical results from eight targeted sampling locations did not identify concentrations of COPC above the commercial / industrial screening criteria.

Accordingly, DL01 and DL02 are considered unlikely to constrain the development provided industry standard construction controls are utilised.

Decoupling area

The Decoupling works would be undertaken in an area (Decoupling area) located centrally at Liddell, on the western side of the main power generating infrastructure. The previous investigations identified a number of AEC across the Decoupling area. Fifty- four targeted sampling locations from previous investigations were identified to be relevant to the Decoupling area. From the 54 sampling locations, only four samples (two for hydrocarbons and two for asbestos) were found to have concentrations of COPC elevated above the commercial / industrial screening criteria. The two asbestos samples were associated with the ash pipeline and AGLM have confirmed that the Decoupling works will have minimal interaction with the ash pipeline. Therefore, the identified asbestos is considered unlikely to impact on the Project.

Elevated hydrocarbon concentrations were identified in the transformer corridor. This area is covered by concrete hardstand and would not be disturbed as part of the Project.

A number of targeted sampling locations are present between the existing solar array area and the 33kV transition area where cable trenching may be required. The results from these sample locations indicate concentrations of COPC below the commercial / industrial screening criteria.

6.7.2.3 Bayswater ancillary works area (BAW)

Based on a review of previous reports, a number of AECs have been identified across the operational areas that identified concentrations of COPC above the commercial / industrial screening criteria.

The remaining areas across Bayswater were not identified as AECs due to their low contamination potential. Previous sampling undertaken across the AECs did not detect widespread gross contamination. However, localised concentrations of COPC were detected above the screening criteria at the following locations:

- Bayswater ash dam
- Fire training area
- Coal Conveyor
- H1 and H2 Howick Coal Conveyor
- Bayswater Landfill
- Ravensworth Void
- Antiene Rail coal unloader
- Oil water separator and fuel storage

- Coal drying area
- Sludge Lagoon
- Demineraliser plant
- Former Contractor Staging area
- Lime Softening plant
- Mobile Plant workshop and refuelling.

6.7.3 Surrounding land uses and sensitive receivers

Identification of sensitive receptors on, and within the vicinity of, the Project is an important step in understanding potential impacts that the Project may have on the Project area and surrounding land use. Sensitive environmental receptors on and adjacent to Bayswater that have been identified by this study include:

- Indoor and outdoor human health receptors in the form of workers on site
- Intrusive maintenance workers both on and off site
- Potential groundwater users in the vicinity of the site
- Ecological receptors, including EEC and vegetation in the local creeks, Lake Liddell, Plashett Reservoir and the Hunter River
- Residents on rural properties along the Hunter River, east of Saltwater Creek, including users of irrigation water for agricultural purposes.

6.7.4 Assessment of impacts

6.7.4.1 Construction

Soils, geology and geotechnical stability

The Project would not significantly modify the existing landform or create new landforms.

During earthworks and vegetation clearance, it is possible that soil erosion may occur. Soil stabilisation and revegetation would minimise potential soil dispersion impacts. The Project is unlikely to cause large-scale soil disturbance at depth and is not proposed to interface with groundwater. Mitigation measures to manage potential impacts of erosion and sedimentation on surrounding watercourses is provided in **Section 6.12.4**.

Degradation of soil resources can reduce the capability of the affected land to support the intended vegetation and or land use. Soils can be degraded by the loss of organic matter and nutrient decline can occur through soil disturbance (resulting in increased breakdown rates of organic matter) and removal of vegetation as a source of new organic matter can reduce soil capability and rehabilitation outcomes. In addition, volatilisation and leaching of nutrients can lead to a decline in nutrient levels. Loss of organic matter can also affect soil properties such as soil water storage, soil structure and cation exchange capacity.

Soils with an LSC class of 5 – 6 are already limited and any further loss of soil capability may result in limitations in establishing stabilising cover and rehabilitation. The Project is not expected to further reduce the soil capability.

New Project components would include establishment of foundations to support new infrastructure. In general, the nature of Project components are not at elevated risk from geotechnical stability risks. The location of Project components would also need to consider potential to increase geotechnical stability risks to existing infrastructure.AGLM has confirmed that no existing infrastructure would be impacted by the Project and as Project components are not located in close proximity to infrastructure at elevated risk fromgeotechnical stability issues the Project is considered to be unlikely to impact on the stability of any existing infrastructure. The detailed design of each Project component would consider geotechnical stability in accordance with applicable design standards to manage risks.

Contamination

The Project does not propose a change in land use from the ongoing "electricity generating works", being a type of industrial use. Bayswater and Liddell, and the potential for elevated COPC present at the sites will continue to be managed in accordance with the EPLs issued by the EPA and all other legal requirements.

The contamination risks for each Project component are described as follows.

Battery

Based on the contamination assessment (**Appendix D**) as summarised in **Section 6.7.2,** potential elevated COPC present in the the three areas assessed for the Battery are unlikely to constrain the development provided industry standard construction controls are applied.

Results from one of the sampling locations in the vicinity of the ash pipeline near the non-process development land (DL01), was found to contain asbestos. The potential asbestos related exposure to construction / maintenance workers associated with the Project can be managed via suitable controls, including unexpected finds protocols, CEMP, the industry standard practice of wetting the work area down, the use of binding polymers, wearing personal protective equipment (**PPE**) and adopting good hygiene practices.

Decoupling

As described in **Section 6.7.2** and the contamination assessment in **Appendix D,** two asbestos samples were associated with the ash pipeline. AGLM have confirmed that the Decoupling works would have minimal interaction with the ash pipeline. Therefore, the identified asbestos is considered unlikely to impact on the Project. However, occupational hygiene controls will be implemented as a precaution to mitigate potential construction worker exposure to asbestos.

The elevated hydrocarbon concentrations identified in the transformer corridor are covered by concrete hardstand, and the Decoupling works along this corridor would be limited to disconnecting and moving the existing transformers to the proposed 33 kV transition area. Therefore, the Decoupling works would not interact with sub-surface infrastructure and would not interact with impacted soil.

It is understood that as part of the Decoupling works there is likely to be a requirement for sub-surface cable trenching, as follows:

- Linking the relocated transformers to the Liddell switchyard
- Linking the Battery to the transformers.

Defined cable trenching routes have not yet been finalised. However, the longest cable route would be between the existing solar array area and the 33 kV transition area, noting the trenching routes are not currently planned to interact with areas identified to have elevated hydrocarbon concentrations. Should localised elevated COPC be present in areas disturbed as part of the Decoupling works, it is likely they would be limited in extent and unlikely to require significant remedial works (if any). Industry standard construction controls would be implemented as part of the development construction. In light of the above, the elevated hydrocarbon concentrations present in the Decoupling area are considered unlikely to constrain the development.

BAW

Should localised elevated COPC be present in areas where the BAW are carried out, it is likely they would be limited in extent and unlikely to require significant remedial works. Industry standard construction controls (including unexpected finds protocols within a CEMP) that will be implemented as part of the Project's construction.

Leaks and spills

Construction of the Project would also involve the storage, treatment or handling of fuels, chemicals, building materials, wastes and other potential contaminants. Any spill during construction would be managed and

cleaned up so as to prevent impacts on human health and the environment. The risk of leaks and spills would be managed through the application of Australian Standards for the storage and handling of fuels and chemicals and appropriate engineering design. In the unlikely event of significant leaks or spills of contaminants, remediation would be implemented immediately during construction.

Summary and suitability for use

The CSM developed for the Project has identified that some potential S-P-R linkages are potentially complete. However, the contamination assessment has concluded that based on the analytical dataset and knowledge of the historical development of the Project site, it is considered that widespread gross contamination is unlikely to be present in the Project site.

Significant remedial works to support the Project are considered an unlikely requirement (if required at all). Potential contamination-related impacts associated with the Project can readily be managed by the implementation of a CEMP that includes (but not limited to):

- An unexpected finds protocol for the appropriate assessment and management of encountered contamination to mitigate impacts to the Project
- Procedures to ensure that all material excavated during the construction of the Project is appropriately assessed and classified before being disposed of in accordance with environmental laws
- Specific control measures to mitigate impacts to soil, water, air, structures and clear protocols for measurement of affected media and validation of results during construction of the Project.

Overall, it is considered that the existing potential contamination risks present in the Project are not an impediment to the implementation of the Project. Accordingly, it is considered that the Project would not give rise to any new contamination related risks to human health or the receiving environment provided that appropriate controls are implemented in the CEMP as outlined above.

6.7.4.2 Operation

The final layout of the Battery facility is likely to comprise large areas of hardstand that will minimise the potential for any direct contact with subsurface soil during operations. Similar scenarios are envisaged for BAW. Construction / maintenance workers are considered to be the receptor groups that would most likely be exposed to contamination (if present). This would occur infrequently and be managed by the CEMP and the current occupational hygiene practices implemented by AGLM at Bayswater and Liddell to manage risks associated with contact with potentially pre-existing contamination during construction and operations.

Operation of the Project is not expected to significantly change the land use or the land capability of the Project area.

6.7.5 Environmental management measures

The environmental management measures to be implemented for impacts to land, geology, soils and contamination are presented in **Table 6-25**. Management measures for potential impacts to water quality as a result of erosion and sedimentation are presented in **Section 6.12.4.** No operational management measures are required.

Table 6-25: Environmental management measures for land and contamination impacts

Reference	Environmental management measures	Timing
L01	The internal bunding and environmental controls for hazardous substances management suitable for the Battery and transformers will be in accordance with applicable guidelines.	Detail design

Reference	Environmental management measures	Timing
L02	Potential contamination-related impacts associated with the Project will be managed by the implementation of a CEMP that includes (but not limited to): ▪ An unexpected finds protocol for the appropriate assessment and management of encountered contamination to mitigate impacts to the development ▪ Procedures to ensure that all material excavated during the construction of the development is appropriately assessed and classified before being disposed of in accordance with environmental laws ▪ Specific control measures to mitigate impacts to soil, water, air, noise, traffic, structures and clear protocols for measurement of affected media and validation of results during construction of the development.	Construction
L03	The Asbestos Management Procedure would be updated as required to provide appropriate control measures during the construction phase (as well as the operational phase if maintenance activities are required) to mitigate any risks of worker exposure to airborne asbestos fibres during work activities.	Construction/ Operation
L04	Detailed design of each Project component would consider and address geotechnical stability risks in accordance with applicable design standards.	Detailed design

6.8 Aboriginal heritage

This section summarises the findings of the ACHAR provided in **Appendix F.** The ACHAR addresses the following SEARs:

Heritage *– including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the project, including adequate consultation with Aboriginal stakeholders having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents(OEH, 2010;*

Historic heritage is addressed separately in **Section 6.9**.

6.8.1 Assessment methodology

The methodology for the Aboriginal heritage assessment included:

- A desktop review of archaeological literature and data including:
- An Aboriginal Heritage Information Management System (**AHIMS**) search on the 13 October 2020 for the Project area with a 200 m buffer
- Review of previous archaeological investigations
- Developing a predictive model in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) to identify areas likely to be of cultural sensitivity within the study area that require survey
- An archaeological survey of the project area carried out on the 23 November 2020 with RAPs and LALC representatives
- Consultation with the Aboriginal community representatives
- Assessment to determine the cultural significance of identified items
- Assessment of the potential impacts on Aboriginal sites, places and objects
- Identification of appropriate mitigation and environmental management measures.

The ACHAR was prepared in accordance with

- ACHCRP (DECCW, 2010a)
- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011))
- The Australia ICOMOS Burra Charter (Burra Charter) (Australia ICOMOS, 2013).

The consultation with the Aboriginal stakeholders was carried out in accordance with the ACHCRP (DECCW, 2010a) and is summarised in **Section 5.6**.

6.8.2 Existing environment

The Project area lies within the Central Lowlands of the Upper Hunter. The region encompasses a belt of undulating hilly terrain which follows the Hunter River and the overall landform is made up of undulating low hills which range from elevation of 140 – 220 m above sea level.

6.8.2.1 Ethno-historic background

The Aboriginal people of the Hunter region would have used the wide variety of natural resources present within the fertile landscape, and ethno-historical accounts list some of the methods through which Aboriginal people harvested fruits, nuts, marine resources, terrestrial fauna, birds and so forth. While there are gaps in the ethno-historical account, such as the lack of description regarding stone artefact manufacture and use, it does provide a basis that can be used to understand how Aboriginal people used the landscape prior to non-Aboriginal colonisation.

Modification of the landscape by Aboriginal people took place through the use of fire farming and reed planting/weir development, but little evidence of such activities is likely to have been preserved in the archaeological record due to the perishable nature of the materials used and the consequent alteration of the landscape through non-Aboriginal occupation. Evidence of campsites, through deposits of stone artefacts and shell, hearths or middens are, in contrast, likely to be found where the landscape has not suffered severe ground disturbance or sedimentation. While ethno-historical accounts refer to camps being located near waterways, campsites would not have been limited to riverbanks. These descriptions do, however, aid in developing a predictive model for the location of Aboriginal sites.

Scarred trees, which were a result of the production of items such as canoes, containers, shelters and bowls also have the potential to be present within the region. Carved trees, which were decorated with designs and could be associated with ceremonial sites, are much rarer. However, the prevalence of logging in the Hunter region would have severely reduced remaining scarred and carved tree numbers.

Other sites, such as grinding grooves, stone quarries, burials and ceremonial grounds (bora rings, stone arrangements), while rarer, are discussed in the ethno-historical records and are known to be focal points within the current cultural landscape.

6.8.2.2 Previous assessments

A number of previous archaeological assessments have been undertaken in the study area and surrounding region. These include the following:

- Bayswater Power Station - Environmental Impact Statement Supplementary Information (The Electricity Commission of New South Wales, 1979)
- Report on Aboriginal Relics on Mount Arthur North Coal Lease, Muswellbrook (Dyall, 1980)
- Aboriginal Relics on the Mount Arthur South Coal Lease, Unpublished report (Dyall, 1981a)
- Mount Arthur South Coal Project: Archaeological Survey, Unpublished report (Dyall, 1981b)

- An Archaeological Survey of the Bayswater No. 2 Colliery Proposed Lease Extension Area, Muswellbrook, the Hunter Valley, (Hughes, 1981)
- Bayswater Ash Disposal Project - Archaeological Survey of Proposed Slurry Pipeline and Water Storage Pond (Pacific Power, 1992)
- Bayswater Power Station Fly Ash Disposal in Ravensworth No. 2 Mine Void and Mine Rehabilitation Environmental Impact Statement (Pacific Power, 1993)
- Archaeological Assessment - Proposed Modifications to Coal Preparation and Transport System - Bayswater Coal Mine Project (Umwelt Australia, 1997)
- Ravensworth Operations Project: Environmental Assessment. Volume 6 (Umwelt, 2010)
- Bayswater Power Station River Intake Project: Indigenous Archaeological Assessment (McCardle Cultural Heritage Pty Ltd, 2007)
- Bayswater Liddell Power Generation Complex Environmental Assessment: Heritage Bayswater (AECOM, 2009).
- Aboriginal Archaeological Due Diligence Assessment for Proposed Pipeline at Bayswater Power Station (AECOM, 2017)
- Preliminary Aboriginal Heritage Assessment for Proposed Electrical Works Modification, Bayswater Brine Concentration Decant Basin (AECOM, 2018)
- Golden Highway Aboriginal Cultural Heritage Assessment (Ogilivers Hill and Winnery Hill) (Jacobs, 2017)
- Bayswater Water and Other Associated Operational Works Project Environmental Impact Statement (Jacobs, 2019a)
- Bayswater Water and Other Associated Operational Works; Aboriginal Cultural Heritage Assessment Report (Jacobs, 2019)
- Bayswater Power Station WOAOW Project Aboriginal Cultural Heritage Assessment, Report to AGL Macquarie (AECOM, 2020).

These previous assessments demonstrate that the area has been subject to past disturbance, particularly during the post-contact period, which has most likely impacted the Aboriginal heritage of the area and reduced the overall number of sites.

6.8.2.3 Database search results

An extensive search of the AHIMS register was carried out on 13 October 2020 for the Project area with a 200 m buffer. The search identified that 56 previously recorded sites are present within 200 m of the development site.

Of these 56 sites, one site ((BAYS AS06 (37-2-6145) is within the Project area and seven sites are within about 20 m of the development site.

All the AHIMS sites are artefact scatters on open ground. The eight sites near and within the development site are described in **Table 6-26** and shown on **Figure 6-15**. One artefact scatter also includes potential archaeological deposit (**PAD**).

Table 6-26: AHIMS sites within 200 metres of the Project Area

AHIMS ID	Site name	Site status	Site type
37-2-0196	Saltwater Creek;No.2	Valid	Artefact Scatter
37-2-0202	Saltwater Creek;No.9	Valid	Artefact Scatter
37-2-0204	Saltwater Creek;No.11	Valid	Artefact Scatter

AHIMS ID	Site name	Site status	Site type
37-2-2355	Delpah D15	Valid	Artefact Scatter
37-2-2740	Liddell EW 4	Valid	Isolated Find
37-2-2745	Liddell EW 9	Valid	Isolated Find
37-2-6145	BAYS AS06	Valid	Artefact Scatter
37-3-0675	Newpac Stockpile OS 2	Destroyed	Artefact Scatter
37-3-1128	REA256	Destroyed	Artefact Scatter

6.8.2.4 Field survey

The field survey was carried out on the 23 and 24 November 2020, covering all areas within the development site where impacts are proposed and where significant prior disturbance is not evident. The development site was divided into seven survey units. No sub-sampling of these areas was employed. The survey was carried out on foot by a team of two Jacobs archaeologists, three AGLM personnel and 12 Aboriginal Sites Officers from the RAPs.

Areas that were assessed by field teams as having no potential for archaeological material to be present, for example because of previous impacts and ground disturbance, were not surveyed. The decision to exclude areas in this way was made in the field, through a consensus of all field team members (including RAPs and AGLM personnel).

During the field survey, thirteen new sites were identified and one previously recorded site. These sites consisted of isolated finds and artefact scatters as detailed in

Table 6-27 and **Figure 6-15**. The majority of the new sites are located within survey unit 1 (SU1; Liddell to Jerrys Plains High pressure water pipeline).

Table 6-27: Archaeological Sites Summary

AHIMS ID	Site Name	Site Type	Survey Unit
37-2-6280	Liddell Jerrys Plains Pipeline AS1	Artefact Scatter	SU1
37-2-6281	Liddell Jerrys Plains Pipeline IF2	Isolated Find	SU1
37-2-6279	Liddell Jerrys Plains Pipeline AS3	Artefact Scatter	SU1
37-2-6291	Liddell Jerrys Plains Pipeline IF4	Isolated Find	SU1
37-2-6290	Liddell Jerrys Plains Pipeline AS5	Artefact Scatter	SU1
37-2-6289	Liddell Jerrys Plains Pipeline AS6	Artefact Scatter	SU1
37-2-6287	Liddell Jerrys Plains Pipeline IF7	Isolated Find	SU1
37-2-6288	Liddell Jerrys Plains Pipeline IF8	Isolated Find	SU1
37-2-6286	Liddell Jerrys Plains Pipeline AS9	Artefact Scatter	SU1
37-2-6283	Liddell Jerrys Plains Pipeline AS10	Artefact Scatter	SU1
37-2-6145	BAYS AS06 (37-2-6145)	Artefact Scatter	SU1
37-2-6285	Liddell Brine Pipeline AS1	Artefact Scatter	SU3
37-2-6282	Liddell Brine Pipeline AS2	Artefact Scatter	SU3
37-2-6284	Liddell M1 Conveyor AS1	Artefact Scatter	SU7

A significance assessment was carried out for the thirteen new sites that were identified during the field survey. The criteria used for the significance assessment are described in the Australia ICOMOS Burra Charter (Australia ICOMOS, 2013). These criteria include assessing for:

- Social value
- Historic value
- Scientific value
- Aesthetic value.
- The significance of all the thirteen new sites identified was found to be low.

Legend

Development site
AGL owned land

AHIMS sites
Valid

Road
Waterway
Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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Figure 6 - 15 Aboriginal heritage

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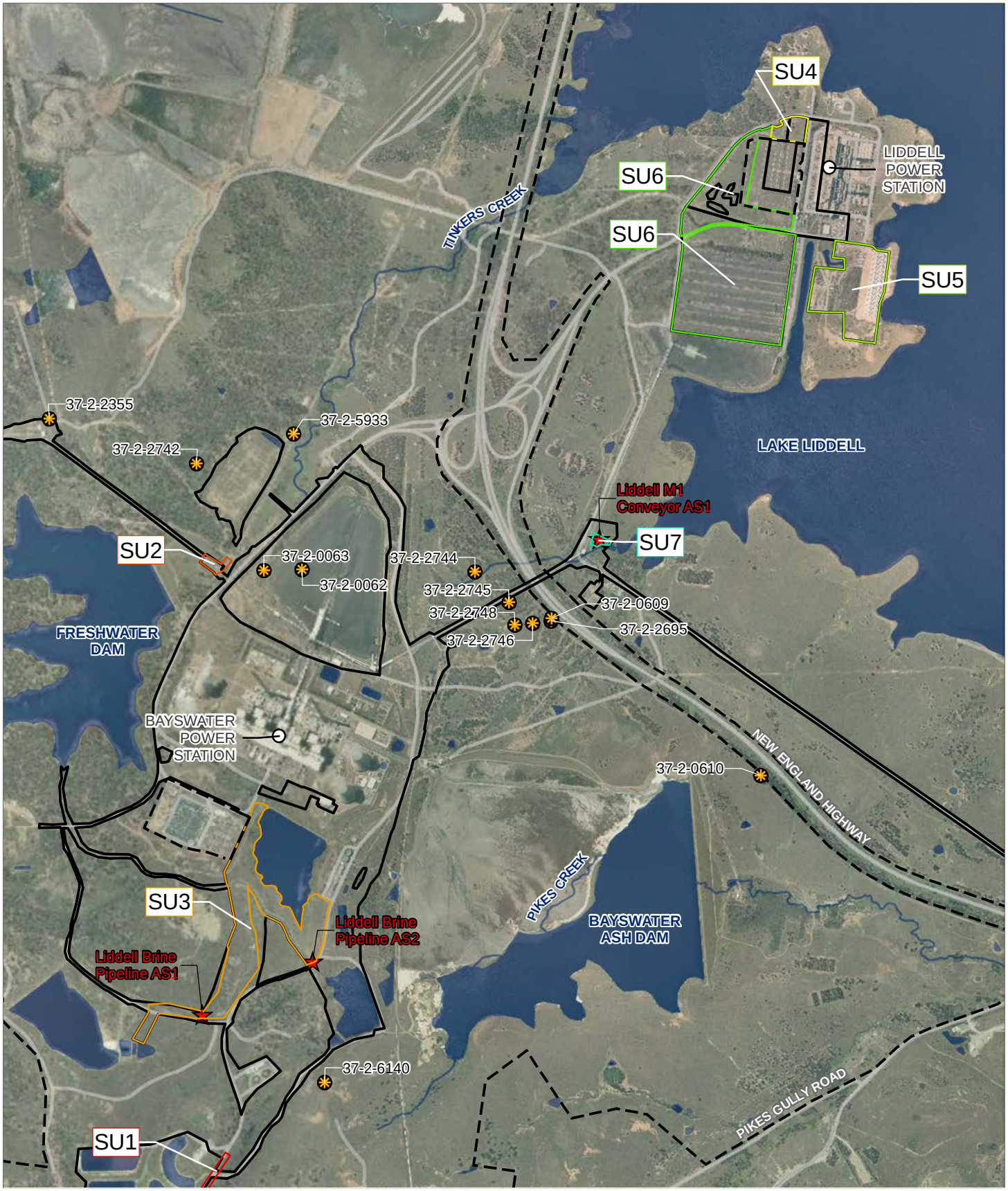

Legend

- Development site
- AGL owned land

AHIMS sites

- Valid
- Newly identified site

Survey units

- SU1
- SU2
- SU3
- SU4
- SU5
- SU6
- SU7

- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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DPE 2020
OEH 2020

Imagery:
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Figure 6 - 15 Aboriginal heritage

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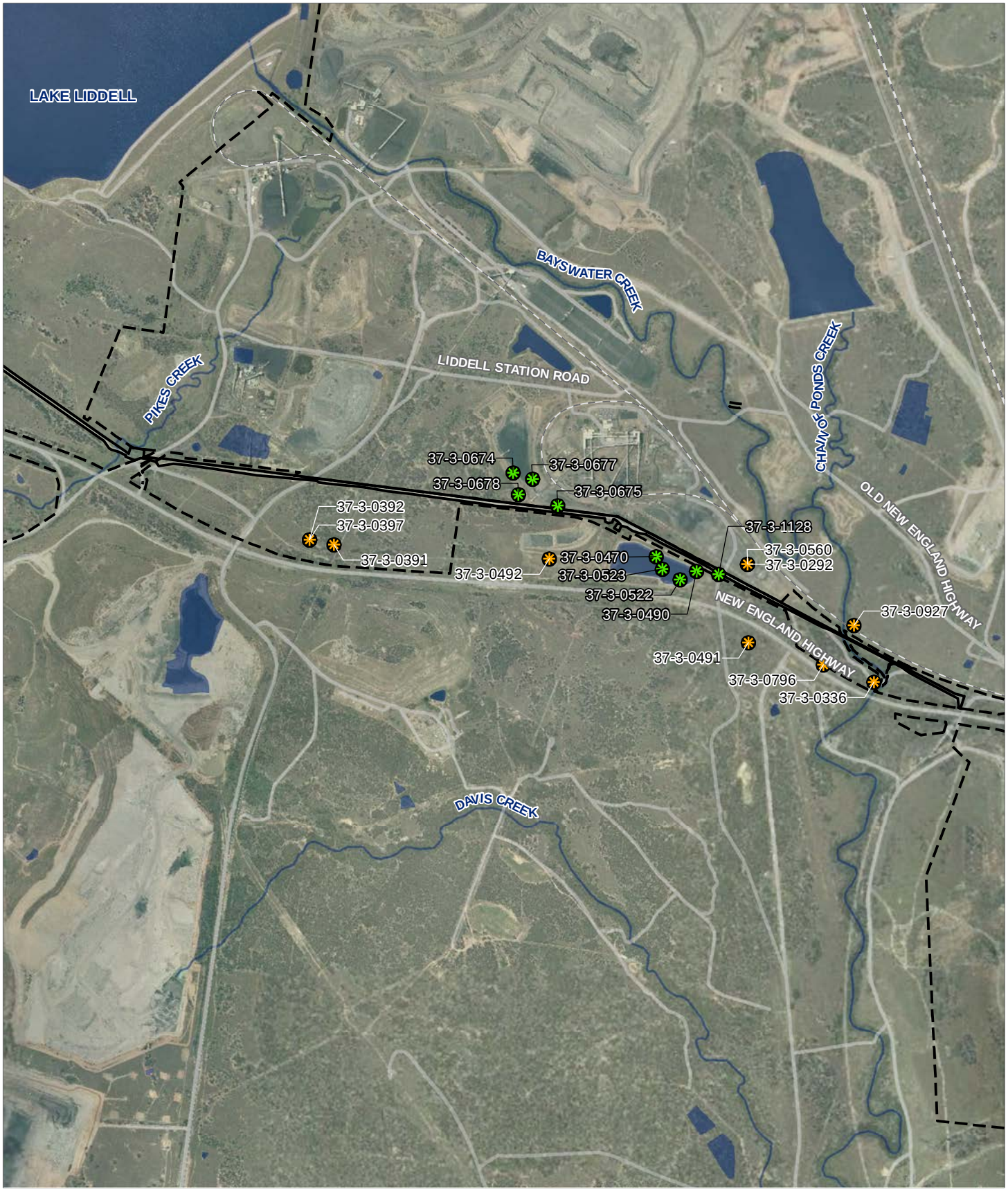

Legend

- Development site
- AGL owned land
- AHIMS sites
  - Valid
  - Destroyed
- Railway
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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DPE 2020
OEH 2020

Imagery:
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Figure 6 - 15 Aboriginal heritage

Date: 4/02/2021 Path: J:\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F019_ABHER_r1v3.mxd
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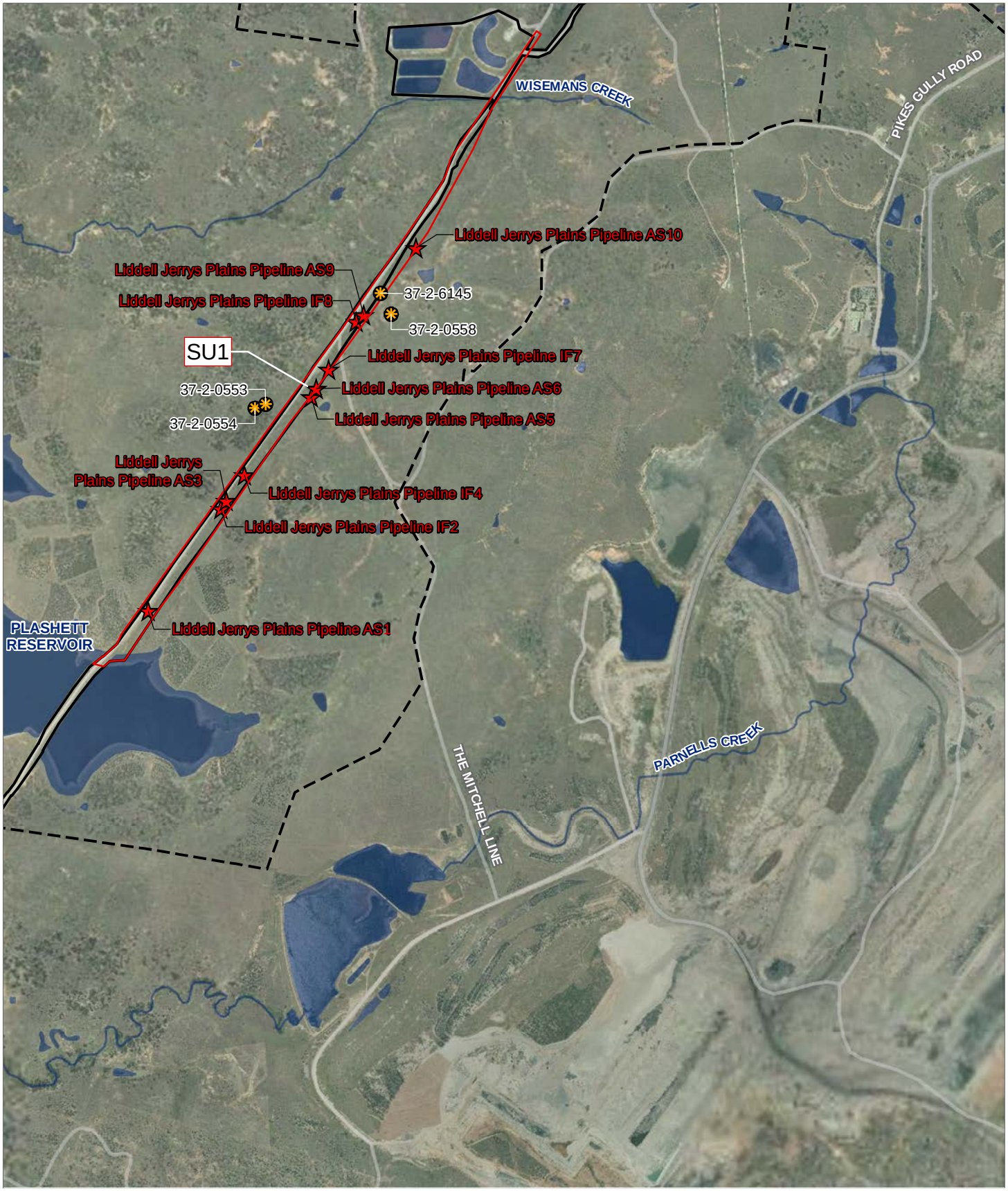

Legend

- Development site
- AGL owned land
- AHIMS sites: Valid
- AHIMS sites: Newly identified site
- Survey units: SU1
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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DPE 2020
OEH 2020

Imagery:
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Figure 6 - 15 Aboriginal heritage

Date: 4/02/2021 Path: J:\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F019_ABHER_r1v3.mxd
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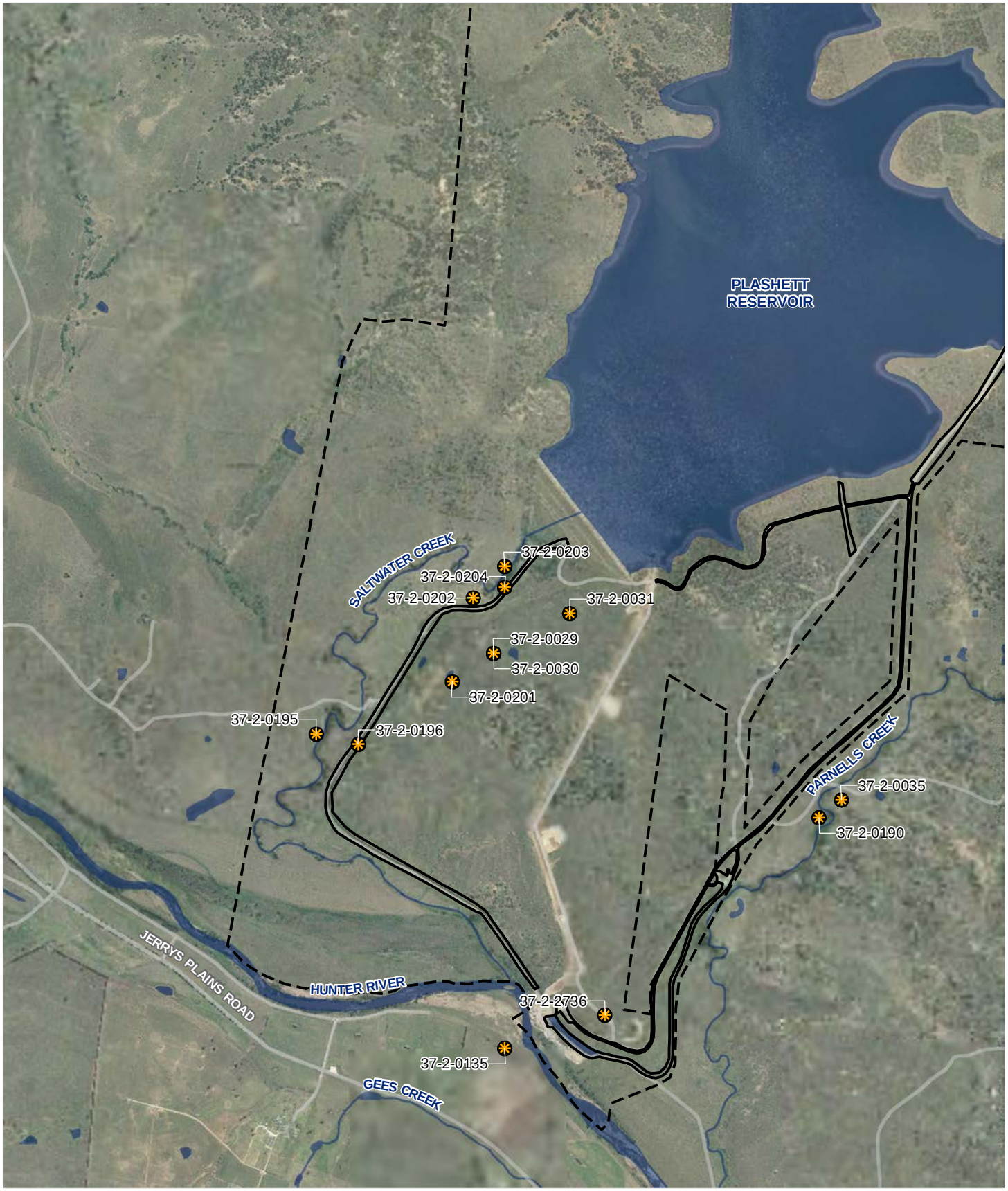

Legend

- Development site
- AGL owned land
- AHIMS sites
  - Valid
- Road
- Waterway
- Waterbody

0 0.5 1 km

1:25,000 at A4

N

Data sources

Jacobs 2021
AGL 2020
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DPE 2020
OEH 2020

Imagery:
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Figure 6 - 15 Aboriginal heritage

Date: 4/02/2021 Path: J:\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F019_ABHER_r1v3.mxd
Created by : NT | QA by : KM

6.8.3 Assessment of impacts

6.8.3.1 Construction

There are 12 sites from SU1 and SU3 wholly within the development site, which have the potential to be directly impacted by construction of the Project. A small portion of one site (BAYS AS06 (37-2-6145)) is located within the development site and would potentially be subject to impact in the event of pipeline repair works. A number of sites are located near the development site, as such they are potentially at risk of indirect impacts during construction of the Project due to it being located close to the disturbance area (refer to **Figure 6-15**). These sites would be protected during construction to avoid inadvertent damage.

6.8.3.2 Operation

No adverse impacts on Aboriginal cultural heritage (either direct or indirect) are anticipated during operation of the Project.

6.8.4 Environmental management measures

Environmental management measures for impact on Aboriginal heritage are presented in **Table 6-28**. No operational management measures are required.

Table 6-28: Environmental management measures for Aboriginal heritage impacts

Reference	Environmental management measures	Timing
AH1	A Cultural Heritage Management Plan (CHMP) will be developed. It will include the methodologies developed in the ACHAR (Section 11.1, 11.2 and 11.3). It will specify that project works will be restricted to the disturbance site. It will include provisions to ensure workers are made aware of cultural heritage places and their value, for example through project inductions. The CHMP will include provisions to guard against indirect impact to the Aboriginal sites near the development site.	Pre-construction
AH2	If repair or maintenance works on the Liddell to Jerrys Plains High Pressure Pipeline are required, the area of works will be subject to surface collection in accordance with Section 11 of the ACHAR (**Appendix F**) of impacted sites. The sites that maybe impacted include: ▪ Liddell Jerrys Plains Pipeline AS1 (37-2-6280) ▪ Liddell Jerrys Plains Pipeline IF2 (37-2-6281) ▪ Liddell Jerrys Plains Pipeline AS3 (37-2-6279) ▪ Liddell Jerrys Plains Pipeline IF4 (37-2-6291) ▪ Liddell Jerrys Plains Pipeline AS5 (37-2-6290) ▪ Liddell Jerrys Plains Pipeline AS6 (37-2-6289) ▪ Liddell Jerrys Plains Pipeline IF7 (37-2-6287) ▪ Liddell Jerrys Plains Pipeline IF8 (37-2-6288) ▪ Liddell Jerrys Plains Pipeline AS9 (37-2-6286) ▪ Liddell Jerrys Plains Pipeline AS10 ▪ BAYS AS06 (37-2-6145). If no works are required in the vicinity of a site, the site will be conserved.	Pre-construction

Reference	Environmental management measures	Timing
AH3	If practicable, the design and construction of the Brine Pipeline will avoid the two recorded site areas (Liddell Pipeline AS1 (37-2-6285) and Liddell Pipeline AS2 (37-2-6282)). The sites will be protected with high visibility fencing. If impact cannot be avoided, the sites will be salvaged through surface collection.	Design, pre-construction, construction
AH4	During any works on the Liddell M1 Conveyor the site (Liddell M1 Conveyor AS1 (37-2-6284)) will be conserved and protected by high visibility exclusion fencing to prevent impact.	Construction
AH5	The Unanticipated Finds Protocol in the ACHAR will be followed for any previously unidentified Aboriginal heritage objects found during the works.	Construction and operation

6.9 Non-Aboriginal heritage

This section considers the non-Aboriginal Heritage component of the Heritage SEAR for the Project:

Heritage *– including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the project, including adequate consultation with Aboriginal stakeholders having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH, 2010);*

The Projects potential impacts on Aboriginal heritage is provided in **Section 6.8** and the summary of consultation with Aboriginal stakeholders is provided in **Section 5.6**.

6.9.1 Assessment methodology

A desktop assessment of known heritage values was carried out, including database searches and a review of the Non-Aboriginal Heritage assessment (Jacobs, 2019b) prepared for the WOAOW EIS. This assessment was considered applicable to this Project.

A search of the following heritage registers was undertaken in June 2020:

- NSW State Heritage Register (**SHR**)
- State Heritage Inventory including s170 State Agency Heritage and Conservation Registers and s136 Interim Heritage Order
- Muswellbrook LEP 2009
- Singleton LEP 2013
- Commonwealth Heritage List
- National Heritage List
- World Heritage List.

6.9.2 Existing environment

The history of the area from the early nineteenth century (including its occupation by Europeans, subsequent use as cleared pastoral land, and through to its exploitation for mineral resources) is reflected in the low potential for archaeological relics and in the evidence of rural infrastructure. The identified and potential heritage of the study area is of low aesthetic and historical significance and negligible research potential, and therefore does not meet the threshold at Local or State level of heritage significance.

No listed non-Aboriginal heritage items were identified within the Project area. One heritage item - Inn and Outbuildings (former) listed on the SHR (00242) and Singleton LEP 2013 (I34) was identified about 500 m north of the BAW, to the east of Bayswater.

6.9.3 Assessment of impacts

No non-Aboriginal heritage items were identified within the Project area. As such construction and operation of the Project is not expected to result in non-Aboriginal heritage impacts. However, there is a low residual risk that unexpected finds may be discovered during construction activities.

Potential risk to any unexpected finds would be managed with standard unexpected finds safeguards and management measures which would be implemented as detailed in **Section 6.8.4.**

6.9.4 Environmental management measures

Environmental management measures for non-Aboriginal impacts are presented in **Table 6-29**. No operational management measures are required.

Table 6-29: Environmental management measures for non-Aboriginal heritage impacts

Reference	Environmental management measures	Timing
NAH1	Should any historical archaeological remains be discovered during construction, all works will stop, the area cordoned off and a heritage professional engaged to examine and advise on the significance of the archaeological finds. If deemed to be of significance, under section 146 (**s146**) of the Heritage Act, a s146 form would be submitted to notify the Heritage Council of the discovery of relics. Further investigation may be required, and appropriate management will be agreed through consultation with Heritage NSW.	Construction
NAH2	In the unlikely event that human remains are uncovered, all work must cease immediately in the vicinity of the remains and the area cordoned off. The local NSW Police must be notified, who would make an initial assessment as to whether the remains are part of a crime scene, or Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be contacted as per AH4.	Construction

6.10 Visual amenity

This section summarises the findings of the VIA provided in **Appendix K.** The VIA addresses the following SEARs:

Visual – including:

- *An assessment of the likely visual impacts of the development on the amenity of the surrounding area, private residences near the development and local road network*
- *A detailed description of the measures that would be implemented to minimise the visual impacts of the development.*

6.10.1 Assessment methodology

The methodology for the VIA included:

- A description of the subject site and surrounding area
- A description of the planning instruments that are relevant to visual impact and apply to the subject site and the surrounding area
- Identification of potential viewpoints using digital elevation model and aerial photography

- An assessment of the visual impact of the Project from publicly accessible locations
- Identification of appropriate mitigation and environmental management measures.

When considering the predicted effect of changes upon views/ visual receptors, the sensitivity is combined with the magnitude of the change to give an overall judgement of significance of impact supported by analysis of evidence and professional judgement. The *Guideline for landscape character and visual impact assessment* (TfNSW, 2020b) is regarded as best practice for visual impact assessments within NSW and provides the following definitions:

- **Sensitivity** refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change
- **Magnitude** refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition.

Table 6-30 is used to rank the criteria above and provide an overall impact assessment as a conclusion to this assessment.

Table 6-30: Impact assessment rating matrix

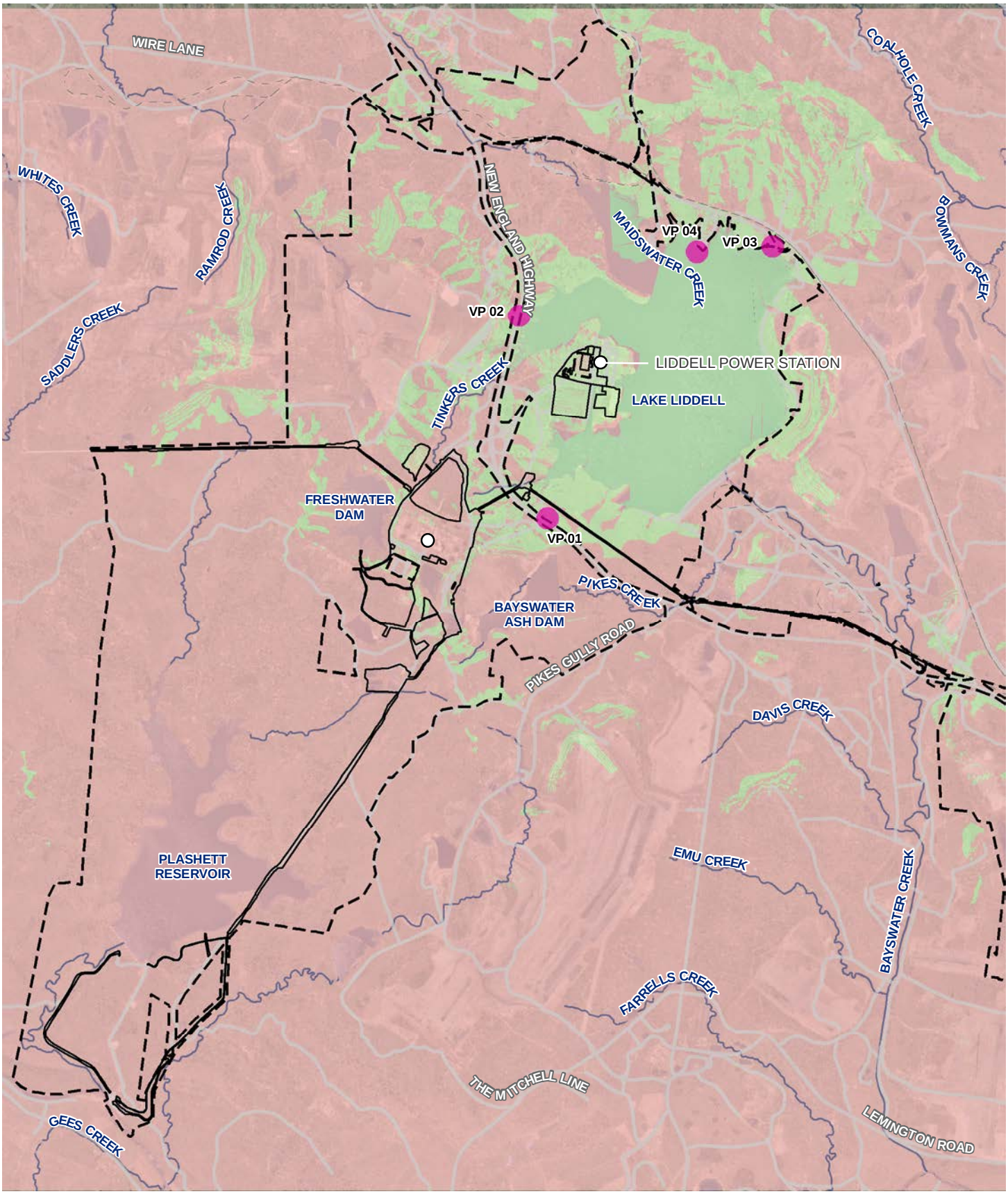
		MAGNITUDE			
		High	Moderate	Low	Negligible
SENSITIVITY	High	High	Moderate/High	Moderate	Negligible
	Moderate	Moderate/High	Moderate	Moderate/Low	Negligible
	Low	Moderate	Moderate/Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.10.1.1 Viewshed

The viewshed comprises the area from within which the Project site would likely be visible. The extent of the viewshed is influenced by a combination of factors including elevation, landform and vegetation. **Figure 6-16** below illustrates the area from which the Battery and Decoupling works may be visible. The viewshed has been computer generated using the visibility of an area 5 m in height above the existing ground level extending across the Battery and Decoupling footprint, to reflect a "worst-case" scenario and allow for flexibility in the location that will undergo change. The BAW component of the Project was found to be not noticeable and in most instances not visible from publicly accessible locations and as such was not considered further in the VIA.

The Battery and Decoupling works have the potential to involve localised modification to landform levels using a combination of cut and fill and introduces new structures however, the nature of the works would not significantly alter the vertical prominence of the site within the landscape. As illustrated by the green area in **Figure 6-16**, the development site does not appear to be visually prominent from publicly accessible areas within the immediate locality. Views filtered by intervening vegetation and power infrastructure towards the site are available from a section of the New England Highway to the west, and Hebden Road to the north-east. The site is visible from various points along these transient routes where potential viewers are likely to be travelling at speed and are not likely to notice the addition of the proposed change to the existing power station.

The Project area is not visible from residential properties and is filtered in views from Lake Liddell Recreation Area. There are no publicly accessible areas to the east of the site which would view the site.



Legend

- Development site
- AGL owned land
- Viewpoint
- Visual impact assessment
  - Areas not visible from battery/decoupling area boundary
  - Areas visible from battery/decoupling area boundary
- Railway
- Road
- Waterway
- Waterbody

0 2 4km

1:80,000 at A4

N

Data sources
Jacobs 2021
AGL 2020
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Geoscience Australia 2020

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Figure 6 - 16 Viewshed and viewpoint

Date: 17/02/2021 Path: \\jacobs.com\ANZ\IE\Projects\04_Eastern\IS334000\22_Spatial\GIS\Directory\Templates\Figures\EIS\IS334000_EIS_F020_ViewshedViewpoint_r2v1.mxd
Created by : XX | QA by : XX

6.10.1.2 Viewpoints

Four representative viewpoints from publicly accessible locations have been selected from within the viewshed to illustrate both the existing view and the potential visual impacts of the Project. These viewpoints are shown on **Figure 6-16** and include:

- **VP01** – Looking north from New England Highway
- **VP02** – Looking south from New England Highway
- **VP03** – Looking south-west from Hebden Road
- **VP04** – Looking south-west from Lake Liddell Recreation Area.

The viewpoints are described further in **Section 6.10.3.2,** and a photo from each view point is also provided in this section.

6.10.2 Existing environment

As described in **Section 1.5,** the Project is located within an area dominated by mining and power generation. The landscape local to Liddell and Bayswater is heavily influenced by industrial activity.

There are limited sensitive receivers or social infrastructure in the locality of the Project. The closest social infrastructure is the Lake Liddell Recreation Area approximately 2 km north of the Battery and Decoupling areas across Lake Liddell. The closest residential areas to the Battery and Decoupling are the Antiene subdivision, which is located approximately 4 km north of the Battery and Decoupling and Jerrys Plains located 14 km to the south. The nearest dwelling is located at the north of the Lake Liddell Recreation Area. While dwellings are located within 1 km of the southern extend of the BAW footprint, no changes to this infrastructure are proposed.

The Battery and Decoupling footprints would be immediately adjacent to the Liddell turbine hall and Liddell switchyard. The Battery and Decoupling would not be visually prominent within the landscape due to mature trees that heavily filter visibility and existing power-related infrastructure surrounding the site.

6.10.3 Assessment of impacts

6.10.3.1 Construction

As outlined in **Chapter 2**, the Project consists of a number of elements of work. The majority of the Project components are largely screened by existing vegetation and topography and are typical of existing infrastructure from publicly accessible locations. Visual impacts during construction would be limited to AGLM personnel and contractors, and construction personnel.

These visual impacts would include clearing of vegetation and stockpiling of debris from construction activities. These visual impacts would be temporary in nature.

6.10.3.2 Operation

Visual impact mechanisms

The Battery and Decoupling components have the potential to introduce a change within the landscape that may be visible from publicly accessible locations. This would include the installation of areas of containerised batteries and additional electrical infrastructure and possible overhead powerlines. The Battery and Decoupling works would be installed within an area dominated by existing, larger energy generation and transmission infrastructure however does introduce new components with visual implications.

The visual impacts of the BAW are considered negligible as limited views exist and the composition and character of views of Bayswater and ancillary infrastructure would be substantially unaltered. The VIA focusses

on the Battery and Decoupling components of the Project, on the basis that the BAW is considered highly unlikely to be noticeable and is mostly not visible offsite.

Viewpoint analysis

The potential visual impacts of the Project were assessed according to the impact of the Project at the four separate viewpoints as described below.

6.10.3.2.1.1 Viewpoint 01 – Looking north from New England Highway

Description: This view looks north across Chilcotts Gully towards Liddell (refer to **Photo 6-1**). The landform is below this elevated section of the New England Highway as it passes over dirt roads that connect the power stations and other infrastructure in the locality. The site is partially visible beyond the trees to the right of the view, set amongst the existing power station infrastructure.

Photo 6-1: View from viewpoint 01 - Looking north from New England Highway

Sensitivity: The sensitivity of the view is low. Viewers in this location would be moving either by bicycle or vehicle where views would be brief and glimpsed at speed. The distance between the view and site would reduce the visibility of the proposed changes, and the scale of the change is not likely to be dominant within the view.

Magnitude: The magnitude of change is negligible within this view. The visible changes would likely be minimal from this location, given the visual screening provided by the existing power infrastructure surrounding the site and the intervening vegetation. The composition and character of the existing view would remain substantially unaltered.

Summary: The impact of the Project on VP01 has been assessed as **negligible.**

6.10.3.2.1.2 Viewpoint 02 – Looking south from New England Highway

Description: The view looks south from the New England Highway towards Liddell across areas of open grassland and mature trees (refer to **Photo 6-2**). The view also features highway infrastructure, and high voltage power lines running parallel with the road corridor. Both Liddell and Bayswater are visible on the horizon and views towards their chimneys and infrastructure above the tree line are characteristic of the area. This view would typically be experienced from vehicles or by cyclists traveling at speed along the highway.

Photo 6-2: View from viewpoint 02 - Looking south from New England Highway

Sensitivity: The sensitivity of the view is low. Viewers in this location would be travelling either by bicycle or vehicle where views would be brief, filtered by highway vegetation and glimpsed at speed. The distance between the viewer and site would reduce the visibility of the proposed changes and the scale of the change is not likely to be dominant within the view, in the context of the surrounding existing power infrastructure.

Magnitude: The magnitude of change is negligible within this view. The proposed changes would likely be visible above the existing vegetation on the horizon, but would be seen in the context of the existing power station and would not exceed the height of the existing infrastructure. The composition and character of the existing view would remain substantially unaltered.

Summary: The impact of the Project on VP02 has been assessed as **negligible.**

6.10.3.2.1.3 Viewpoint 03 – Looking south-west from Hebden Road

Description: This broad view looks south-west towards the site from Hebden Road, a minor road that connects the New England Highway to the Lake Liddell Recreational Area (refer to **Photo 6-3**). This view looks across Lake Liddell towards Liddell. This view would typically be experienced by vehicles or cyclists traveling at speed along the road however, the attractiveness of the lake may result in travellers slowing to appreciate the view. It should be noted that there are no stopping places along this section of the road. The view may also be representative of travellers on the Main Northern Railway between Newcastle and Muswellbrook.

Photo 6-3: View from viewpoint 03 - Looking south-west from Hebden Road

Sensitivity: The sensitivity of the view is low. Viewers in this location would be moving either by bicycle or within a vehicle or train where views would be brief and glimpsed at speed.

Magnitude: The magnitude of change is negligible within this view, as the visible changes would likely be adjacent to, or located amongst and barely distinguishable from the existing power infrastructure surrounding the site. The distance between the viewer and the power station result in the composition and character of the existing view remaining substantially unaltered.

Summary: The impact of the Project on VP03 has been assessed as **negligible.**

6.10.3.2.1.4 Viewpoint 04 – Looking south-west from Lake Liddell Recreation Area

Description: This view looks south-west from Lake Liddell Recreation Area across Lake Liddell towards Liddell (refer to **Photo 6-4**). The recreation area is accessed from Hebden Road on land that gently slopes down towards the lake. The land has open access to the shore of the lake and is used as a caravan and camping ground featuring open grassland and scattered mature trees. Liddell is a notable feature on the opposite side of the lake within panoramic views with minor screening of built form provided by mature trees along the far shore.

Photo 6-4: View from viewpoint 04 - Looking south-west from Lake Liddell Recreation Area

Sensitivity: The sensitivity of the view is high due to use of the viewpoint for recreational and tourism purposes and where visitors are likely to contemplate, spend long periods of time and focus on particular views. Viewers at this location would likely be static on camping pitches as well as undertaking leisure activities within the recreation area. It should be noted that the lake is not currently accessible. The mature vegetation within the recreation area would partially filter views. It should be noted that the high sensitivity of the site is due to use of the viewpoint for recreational and tourism purposes. Viewers from this location are unlikely to focus solely on the view of Liddell across the landscape given the panoramic views available across the lake.

Magnitude: The magnitude of change is considered to be negligible within this view. The visible changes are not likely to be distinguishable and would be seen within the context of the existing power infrastructure from this viewpoint and the composition and character of view would be substantially unaltered.

Summary: The impact of the Project on VP04 has been assessed as **negligible**.

6.10.3.3 Changing land use context

It is noted that the Project would be operational beyond the end of life of Liddell and occur within a changing land use context. A future land use has not been confirmed however, the current land use zoning, and the draft Muswellbrook Local Strategic Planning Statement 2018-2038 envisage the ongoing use of the AGLM landholding for energy generation purposes.

The Battery and Decoupling works are generally low laying, containerised infrastructure established in a formalised layout. This layout is unlikely to be detrimental from a visual perspective for likely future land uses of the site. If more visually sensitive land uses are proposed, the low-lying nature of the infrastructure can be readily screened with mitigation planting.

6.10.4 Environmental management measures

Environmental management measures for landscape character and visual impacts are presented in **Table 6-31**. No operation management measures are required.

Table 6-31: Environmental management measures for landscape character and visual impacts

Reference	Environmental management measures	Timing
V1	Retention and enhancement of existing landscape features (areas of scrub, individual trees) will be considered where feasible.	Design
V2	Colour of proposed structures and built form will be considered in a suitable muted palette to visually integrate the Project within the landscape where possible.	Design
V3	Where possible, consider minimal use of reflective surfaces to avoid drawing attention to the site within views due to reflective glare.	Design
V4	Limit the area of disturbance during construction where possible.	Construction
V5	Mitigation tree and shrub planting will be considered to visually integrate the Project within the surrounding landscape.	Construction
V6	▪ All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and will be removed from the site following the completion of construction ▪ Stockpiles will be stabilised to prevent erosion by wind and water and avoid the development of dust plumes adversely impacting air and visual quality ▪ On completion of the work disturbed areas will be stabilised and rehabilitated.	Construction

6.11 Waste

This section provides an assessment of the potential impacts of the waste generated by the Project and measures to mitigate them, in accordance with the following waste component of the SEARs:

- ***Waste*** *– including identification, quantification and classification of the likely waste streams likely to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste including waste to be used for reclamation or other project activities.*

6.11.1 Assessment methodology

The identification of likely waste streams has involved consultation with Project development team including the battery supplier to understand the construction methodology. Limited information is available regarding likely

quantities, but no problematic waste streams or volumes are anticipated. Waste was then attributed to a likely classification based on the EPA Waste Classification Guidelines (EPA, 2014) which separate waste into the following:

- Special waste
- Liquid waste
- Hazardous waste
- Restricted solid waste
- General solid waste (putrescible)
- General solid waste (non-putrescible).

6.11.2 Existing waste generation and management

Waste management associated with the operation of Bayswater and Liddell is undertaken in accordance with AGL-HSE-STD-009.7 – Waste Standard and AGLM-HSE-PLN-009.07 Waste Management Plan and regulated under EPL 779 and EPL 2122. The main waste streams generated on site are outlined in **Table 6-32**.

Table 6-32: Liddell and Bayswater main waste streams

Classification	Waste Stream
Special waste	▪ Asbestos waste ▪ Waste tyres ▪ Clinical waste
Liquid Waste	▪ Sewage effluent ▪ Oily water and waste oil ▪ Parts washers liquid waste ▪ Degreaser ▪ Brine concentrator effluent ▪ Cooling water ▪ Boiler and station wash effluent
Hazardous Waste	▪ Lead acid and NiCad batteries ▪ Oily rags and Oil absorbents ▪ Aerosols ▪ Oil filters ▪ Waste grease ▪ Unused/waste chemicals
General Solid Waste (putrescible)	▪ General food waste
General Solid Waste (non-putrescible)	▪ Paper and cardboard ▪ Glass and aluminium cans ▪ Garden and wood waste ▪ Virgin excavated material ▪ Building/demolition waste ▪ Fly and furnace bottom ash ▪ Scrap metal ▪ Air filters

Classification	Waste Stream
	▪ Metal and plastic drums

AGLM has implemented a Total Waste Management System (**TWMS**) administered by an external waste contractor. This contract includes key performance indicators for the maximisation of waste recycling options, employee training and options for the minimisation of non-recyclable waste.

6.11.3 Assessment of impacts

6.11.3.1 Identification of new waste streams

Existing waste generation and management process would remain unchanged with the following exceptions:

- Formalisation of the Bayswater Waste Storage Area aimed at reducing contamination risks
- Brine Concentrator Decant Basin return water pipe aimed at facilitating processing of brine to salt cake subject to WOAOW project approval.

Key additional waste generation activities are identified as follows:

- Management of Battery components including enclosures, battery cores, inverters and transformers at end of life
- Demolition waste associated with existing solar array, coal stockpile areas, conveyor shortening and redundant infrastructure associated with tank replacement
- Standard construction waste.

These waste streams are described in more detail below and composition summarised in **Table 6-35**.

Battery components

Battery technology is in its early stage of deployment and maturity and the rapid increase in deployment makes end of life planning for batteries an important consideration. At this stage, AGLM have not appointed a technology supplier and do not have an agreement that the batteries will be returned to the supplier at the end of their useful life.

Where possible, all components of the asset would be recycled or reused as to align with the preferences of the waste hierarchy. **Table 6-33** below, describes the recycling opportunities and relevant schemes or legislation for major components of the Battery. The scrap metal market in Australia has been weakened by the COVID-19 pandemic but is projected to grow over the next five years, aligning with the projected growth of domestic and global construction activities.

Table 6-33: Recycling opportunities and relevant schemes for major asset components

Battery component	Recycling opportunity
Lithium-Ion Batteries	Federal Government listed batteries as a priority product, first appearing on the product priority list in 2014-15, moving to a top priority in the product priority list 20-21. For this reason, the Battery Stewardship Council is progressing toward a voluntary industry scheme commencing in 2020. The Australian Battery Recycling Initiative (**ABRI**) lists 19 battery recyclers servicing NSW. It is anticipated that with the expansion of both Electric Vehicles and Energy Storage Systems at both residential and utility scale, opportunities to recycle batteries will be available and viable at end of life.

Battery component	Recycling opportunity
	AGL is a member of ABRI to ensure that end-of-life solutions for energy storage systems are built in at the design stage.
Battery container	There are no explicit schemes/legislation on battery container recycling, however, industrial-scale battery containers can be treated as waste steel at their end-of-life phase. Storage/housing of industrial batteries is typically made from galvanised steel. Waste steel can be recycled at various industrial steel recyclers across Australia and the industry is well established.
Inverter container	Industrial-scale inverter containers are typically made from galvanised steel and are similar to industrial battery containers. Same recycling methods as industrial battery containers (see above). Federal Government listed inverters (domestic, commercial and industrial) with solar PV as a priority product on product priority list 20-21 which promotes recycling pathways. This does not explicitly mention inverter containers but refers to inverters as a whole. Listed products are considered a high priority for consideration of possible product stewardship approaches.
Air conditioning units (HVAC)	Federal Government listed air conditioners fourth on product priority list 2014-15 where listed products are considered a high priority for consideration of possible product stewardship approaches. Federal Government comments on refrigeration and air-conditioning disposal due to the ozone depleting substances or synthetic greenhouse gases (**SGGs**) they contain. This requires a Refrigerant Trading Authorisation to be held by those wanting to dispose of these substances within air conditioners. It is noted that hazardous materials are not included in assets within this project, however, HVAC systems typically contain refrigerants.
Step-up transformers	There are no explicit schemes/legislation on Step-up transformer. Metal components would be readily recyclable following decontamination. Federal government Product Stewardship for Oil Program (**PSO**) encourages increased collection and recycling of used oil in Australia by providing oil recyclers with product stewardship benefits. It is noted that PCBs are not included in new assets within this Project, however, PCBs are typically used in step-up transformers.
Switch room, prefabricated steel structure and pier footings	There are many components that make up prefabricated switch room. These components are likely to be separated for individual end-of-life management e.g. external steel sheeting steel, air conditioning system, alarm system, vinyl flooring, switchboards etc.

Demolition wastes

Demolition waste would be generated associated with existing solar array, coal stockpile areas, conveyor shortening and redundant infrastructure associated with upgrade and tank replacement. The demolition waste streams are summarised in **Table 6-34**.

Table 6-34: Demolition waste streams

Battery component	Recycling opportunity
MA1B conveyor shortening	Approximately 5 km of the MA1B conveyor would be removed as part of the BAW. The conveyor would be removed using standard demolition practices. It is likely that once the belt is removed, the steel could be salvaged, offsetting the cost of demolition. There are a range of uses for end-of-life conveyer belt including line fences, paths for protection of sand dunes and weed suppression matting. AGLM or its demolition contractor would seek appropriate reuse opportunities for the conveyor belt were able. The conveyer structure itself (including rollers and pulleys) would be recycled given that they are predominantly constructed of steel. Subject to detailed planning, concrete structures, hardstand and access tracks would be removed and would be recycled off site for road base / fill type applications if confirming with waste exemptions at the time if unable to be re-used on site as fill.
Liddell coal stockpile	The Liddell coal stockpile area would require removal of coal handling infrastructure. This would include approximately 5 km of conveyor and associated stacker / reclaimer equipment. Most components would be recyclable as identified above. Residual coal remaining in the stockpile area is intended to be burnt in Liddell consistent with existing operations.
Solar array	The solar array consist of approximately 5 ha of solar thermal equipment. This consists predominantly of steel pipes used for heat absorption and water and steam transfer, mirror reflectors and steal mounting structures. Steel components would be recyclable while mirror components would require disposal if unable to be reused.
Redundant tanks	Two redundant rubber lined steel tanks would require disposal as their condition may preclude recycling.

Standard construction wastes

Other standard construction wastes are expected to include:

- Spoil from cut and fill activities for the Battery, Decoupling and River Road refurbishment
- Green waste from clearing activities
- General construction waste
- Sewage.

Table 6-35 identifies likely waste streams, their classification and estimated quantity where possible and proposed management.

Table 6-35: Likely waste streams

Waste identification	Waste description	Likely Classification	Estimated quantity	Proposed management
Sewage	Portable ablutions facilities pump-out	Liquid	Up to 20,000 litres per week at peak construction (100 l per person per day).	BAW works would use existing facilities at Bayswater. BAW works may require pump-out for off-site disposal or disposal through existing Bayswater or Liddell treatment systems. Battery and decoupling works would be managed through current Liddell facilities until closure.
Fuels, lubricants, and chemicals	Containers that previously contained Class 1, 3, 4, 5 or 8 substances used for construction plant. Used oil from construction plant.	Hazardous	Unknown volume, waste associated with minor maintenance of vehicles only.	Fuels and oils drained from plant for maintenance would be decanted for re-use. Where unsuitable they would be taken off-site for recycling.
Hydrocarbon contaminated soils	Spills from construction plant and refuelling	Hazardous	Minimal	Spill clean-up material would be placed in dedicated covered skip bin for collection for off-site disposal.
Excavated natural materials	Earthworks spoil	General	Subject to detailed design but able to be balanced on site.	Maintaining soils on site. Any chance finds of unsuitable or contaminated material would be tested to confirm waste classification prior to off-site disposal.
Green waste	Clearing of vegetation	general	Subject to detailed design	Reuse in rehabilitation on site unless identified as weed infested in which case disposal at green waste facility.
Demolition waste	Conveyor components including belts, steel structure, rollers. Solar array components including mirrors, steel pipes and frames, wiring pumps and motors.	General	As described above.	Re-usable components which may include much of the conveyor, motors and pumps would be segregated for off-site repurposing or reuse.

Waste identification	Waste description	Likely Classification	Estimated quantity	Proposed management
	Road materials			Recyclable content would be segregated for off-site recycling. Waste materials not able to be reused or recycled would be classified for lawful disposal.
Construction waste	Timber, packaging, metal, asphalt, concrete, glass, plastic, rubber, plasterboard, ceramics, bricks from the installation of foundations and underground services and above ground civil, mechanical and electrical plant and equipment.	General	Unknown. Limited packaging waste is required as Battery components would be delivered pre-assembled.	Segregated for recycling to the extent practical in accordance with current site practices. Material unable to be recycled or reused on site would be classified for lawful disposal
Grit, sediment in erosion controls	Collected in, and removed from, stormwater treatment devices and/or stormwater management systems.	General	As generated	Clean sediment would be incorporated into rehabilitation.
Site office waste	Paper/cardboard	General	As generated	Recycled as per existing site practices.
Food waste	Generated from worker's lunches.	Putrescible	Approximately 100 kg per day	Off-site disposal as per existing practices.

6.11.3.2 Operational waste

Over the life of the Project, various components of the Battery may require or benefit from upgrade or replacement. This would most likely involve the replacement of battery cores within the containers but may also involve the repair or replacement of other infrastructure. End of life or defective lithium-ion batteries are expected to be returned to the supplier for re-purposing or appropriate disposal, while steel components would be recycled.

The operation of the BAW would not generate additional waste streams or alter waste management processes beyond improvements to how waste liquids from Bayswater are stored prior to disposal.

6.11.4 Environmental management measures

Environmental management measures for waste and resource use are presented in **Table 6-36**.

Table 6-36: Environmental management measures for waste impacts

Reference	Environmental management measures	Timing
WR01	A Waste Management Plan will be developed for the Project with the following criteria: ▪ A hierarchical waste management approach will be used, from the most preferable (reduce, reuse or recycle wastes) to the least preferable (disposal) to prioritise waste management strategies to avoid waste generation ▪ The plans will promote the use of materials with minimal packaging requirements, removal of packaging offsite by suppliers and fabrication of parts offsite ▪ Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors ▪ All waste types will be separated at source for recycling ▪ A licensed service provider will be appointed to collect waste during construction and operation ▪ Each waste type will be classified for transport to ensure correct handling. ▪ Any waste that cannot be recovered or recycled will be disposed of to a suitably authorised or licensed treatment or disposal facility where it will be treated and disposed of according to its classification.	Detailed design
WR02	Cleared vegetation will be either mulched for onsite reuse or used to created habitat piles, noting that any weeds and pathogens will be managed according to requirements under the *NSW Biosecurity Act 2015.*	Construction

6.12 Water

This section provides an assessment of the potential impacts of the Project on surface water and hydrology, and provides the measures to mitigate them. The assessment addresses the following SEARs:

Water – including:

- *A description of water demand, a detailed water balance, a breakdown of water supplies and the measures to minimise water use;*
- *An assessment of the likely impacts of the development (including flooding) on the quantity and quality of the region's surface and groundwater resources, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;*
- *A description of the proposed water management system, water monitoring program and all other proposed measures to mitigate surface water and groundwater impacts; and*
- *A description of the erosion and sediment control measures that would be implemented to mitigate any impacts during construction;*

6.12.1 Assessment methodology

The methodology for the hydrology assessment included:

- A review of existing background information relevant to the Project area including the Surface Water, Groundwater and Flooding Technical Paper (Jacobs, 2020b) prepared for the WOAOW project EIS
- Review of LEP flood mapping and topography to confirm Project is at an elevation unlikely to be affected by, or affect flooding

- Review of existing water balance and supply arrangements and potential for the Project result in changes beyond existing variability
- Assessment of the impact of construction and operational activities on water quality, hydrology and groundwater
- Identification of appropriate mitigation and environmental management measures.

The assessment focusses on the Battery and Decoupling works components of the Project on the basis that these items introduce new risks to the AGLM landholding. The nature of the BAW components, being either environmental improvements aimed at reducing water quality risks or otherwise in keeping with existing conditions, mean water impacts are limited. The management measures would be applied to all Project components on a reasonable and feasible basis.

6.12.2 Existing environment

6.12.2.1 Climate

The Project area is considered to have a Mediterranean type climate with hot summers and cool to mild winters. Jacobs (2020) summarises the key points of the Project area climate as follows:

- The average long-term annual rainfall for the AGLM Bayswater rain gauge of 699 millimetres (**mm**). Rainfall is generally greater in the late spring/summer months from November to February. Within the winter months, rainfall is relatively high in June
- Average Class A pan evaporation is 1,514 mm/year (based on data from 1920 to present)
- Rainfall surplus, defined as rainfall minus evapotranspiration, is a description of the available water for recharge to groundwater. A positive rainfall surplus indicates a water surplus, which may manifest itself in increased potential for groundwater recharge. Conversely, a negative rainfall surplus indicates a water deficit and therefore is associated with reduced potential for groundwater recharge. Based on the Doyles Creek daily rainfall and the Bureau of Meteorology (**BOM**) Areal actual evapotranspiration (**AAET**) monthly averages, there is a rainfall surplus in February and from April to September. Remaining months have a rainfall deficit.

6.12.2.2 Regional water catchments

The Project is situated in the central region of the Hunter River catchment area which spans approximately 22,000 square kilometres (**km^2**). The Hunter River rises in the Mount Royal Range north east of Scone and travels approximately 450 km to the sea at Newcastle. The largest tributary of the Hunter River is the Goulburn River which joins the Hunter River approximately 25 km to the west of the Project. The Hunter River flows to the south of the study area. The Hunter River is located immediately south of the southern extent of the BAW footprint and approximately 14 km south of the Battery and Decoupling footprints.

Within the Project area is the Bayswater Creek and Saltwater Creek sub catchments. Bayswater Creek has a total catchment area of approximately 96 km^2. A dam wall was constructed across Bayswater Creek in the 1960s to create Lake Liddell, a large cooling water pond for Liddell and Bayswater. Bayswater Creek has been highly modified downstream of Lake Liddell including the construction of a diversion channel which has resulted in significantly altered aquatic and riparian habitat. In particular, a drop structure has been constructed near the confluence of Bayswater Creek and the Hunter River. While discharges from Lake Liddell are the primary source of flow into Bayswater Creek, a number of other tributaries flow into Bayswater Creek including Pikes Creek, Davis Creek, Emu Creek, and Chain of Ponds Creek.

Saltwater Creek sub-catchment area is comprised of two major drainage lines, Saltwater Creek running north-south and Noname Creek (**Saltwater Creek Tributary**) running east-west, which joins Saltwater Creek in the south before draining into Plashett Reservoir. Plashett Reservoir is a constructed water storage for Bayswater and Liddell which receives water pumped from the Hunter River as well as catchment drainage.

6.12.2.3 Waterways and waterbodies

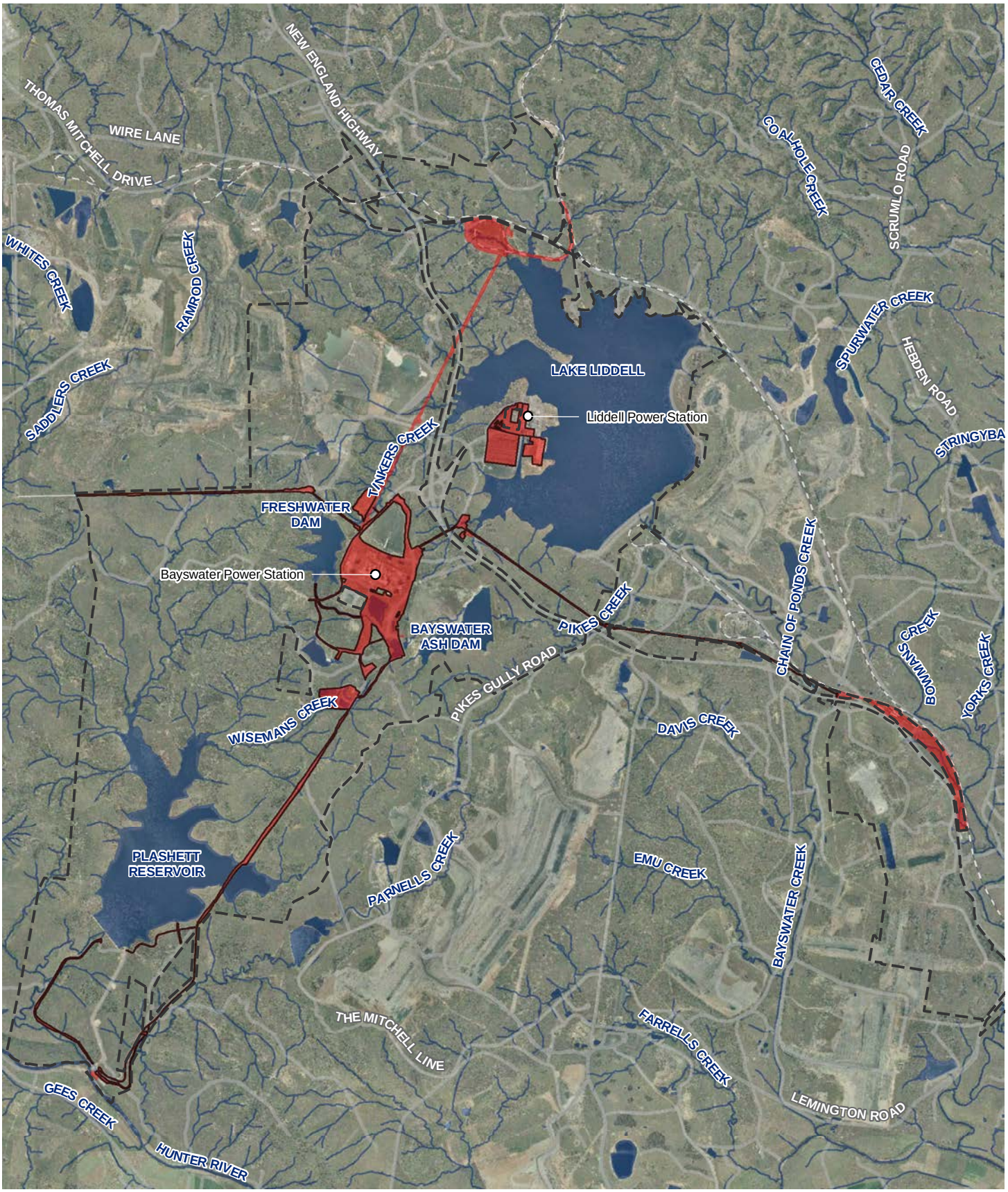
Within the vicinity of the Project are a number of waterways and artificial water bodies, as shown in **Figure 6.17**. These include:

- Tinkers Creek, Bayswater Creek, Pikes Creek, Saltwater Creek, Chilcotts Creek and Wisemans Creek
- Bayswater Ash Dam, Plashetts Reservoir, Lake Liddell and Freshwater Dam.

The waterways and artificial water bodies adjacent to or that intersect with the Project area described as follows:

- Bayswater Ash Dam (**BWAD**) is located at the top of the Pikes Creek catchment. The BWAD is designed as a slurry water system. It is designed to minimise clean water flow to the dam and maximise the use of poorer quality water within the ashing cycle. Seepage within the main embankment is collected via a system of drains and the water is returned to the dam using a series of pumps. Seepage issues are known to exist and are managed under EPL 779. The separately proposed WOAOW project includes upgrades to the seepage interception works at the BWAD. Discharge under flooding conditions would occur from the BWAD spillway (a licenced discharge point under EPL 779) to Chilcotts Creek and flow to Lake Liddell
- Plashett Reservoir is located in the south-western portion of the study area. This waterbody has a capacity of approximately 67 gigalitres (**GL**) and collects run off from sub-catchments in the northern extent of the reservoir, Saltwater Creek, Saltwater Creek Tributary and Wisemans Creek, as well as from a number of small, unnamed perennial streams in proximity to the reservoir. Additionally, water is pumped from the Hunter River into Plashett Reservoir
- Lake Liddell, with a capacity of approximately 150 GL, is an artificial lake constructed to supply cooling water to Bayswater and Liddell by damming Bayswater Creek. The lake is located to the north of the Project and collects runoff from the upper portion of the Bayswater Creek catchment. The lake receives flows from licenced discharges of Bayswater and Liddell. Discharges from Bayswater are released into the lake via Tinkers Creek and Chilcotts Creek. Flows from Lake Liddell are intermittently released to Bayswater Creek from a licenced discharge point at the main dam wall. Water discharges released from Lake Liddell to Bayswater Creek are monitored at a licenced discharge point. The quality of water released into Bayswater Creek is subject to regulation by the Hunter River Salinity Trading Scheme (**HRSTS**) and water quality parameter limits implemented under EPL 779
- Freshwater Dam is located to the west of Bayswater and is used to store water from the Lime Softening Plant. The freshwater dam also supplies water to Jerrys Plains for potable water supply after treatment through the Bayswater water treatment plant
- Tinkers Creek drains from the Freshwater Dam west of Bayswater into Lake Liddell south of Liddell. Tinkers Creek receives flow from a modified drainage line that links the Freshwater Dam (located to the south-west) to Tinkers Creek. Water is discharged from Bayswater from two licenced discharge points that drain to Tinkers Creek which subsequently flows downstream into Lake Liddell
- Bayswater Creek has been dammed to create the Lake Liddell reservoir and heavily modified below the dam wall to accommodate discharges downstream into the Hunter River. The creek acts as a transfer channel between Lake Liddell and the Hunter River with discharges to Hunter River regulated by the HRSTS
- Pikes Creek is located to the east of Bayswater and flows in a north-easterly direction through the Bayswater Ash Dam and under the New England Highway. Pikes Creek receives flow from a number of small tributaries downstream of the Bayswater Ash Dam (**BWAD**)
- Chilcotts Gully is an ephemeral stream that flows in a north-easterly direction toward Lake Liddell and crosses under the New England Highway
- Wisemans Creek is a third order stream which flows in a south-westerly direction toward Plashett Reservoir. The creek receives flow from a number of small tributaries located along its length.

The majority of the waterways in the Project area are highly disturbed and are not classified as sensitive receiving environments.



Legend

- Project area
- Development site
- AGL owned land
- Railway
- Road
- Waterway
- Waterbody

0 2 4km

1:90,000 at A4

Data sources

Jacobs 2020
© Department Finance, Services and Innovation 2019
AGL 2019

Imagery:
© Department of Customer Service 2020

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Figure 6 - 17 Waterways

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6.12.2.4 Surface Water quality

Salinity of water courses within the Hunter River catchment are naturally elevated, with sources of salt related heavily to rainfall and weathering products which enter streams via surface runoff pathways and groundwater sources, particularly from the underground geology of the Permian coal measures. Of the surface water salinity observations from across the Hunter region (including Bayswater Creek), median electrical conductivities exceeded 5,500 micro Siemens per centimetre (**µS/cm**) for areas in proximity to the power station facilities (Bioregional Assessments, 2019).

Receiving waters for the Battery and Decoupling works are limited to Lake Liddell which discharges to Bayswater Creek and then the Hunter River. The water quality of Lake Liddell and Bayswater Creek are summarised as follows.

Lake Liddell

Lake Liddell is an artificial waterbody that was constructed in the 1960's for use of supplying cooling water to Bayswater and Liddell power stations by damming Bayswater Creek. The water quality of the lake is influenced by a number of sources as it collects runoff from the upper portion of the Bayswater Creek catchment (Bioregional Assessments, 2019), as well as from licenced discharges released from Bayswater and Liddell at Tinkers Creek, Chilcotts Creek and directly into the Lake Liddell. The water quality of Lake Liddell is monitored at LDP08 (now EPL Point 23), which is located at the pipe at the dam wall used to release water to Bayswater Creek (Jacobs, 2020b).

The pH values complied with the requirements specified in EPL 779 for LDP08 (now EPL Point 23) monitoring site at all times (6.5-8.5).

A large portion of the trace metals and ions had concentrations below detection limits or below ANZG (2018) guidelines for either the protection of aquatic ecosystems (greater than 80 % species protection) or primary industry (irrigation and general water use and livestock drinking water). The exceptions were boron, cadmium, chloride, copper, fluoride and molybdenum.

Bayswater Creek

Bayswater Creek is the main transfer channel linking Lake Liddell and the Hunter River, with Lake Liddell receiving runoff from the upper portion of the Bayswater Creek catchment and discharge from the power station facilities (Jacobs, 2020b). Bayswater Creek also receives a small proportion of its flow from Pikes Creek.

Water sampling at locations along Bayswater Creek was undertaken by (Aurecon, 2013) in December 2010. Results were extracted from Aurecon (2013), analysed and compared to the ANZECC/ARMCANZ (2000) guidelines for the protection of lowland river aquatic ecosystems, or ANZG (2018) guidelines for either the protection of aquatic ecosystems or primary industry (irrigation and general water use and livestock drinking water).

The quality of water within Bayswater Creek at the time of sampling was characterised by high electrical conductivity (**EC**), with all samples above the ANZECC/ARMCANZ (2000) guidelines, however all samples were below the stated median EC value for water courses in the area (5500 µS/cm) (Bioregional Assessments, 2019). pH levels remained within the ANZECC/ARMCANZ (2000) guidelines values on all four sampling occasions.

Based on data for toxicant concentrations, a large portion of the analysed trace metals and ions had concentrations below detection limits or below recommended upper limits stated in the ANZG (2018) guidelines for either the protection of aquatic ecosystems (greater than 80 % species protection) or primary industry (irrigation and general water use and livestock drinking water). The exceptions were aluminium, chloride, chromium, copper, fluoride, iron, sodium and zinc which were above the guideline level at a minimum of one sampling site.

6.12.2.5 Groundwater

Groundwater is likely to be hosted in two primary formations: the porous sediments of the alluvium associated with the creeks in the Project area, and the fractured rock aquifer of the Permian sequences.

The creek lines may host a small amount of alluvium, which is considered to be sediment that has been transported by water movement and shows flow structure. The groundwater in the alluvium is likely to be unconfined. Groundwater flow in these systems generally flow parallel to the creek flow direction, and dependent on the stream size, whether it is ephemeral perennial etc.

Groundwater hosted in fractured rock systems are likely to be hosted either in the primary porosity of the rock or within the fractures, joints and bedding planes of the rock units. The key aquifers in the fractured rock systems are the coarse and weathered units and the coal seams. The coal seams host groundwater within the jointing and cleat network within the coal seams. The fractured rock groundwater systems can be confined or unconfined, and the shallow aquifer flow directions follow the general surface topography.

Discharge of groundwater from the fractured rock aquifers to the surface and to alluvium can occur at seepage points at the surface. Groundwater from the fractured rock aquifers in the area is generally considered to be brackish to saline. The alluvium is predominantly recharged by rainfall, with a small percentage of rainfall infiltrating to the water table. The alluvium in the area discharges eventually to the Hunter River alluvium or it contributes to the baseflow of the surface water bodies. The alluvium is most likely to be recharged by rainfall and discharge from the underlying fractured rock aquifers, except in areas where the fractured rock has been depressurised and/or dewatered by mining. In the areas of depressurisation, the hydraulic gradient may be the opposite and the alluvium may recharge the fractured rock aquifers. Interaction between the porous aquifers and the fractured rock aquifers is likely to be low where the environment is not disturbed.

Depths to groundwater vary considerably. In the alluvium, unconsolidated porous material (such as colluvium) and the weathered rock (all unconfined aquifers) the depth to groundwater is generally low – with depths to water between 0 m below ground level (**mBG**L) and approximately 10 mBGL. In the fractured rock aquifers, depth to water ranges from a few metres to tens of metres below ground level.

6.12.2.5.1 Registered groundwater bores

There are 35 registered groundwater bores within the surrounding lands, the monitoring data from these bores found that standing water levels for the bores ranged from 3 to 43 mBGL) (16 mAHD to 182 mAHD) across the site.

6.12.2.5.2 Groundwater levels within the Project area

The existing groundwater data for the AGLM site indicates that average groundwater depths range from 0.4 mBGL to 11.5 mBGL. It must be noted that the relatively shallow groundwater depths are a result of the relevant bores being located in relatively low-lying land.

6.12.2.5.3 Groundwater quality

Existing groundwater quality is well understood from the data from existing groundwater bores within the AGLM site. The data from the existing bores was analysed (Jacobs, 2020b) and compared to the National Water Quality Management Strategy - *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) for freshwater 95 % level of protection, trigger values for lowland rivers, and freshwater 99 % level of protection (used only for bioaccumulate Mercury and Selenium) The following general keys points are noted:

- Aluminium, Boron, Copper, Cadmium, Manganese, Nickel and Zinc concentrations were frequently above ANZECC 2000 GW 95 % guideline levels

- Reactive phosphorous and total nitrogen were at times above the ANZECC 2000 guideline levels for lowland rivers
- The pH values at BA_MW01, BA_MW03 BQ_MW04 and BA_ BQ_MW10 were above the ANZECC 2000 guideline levels for lowland rivers
- Total Recoverable Hydrocarbons (**TRH**), Benzene, toluene, ethyl benzene and xylenes (**BTEXN**), Poly-aromatic hydrocarbons (**PAHs**) and Polychlorinated biphenyl **(PCBs**) concentrations were all below the laboratory detection limits.

6.12.2.6 Sensitive receiving environments

No waterways within or adjacent to the Battery and Decoupling footprints (refer to **Figure 6.17**) have been classified as sensitive receiving environments. This conclusion has been made based on the following considerations:

- No waterways within the Project area are part of the drinking water catchments for any of the surrounding townships. While the Freshwater Dam provides storage for Jerrys Plains, this water is treated prior to being supplied and works within its catchment associated with the Project are limited to those consistent with ongoing operations of Bayswater
- Commercial fishing is prohibited in waterways within the footprint area, and no waterways are classified as aquaculture areas
- Lake Liddell, Plashett Reservoir and Bayswater Creek have been mapped as Key Fish Habitat (DPI, 2019), however, no threatened species are predicted to occur, and only minimal suitable aquatic habitat features appear to be present along the banks of the waterways. Considering this, all three waterways have been classified as Type 3 minimal Key Fish Habitat (DPI, 2013). Furthermore, Bayswater Creek has been highly modified downstream including the construction of a diversion channel which has resulted in significantly altered aquatic and riparian habitat. In particular, the construction of a drop structure near the confluence of Bayswater Creek and the Hunter River prevents the migration of fish upstream
- No other waterways within the Project footprint have been mapped as Key Fish Habitat
- Review of the Water Sharing Plan (**WSP**) GDE maps for the *North Coast Fractured and Porous Rock Groundwater Sources* (NSW Government, 2016)and the *Hunter Unregulated and Alluvial Water Sources* (NSW Government, 2009) identified no high priority GDEs within the groundwater assessment study area boundary.

6.12.2.7 Flooding

The Project is not located on land that is mapped under the Singleton LEP as being susceptible to flooding. No mapping for flood prone land is available under the Muswellbrook LEP. The Battery and Decoupling footprints are elevated above the maximum water level of Lake Liddell and away from drainage lines.

6.12.2.8 Existing water balance

Bayswater and Liddell have an integrated water management system, the primary objective of which is to ensure adequate supply of water for cooling purposes and for other processes across the sites. The primary water source for the site is the Hunter River, and the major water storages on site include Lake Liddell, BWAD, Liddell Ash Dam, Plashett Dam, and Freshwater Dam.

AGLM commissioned AECOM to improve the capability of the business to proactively manage Bayswater and Liddell water and waste assets. To this end, a draft water balance of the site water management system was developed (AECOM, 2019). The site water balance quantifies the movement of water across the site, based on inflows to the site, outflows and process usages, storages and operating rules.

The site water balance model is setup to run two different scenarios, a historical simulation and a future simulation. The historical simulation uses metered data for key water demands (such as cooling tower demand, forced evaporation), and allows the model results to be validated against historical data. The future simulation is

based on the relationships between key water demands and predicted ash production and/or power generation for the site.

Bayswater and Liddell share an integrated water supply and treatment system. This supply system is designed to pump up to 61,000 ML per year from the Hunter River at Jerry's Plains to meet the water requirements of Liddell (25,000 ML per year) and Bayswater (36,000 ML per year).

The major source of water for AGLM operations are water allocations from the Hunter River.

The maximum allocated water volume is shown in **Table 6-37,** with allocations reset based on the calendar year. The actual annual usage of water on site from the Hunter River is variable, and dependent on water availability from the Hunter River, water quality (on site and in Hunter River), and dam levels at AGLM.

Table 6-37: AGLM Water Allocations

Water allocation (calendar year	Volume (ML)
Water utility	36,000
Supplementary	36,000
General security	2090
High Security	1740
Total	75,830

The main water uses on site are as follows:

- Evaporation via Bayswater cooling towers
- Forced evaporation from Lake Liddell
- Water circulated in the ash management system
- Cooling tower blowdown
- Washdown
- Domestic water supply for Bayswater, Liddell and Jerry Plains
- Fire system
- Dust suppression
- Coal handling.

Water is also lost from the system via the following:

- Natural evaporation from storages
- Seepage
- Discharges from Lake Liddell under the HRSTS
- Over topping of Plashetts reservoir.

6.12.3 Assessment of impacts

6.12.3.1 Construction

6.12.3.1.1 Water quality and hydrology

During construction, water would be required for activities such as dust suppression, drilling, concrete works and revegetation. Water would be sourced from existing onsite sources in accordance with existing water allocations. No new potable water connections would be required, and no surface water would be abstracted during construction of the Project.

Potential impacts to water quality and hydrology could occur through the following construction activities:

- Removal of vegetation, general earthworks, including stripping of topsoil and excavation could result in the mobilisation of exposed soils, increased erosion and sedimentation (**Section 6.4.2** provides further details of soil landscapes within the Project area, including soil erodibility)
- Stockpiling of topsoil and vegetation leading to the discharge of sediment-laden water
- Transportation of cut and/or fill materials and the movement of heavy vehicles across exposed earth
- Potential for spills and leaks of chemicals, petroleum, oils and other toxicants from construction machinery, plant equipment, refuelling and vehicles travelling to and from Liddell and Bayswater, result in discharge to the environment
- Concreting works resulting in concrete dust, concrete slurries or washout water entering downstream waterways which can increase the alkalinity and pH of downstream waterways which can be harmful to aquatic life.

With the implementation of the proposed environmental management measures, construction activities are unlikely to result in any significant adverse effects to water quality and hydrology.

Water use would not be significant for the Project and measures to reduce water use would be applied where possible.

6.12.3.1.2 Groundwater

Extraction of groundwater for construction use is not proposed. The Project would source potable water from onsite utilities. The Project is therefore not expected to impact on any adjacent licensed water users or existing groundwater infrastructure.

Indirect impacts to the groundwater environment during construction may occur as a result of potential spills or leaks of hazardous materials occurring during construction and migrating to the water table. Potential spills or leaks may include oils, lubricants and fuels used by construction plant.

The majority of construction activities would be limited to surface works and as such, there would be limited possibilities for direct interaction with groundwater.

6.12.3.1.3 Water balance

The Project has limited implications for the overall site water balance as follows:

- The construction of each Project element may require water for ground improvement, dust suppression and wash down purposes that would be drawn from within the existing AGLM water allocations and would be negligible compared to existing uses
- The operation of the Battery and Decoupling is not expected to require notable water supply and this would be drawn from existing domestic supply available to Liddell under existing AGLM allocations
- The construction of the BAW components would not alter the Bayswater and Liddell water balance.

6.12.3.2 Operation

6.12.3.2.1 Water quality and hydrology

The operation of the Project would not change the water use and the site water management system or require any new water discharge points under the EPLs held for the Sites.

The Project would involve the establishment of new permanent impervious surfaces within the Battery and Decoupling footprints and some BAW component footprints. As such (without appropriate on site management of drainage), there may be an ongoing potential risk of soil erosion and subsequent transportation of sediment into nearby receiving waterways as a result of concentrated flows, discharging from and adjacent to impervious areas. An overall small increase in surface water runoff would also result from the Project.

6.12.3.2.2 Flooding

The BAW works are generally limited to existing infrastructure areas and have negligible potential to affect flood behaviour. Detailed design would consider implications for flooding. Works associated with the BAW components do not affect drainage lines other than existing water transfer canals where the only works would be maintenance with the effect of returning water transfer to design capacity.

The Battery and Decoupling footprints are above the maximum storage level of Lake Liddell and away from drainage lines. Detailed design would confirm that there is no risk of flooding in these areas and include drainage suitable to manage and convey stormwater in a manner that avoids flooding risk to existing or proposed assets.

6.12.3.2.3 Groundwater

No operational impacts are expected on groundwater.

6.12.4 Environmental management measures

Environmental management measures relating to water (including groundwater and surface water) are outlined in **Table 6-38**.

Table 6-38: Environmental management measures for water impacts (groundwater and surface water)

Reference	Environmental management measures	Timing
W1	The specific requirements for water quality controls will be confirmed as the detailed design develops and prior to commencement of construction of each Project component, to ensure the objectives of the Project are achieved.	Pre-construction
W2	The following measures will be undertaken to manage activities in proximity to waterways: ▪ Works within waterfront land will be managed in accordance with the relevant guideline as deemed appropriate ▪ Implementing practices to minimise disturbance of banks and undertake bank stabilization ▪ Appropriate drainage features will be incorporated into the design of the Project components by a suitably qualified and experienced professional. All Project components will be designed and constructed in accordance with relevant guidelines.	Pre-construction and construction
W3	Stockpiles would be managed to minimise the potential for mobilisation and transport of dust, sediment and leachate in runoff. This would include:	Construction

Reference	Environmental management measures	Timing
	▪ Minimising the number of stockpiles, area used for stockpiles, and time that they are left exposed ▪ Locating stockpiles away from drainage lines, waterways and areas where they may be susceptible to wind erosion ▪ Stabilising stockpiles, establishing appropriate sediment controls and suppressing dust as required.	
W4	Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and Volume 2D commonly referred to as the "Blue Book" where appropriate. Additionally, any water collected from worksites will be treated and discharged (where able) to avoid any potential contamination or local storm water impacts. Measures will be designed in accordance with the relevant guideline where appropriate.	Construction
W5	Water use during construction will be minimised where possible and measures to reduce water use will be applied.	Construction
W6	The Bayswater site operational water quality monitoring program will be updated and implemented as required.	Pre-operation and operation

6.13 Social and economic impacts

This section provides an assessment of the potential social and economic (socio-economic) impacts of the Project and measures to mitigate them. The assessment addresses the following SEARs:

Social and Economic *– including an assessment of the social and economic impacts and benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services.*

6.13.1 Assessment methodology

The methodology for this assessment has been informed by the requirements of the *Social Impact Assessment Guideline for State significant mining, petroleum production, and extractive industry development* (SIA Guidelines) (DPE, 2017) and the requirements of the *Draft Social Impact Assessment Guideline for State significant projects* (Draft SIA Guidelines) (DPIE, 2020c). The assessment process involved:

- Scoping of the potential socio-economic issues relevant to the Project and communities likely to be most affected by the Project and identification of the study area for the assessment
- Describing the existing socio-economic environment of the study area to provide a baseline from which impacts of the Project were assessed
- Assessing the potential socio-economic impacts of the Project, including both negative and positive impacts. This included consideration of potential impacts on local amenity, access and connectivity, business and communities and potential cumulative impacts. An evaluation of significance was also carried out
- Identification of appropriate mitigation and environmental management measures.

6.13.1.1 Evaluation of significance

A matrix was used to evaluate the overall significance of identified socio-economic impacts based on the evaluation of significance matrix within the Draft SIA Guidelines (see **Figure 6-18**). This was based on consideration of the expected magnitude and likelihood levels defined in Table **6-39**.

Likelihood level		Magnitude level 1 Minimal	2 Minor	3 Moderate	4 Major	5 Transformational
A	Almost certain	Medium	Medium	High	Very High	Very High
B	Likely	Low	Medium	High	High	Very High
C	Possible	Low	Medium	Medium	High	High
D	Unlikely	Low	Low	Medium	Medium	High
E	Very unlikely	Low	Low	Low	Medium	Medium

Figure 6-18: Social impact significance matrix (DPIE, 2020c)

Table 6-39: Likelihood and magnitude level definitions

Category		Description
Likelihood level		
A	Almost certain	Definite or almost definitely expected (e.g. has happened on similar projects)
B	Likely	High probability
C	Possible	Medium probability
D	Unlikely	Low probability
E	Very unlikely	Improbable or remote probability
Magnitude level		
1	Minimal	No noticeable change experienced by people in the locality
2	Minor	Mild deterioration/improvement, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable
3	Moderate	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people
4	Major	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area
5	Transformational	Substantial change experienced in community wellbeing, livelihood, amenity, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20 % of a community

6.13.1.2 Study area

The Project is located within the Muswellbrook Shire and Singleton LGAs in the Hunter region of NSW. The study area for this assessment includes the Muswellbrook and Singleton LGAs. It is likely that potential impacts of the Project's construction and operation would also be experienced by communities in the wider region. As such, this assessment also considers potential positive and negative impacts for community in the wider region and across NSW, where relevant.

6.13.2 Existing environment

6.13.2.1 Regional context

The Hunter Region has traditionally been known for coal mining, viticulture and horse breeding, although in recent times, the region has developed a reputation for food production and tourism. Newcastle City is the main population centre in the region with Singleton and Muswellbrook being the main towns near the Project. These are identified in the Hunter Regional Plan 2036 as important strategic centres in the region and as the focus for population and/or economic growth over the next 20 years.

Muswellbrook LGA is located in the Upper Hunter, approximately 130 km north west of Newcastle. The Muswellbrook LGA covers an area of about 3,405 km^2 and consists of two larger towns – Muswellbrook and Denman – and a number of rural communities. The Muswellbrook LGA is the predominant location for NSW's power generation and a key centre for coal mining. Agriculture, viticulture and equine are also key industries for the Muswellbrook LGA (DPIE, 2016).

Singleton Council LGA is located approximately 75 km west of Newcastle and covers an area of approximately 4,893 km^2. The town of Singleton is the major town in the Singleton LGA. The Singleton LGA has traditionally been a centre for primary production. Key industries include coal mining, agriculture, manufacturing and retail. Viticulture and related tourism are also growth industries (DPIE, 2016).

Bayswater and Liddell are located between Singleton and Muswellbrook and produce approximately 23,000 GWh of electricity a year, enough power for two million houses. The production of electricity from Bayswater and Liddell currently meets approximately 30 % of the electricity needs of NSW.

6.13.2.2 Community profile

Key population and demographic characteristics of communities in the study area are presented in **Table 6-40**. Muswellbrook LGA had an estimated resident population (**ERP**) of 16,383 people in 2018, while Singleton LGA had an ERP of 23,422 people. Over the 10 years to 2018, the population of the LGAs grew at an average annual rate of growth well below the NSW average. The population of the LGA's are generally predicted to remain relatively stable with the Muswellbrook LGA projected to be 18,338 people by 2041 (an average annual growth rate of 0.43 % from 2016), while the Singleton LGA is projected to be 23,383 people (a decline of 0.03% annually from 2016) This is below the expected rate of growth in NSW.

Compared to NSW, the Muswellbrook and Singleton LGAs generally had:

- Younger populations, with lower median ages, higher proportions of children and lower proportions of older people aged 65 years or over
- Lower levels of cultural diversity, with higher proportions of people born in Australia and lower proportions of people who speak a language other than English at home
- High levels of people who identified as Aboriginal and/or Torres Strait Islander, with this group representing 8.3 % of the population in Muswellbrook LGA and 5.7 % in the Singleton LGA
- Higher proportions of couple only families in Muswellbrook LGA and higher proportion of families with children in Singleton LGA
- Housing that comprised predominantly separate detached dwellings, with higher proportions of dwellings in the Singleton LGA that were owned outright or with a mortgage and dwellings in the Muswellbrook LGA that were rented, possibly reflecting the fly-in/fly-out workforce associated with mining operations
- Relatively low rental costs, and lower proportions of people in the Singleton LGA that experience rental housing stress reflecting more affordable rental accommodation options.

Table 6-40: Population and demographic characteristics

Characteristics	Muswellbrook LGA	Singleton LGA	NSW
Population and growth			
Estimated resident population (2018)	16,383	23,422	7,988,241
Average annual change in ERP (2008-2018)	0.4 %	0.2 %	1.4 %
Projected population (2041)	18,338	23,383	10,572,696
Age profile			
Median age (years)	35	36	38
0-14 years	22.5 %	21.1 %	18.5 %
15-64 years	64.6 %	66.1 %	65.1 %
65+ years	13.0 %	12.7 %	16.2 %
Cultural diversity			
Aboriginal and/or Torres Strait Islander	8.3 %	5.7 %	2.9 %
Australian born	84.7 %	84 %	65.6 %
Households where non-English is spoken	5.0 %	4.7 %	26.5 %
Families and households			
Couple family with no children	37.2 %	36.1 %	36.6 %
Families with children (one parent and couple families)	61.8 %	62.6 %	61.7 %
Total families	4,100	5,962	1,940,226
Housing			
Total dwellings	6,826	8,718	2,889,061
Dwelling occupancy rate	84.4 %	88.9 %	90.1 %
Separate houses	87.8 %	87.7 %	66.4 %
Semi-detached, row or terrace house, townhouse, flat, apartment, etc	10.0 %	10.7 %	32.1 %
Owned outright or owned with a mortgage	57.6 %	68.6 %	64.5 %
Rented	38.9 %	28.4 %	31.8 %
Median weekly rental costs ($)	250	280	380
Households with rent payments greater than or equal to 30% of household income	13.0 %	7.6 %	12.9 %

Source: Based on ABS (2016) QuickStats Muswellbrook LGA and Singleton LGA

6.13.2.3 Economic profile

Table 6-41 provides an overview of income and employment data for communities in the study area. At the 2016 Census, compared to NSW:

- Muswellbrook LGA generally had lower weekly personal and household incomes, while communities in the Singleton LGA generally reported higher incomes
- Singleton LGA had higher levels of workforce participation with about 63.6 % of people aged 15 years or over employed or looking for work, while workforce participation in the Muswellbrook LGA was similar to the NSW average
- Muswellbrook LGA had a rate of unemployment well above the NSW average, while the Singleton LGA had a level of unemployment similar to NSW.

The importance of coal mining to the economy of the Muswellbrook and Singleton LGAs is reflected in mining being the highest industry of employment, employing more than one in five workers in both the Muswellbrook and Singleton LGAs. The importance of tourism to communities in the LGAs is also evident with accommodation and food services in the top five industries of employment in both LGAs.

About 4.8 % of people aged 15 years or over in the Muswellbrook LGA and 2.7 % of people aged 15 years or over in the Singleton LGA were employed in electricity, gas, water and waste services. This is well above the proportion of people employed in this industry in NSW as a whole (0.9 %) and reflects the importance of the power generation industry to communities in the study area.

Table 6-41: Employment and income

Characteristic	Muswellbrook LGA	Singleton LGA	NSW
Income			
Median weekly personal income	$640	$684	$664
Median weekly household income	$1,346	$1,682	$1,486
Households with income <$650/ week	22.6 %	17.6 %	19.7 %
Households with income >$3,000/ week	13.6 %	19.3 %	18.7 %
Employment			
Total labour force	7,331	11,531	3,605,872
Full time work (%)	59.3 %	59.5 %	59.2 %
Unemployment (%)	8.2 %	6.1 %	6.3 %
Main industries of employment	▪ Mining (20.3 %) ▪ Retail trade (8.8 %) ▪ Health care and social assistance (8.2 %) ▪ Agriculture, forestry and fishing (6.3 %) ▪ Accommodation and food services (6.5 %)	▪ Mining (22 %) ▪ Health care and social assistance (7.7 %) ▪ Accommodation and food services (7.6 %) ▪ Retail trade (7.5 %) ▪ Public administration and safety (6.6 %)	▪ Mining (0.6 %) ▪ Health care and social assistance (12.5 %) ▪ Retail trade (9.7 %) ▪ Education and training (8.4 %) ▪ Construction (8.4 %) ▪ Professional, scientific and technical services (8.1 %)

Source: Based on (ABS 2016)

Tourism is a key industry for the Hunter local and regional economy, contributing around $2.2 billion to the Hunter region economy and directly employing around 15,800 people in 2018-2019 (Tourism Research Australia, 2019). The food services industry and accommodation industry directly contributed more than $175 million and $135 million respectively to the regional economy in the same period. In the year ending December 2019, the Hunter region attracted around 13.3 million visitors, including domestic and international overnight visitors and day-trippers. International visitors accounted for about 22.8 % of visitors, with domestic overnight visitors a further 17 %, the majority of which were from Sydney or regional NSW. The main form of accommodation for domestic visitors was 'friends or relatives property' followed by 'standard hotel/motor inn (below 4 star)', while 'rented house/apartment/flat or unit' was the top accommodation choice for international visitors (Destination NSW, 2019).

6.13.2.4 Visitor accommodation

A range of short-term visitor and tourist accommodation options are available in Muswellbrook and Singleton townships, including motels, serviced apartments and motor inns.

In 2018-19, there were 167 accommodation establishments with 10 rooms or more in The Hunter region, which offered a total of 7,063 rooms. This increased to 169 establishments in the year ending June 2020, offering 7,010 rooms. Room occupancy in 2018-2019 was 67.2 %, with this decreasing to 56.1 % in June 2020 (Destination NSW, 2019) (Destination NSW, 2020). The reduction in room occupancy rate between 2018-19 and 2020 is likely to reflect restrictions on domestic and international travel within Australia resulting from the COVID-19 pandemic. Previous data on tourist accommodation in the Hunter region suggests that occupancy rates vary across the year, with high occupancy in December and March quarters, and lower occupancy levels in June and September quarters (Australian Bureau of Statistics, 2016). In addition to accommodation establishments with 10 or more rooms, there are a large number of self-contained apartments, holiday houses, bed and breakfast accommodation, and caravan, camping and holiday parks within the Hunter region.

The closest accommodation services to the Project area are generally located in Muswellbrook, approximately 16 km north of the Project and at Singleton about 34 km south of the Project. A range of accommodation options are also in locations such as Maitland, Cessnock and Newcastle, located about 1-1.5 hrs commuting distance of the Project.

6.13.2.5 Social infrastructure

The Muswellbrook and Singleton LGAs accommodate a range of social infrastructure and community facilities that cater for residents, workers and visitors of local and regional communities. These include education facilities, health, medical and emergency services, sport, recreation and leisure and cultural facilities. The majority of social infrastructure servicing communities across the study area are located within the larger towns of Muswellbrook and Singleton, with social infrastructure in smaller rural communities generally limited to primary school and local sport and recreation uses.

The Project area is located within an area dominated by mining and power generation and is removed from social infrastructure. The closest social infrastructure (and sensitive receiver) to the Battery Liddell is about 2 km across the Liddell Lake northeast of the Project, being the Lake Liddell Recreation Area. The Singleton Mx Track is located 5 km southeast of Liddell.

6.13.2.6 Community values

The character and identity of the Muswellbrook and Singleton LGAs is influenced by the region's rural amenity and industries, as well as the presence of equine industry, coal mining and power generation. Consultation for the Muswellbrook Shire Community Strategic Plan 2017-2027 identified jobs, jobs security, economic diversification and resilience as key issues for local communities (Muswellbrook Shire Council, 2017). Reducing the community's impact on the environment, including improved regeneration and greening of mined lands, improved air quality, and protection of biodiversity and remnant endangered flora and fauna are also important issues for Muswellbrook LGA's residents (Muswellbrook Shire Council, 2017).

Residents of the Singleton LGA have indicated in the SC Strategic Plan that local jobs, increasing the diversity and resilience of the local economy, and protection and enhancement of a sustainable environment are also important to them (Singleton Council, 2017).

6.13.2.7 Transport and access

Access to the Project area is via the New England Highway. The New England Highway is a National highway connecting Tamworth, Armidale and South East Queensland in the north to Newcastle in the south. Within the study area, the highway is the key access route for communities and industry to and from Newcastle. The mining industry in particular is a key user of the highway, including for heavy haulage and the movement of employees. Employee movements are often shift related, so traffic movements are strong through most of the day with morning and afternoon peaks. TfNSW have developed a vision for the New England Highway that focusses on efficiency and support of industry through access for and the ability to withstand heavy vehicle loads for agriculture, mining and the power industry. The AGLM site has its own grade separated interchanges on the New England Highway with long entry and exit lanes that make allowance for less mobile heavy haulage.

6.13.3 Assessment of impacts

6.13.3.1 Construction

During construction, potential socio-economic benefits and impacts of the Project would mainly be associated with direct and indirect employment opportunities, benefits for businesses that support construction activities, increased construction traffic, demand for workforce accommodation, and potential impacts on community values.

Due to the remoteness of the Project to sensitive uses, construction activities are not expected to result in construction noise, dust or lighting impacts that would affect local communities.

6.13.3.1.1 Employment

The Project would impact positively on employment through the creation of direct employment opportunities for up to 250 people during the peak construction phase, including construction workers directly employed by the Project and specialty contractors. Where possible, the construction workforce would be sourced from within the study area and surrounding communities within the Hunter region, although specialised workers may also need to be sourced from elsewhere in NSW. As indicated in **Section 6.13.2.3**, levels of unemployment in the Muswellbrook LGA were above the NSW average at the 2016 Census, with the unemployment rate in the Singleton LGA marginally below NSW. The Project would generate local employment over a three year period, helping to support reduced levels of unemployment in the study area and surrounding region.

The Project is also likely to generate a number of indirect jobs in local, regional and national businesses and industries from increased economic activity and spending at businesses providing goods and services to support construction activities.

6.13.3.1.2 Local businesses

During construction, potential benefits for businesses would mainly be associated with provision of goods and services to support construction activities (e.g. equipment hire, specialty trades, fuel supplies, transportation, administrated services etc). Spending with local suppliers for construction related activities would help to support local business growth and development within the study area and surrounding region. Increased spending by workers on such things as accommodation, food and services is also likely to impact positively on businesses in the study area and wider Hunter region.

The use of some tourist accommodation such as hotels, motels, self-contained apartments, caravan and cabin accommodation for the construction workforce is likely to have positive impacts on owners of these businesses, by providing a base load demand. Cafes, restaurants and eateries are also likely to benefit from an influx of

project workers during the construction over the three year construction phase. However, this also has potential to temporarily reduce the availability of some accommodation types in nearby towns for travellers and visitors. This may have flow on effects for other tourism related businesses such as visitor attractions and restaurants/ cafes.

Locally, there are no businesses near the Project that would be impacted by increased construction activity.

6.13.3.1.3 Transport and access

Construction of the Project would generate construction traffic associated with the haulage and delivery of construction materials and equipment, transport of construction workforce, and general site activities. Roads within the study area are currently used by traffic associated with the mining and energy sector, and road users are generally familiar with the presence of heavy vehicles. While an increase in construction related traffic may impact on perceptions of road safety for some individuals, this is unlikely to impact on overall community perceptions of road safety. As previously mentioned, the additional traffic volumes required for the Project are expected to have a minimal impact on the road network and operation of the New England Highway.

6.13.3.1.4 Housing and accommodation

During construction, the Project would generate employment for up to 250 people during the peak construction works, including construction workers directly employed by the project and specialty contractors. Where possible, workers and contractors would include existing residents of communities in the study area and surrounding region (up to about 1-1.5 hours commuting distance). Maximising the use of local workers would help to reduce demand for temporary worker accommodation although, it is likely that short-term visitor accommodation or rental housing would be needed for construction workers from outside local and regional communities.

It is likely that temporary accommodation would be sourced from towns within commuting distance of the project, for example Muswellbrook, Singleton, Denman, Maitland and Newcastle. As indicated in **Section 6.12.2.4**, room in the Hunter region was 67.2 % in 2018-2019, with this decreasing to 56.1 % in June 2020, largely as a result of the COVID-19 pandemic. Muswellbrook and Singleton have a large number of establishments that provide accommodation to workers for the power and mining industries and it is likely that there is capacity within the existing accommodation sector to respond in part to the accommodation needs of the project, particularly if recent employment downturns in the Hunter Valley mining sector are ongoing.

While, there is potential for the use of visitor accommodation by construction workers for the Project to impact on the availability of some accommodation types in nearby towns, particularly during peak tourist periods it is likely that impacts would be managed through the use of a variety of accommodation types. The program of works would also be undertaken in stages with varying duration of individual works, which would also help to reduce the peak demands on visitor accommodation. Ongoing consultation would be undertaken with accommodation providers to assist in managing any impacts on visitor accommodation during peak visitor times.

Some construction workers may decide to rent within the study area for the duration of the works resulting in increased demand for rental housing in towns near the Project. This may increase pressure on rental prices possibly impacting on access to affordable rental housing and rental affordability for some groups on low or fixed incomes (e.g. unemployed, elderly, students). As indicated in **Section 6.13.2.2**, households in the Singleton LGA displayed levels of rental housing stress below the NSW average, while the Muswellbrook LGA reported levels of housing stress similar to NSW as a whole. The increase in rental prices may increase the incidence of rental housing stress for some households or result in some households having to move to more affordable accommodation elsewhere.

Maximising the use local workers who currently live within the study area and surrounding region along with short-term visitor accommodation for the non-local workforce would assist in managing potential impacts on rental housing.

6.13.3.1.5 Community values

Due to the remoteness of the Project to sensitive uses, construction activities are not expected to result in construction noise, dust or lighting impacts on nearby communities.

Vegetation clearing would be required at various locations within the Project area during the early phases of construction. Where possible, the new infrastructure and works would be located in previously disturbed areas, although some clearing may be required at some locations. As indicated in **Section 6.13.2**, protecting biodiversity and remnant endangered flora and fauna is important to communities in the Muswellbrook and Singleton LGAs and the clearing of vegetation for the Project is likely to be of interest to some people. Where possible, opportunities to minimise the extent of clearing would be considered during detailed design.

Local jobs are also important to the community, and the provision of direct and indirect jobs through the construction phase is likely to be seen as a positive by communities in the Muswellbrook and Singleton LGAs.

6.13.3.2 Operation

Beyond the Battery, there are not expected to be any material changes to the existing approved operation of Bayswater and Liddell which would generate any social and economic impacts over and above existing approved operation as part of the Project. This approval would not directly impact on the main generation activities carried out at AGLM land holding including the combustion of coal to produce electricity or any air emissions resulting from that. Coal consumption, water consumption and ash generation would not increase as a result of the Project.

Once operational, the Project would benefit communities, businesses and industry by increasing the reliability in the NEM. The Project would result in more efficient use of electricity generated , allowing the storage of energy during periods of low energy demand for use in periods of high energy demand. This would provide an overall downward pressure on energy prices, supporting reduced electricity costs for households, businesses and industry over the medium to long term. The Battery component of the Project also supports the transition to a low carbon energy future and assists in meeting NSW and Australia's GHG reduction targets.

6.13.4 Evaluation of significance

Table 6-42 presents a summary of the social and economic impacts of the Project's construction and operation, along with the outcomes of the evaluation of significance. The rating of likelihood and magnitude are combined to determine overall significance of both positive and negative social impacts. The evaluation of magnitude of social impacts is based on the social risk matrix presented in **Figure 6-18**.

Table 6-42: Summary of social and economic impacts and evaluation of magnitude level

Impact	Phase	Likelihood	Consequence	Magnitude
Negative social and economic impacts				
Potential impacts on local tourism businesses due to reduced availability of tourist accommodation	Construction	Unlikely	Minor	Low
Potential impact on rental prices due to increased demand for rental housing from construction workers	Construction	Possible	Minor	Medium
Impact on community values relating to the environment	Construction	Possible	Minimal	Low

Impact	Phase	Likelihood	Consequence	Magnitude
Changes to perceptions of safety for some road users due to increased traffic, including heavy vehicles, on the New England Highway	Construction	Possible	Minimal	Low
Positive social and economic impacts				
Creation of direct employment opportunities for local and regional communities	Construction	Likely	Moderate	High
Indirect benefits for employment due to increased demand for goods and services by construction workers and construction activities.	Construction	Possible	Moderate	High
Benefits for businesses that support construction activities (e.g. accommodation providers, etc)	Construction	Possible	Moderate	High
Impact on community values relating to the environment and local jobs	Operation	Possible	Minor	Medium

6.13.5 Environmental management measures

Environmental management measures to manage social and economic impacts of the Project's construction and operation are summarised in **Table 6-43**. Management measures for air quality, noise, traffic, biodiversity, visual amenity are provided in **Section 6.2, Section 6.4, Section 6.5, Section 6.6, Section 6.10** respectively.

Table 6-43: Environmental management measures for social and economic impacts

Reference	Environmental management measures	Timing
SE1	AGLM will keep the community and stakeholders updated on the project via the existing community engagement forum and AGL website.	Pre construction
SE2	Identify opportunities to maximise the use of local suppliers, labour and businesses in the provision of goods and services for construction.	Construction
SE3	Consultation with local tourist accommodation providers to identify peak tourist periods and consider timing of these periods in the planning of non-time-critical construction activities.	Construction

6.14 Infrastructure impacts

This section addresses the infrastructure impacts component of the SEARs:

Infrastructure Impacts *– including an assessment of impacts on infrastructure, including other utility servicing infrastructure (such as electricity, gas and water supply);*

6.14.1 Assessment methodology

The assessment identified and considered the Project's impacts on infrastructure (such as electricity, gas and water supply).

6.14.2 Existing environment

As described in **Section 1.5**, the Project locality is heavily influenced by industrial activity including power generation, mining and agriculture.

The AGLM landholding comprises Bayswater and Liddell operational areas, the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands.

Within the development site the only infrastructure that would be impacted by the Project is the existing Liddell switchyard and transmission lines and road crossings of the New England Highway, Pikes Gully Road and Hebden Road as shown in **Figure 2-1**. The Liddell switch yard supplies several loads critical to AGLM operations.

6.14.3 Assessment of impacts

As described in **Section 2.2**, the Battery and Decoupling footprints would be located next to the Liddell switchyard, with parts of the Decoupling work being within TransGrid easements (i.e. the connection into the Liddell switchyard). The Decoupling would facilitate the replacement connection point(s) for the 33 kV network supplying critical loads associated with Bayswater and other infrastructure into the Liddell switchyard and the NEM. The Battery would also connect in this manner either through the Decoupling transformer yard or an expanded transformer yard for future stages.

Prior approval from TransGrid and/ or ETMHC would be sought for any works required to be undertaken within Liddell switchyard and any easements required to be created would be negotiated and agreed with TransGrid and/or ETMHC.

During commissioning activities it is expected there would be an increased risk of disruption to power supplies to Bayswater and other infrastructure loads on the 33 kV network due to need to rely on one transformer.

No new works or infrastructure is proposed at locations where the development site crosses the New England Highway, Pikes Gully Road or Hebden Road. Existing agreements are in place for maintenance activities at these locations.

6.14.4 Environmental management measures

Environmental management measures relating to infrastructure are outlined in **Table 6-44**.

Table 6-44: Environmental management measures for infrastructure impacts

Reference	Environmental management measures	Timing
I1	AGLM will continue to consult with TransGrid and ETMCregarding any perceived impacts on the Liddell switchyard.	Pre-construction
I2	AGLM will consult with Ausgrid as the network provider responsible for other on site supply regarding continued supply.	Pre-construction/ construction

6.15 Cumulative impacts

This section provides an assessment of the potential cumulative impacts of the Project when considered with other projects in the locality to address the following SEARs:

- ***Cumulative*** *– including industrial facilities in the area and other nearby approved and proposed development, particularly in relation to hazards and risk, air quality, noise and vibration, traffic and soil and water.*

6.15.1 Overview

Cumulative impacts are compounding environmental and community impacts caused by past, present or reasonably foreseeable future activities. Cumulative impacts may arise from the interaction of construction and operation activities of the Project and other approved or proposed projects in the area. When considered in isolation, specific Project impacts may be considered minor. However, these minor impacts may be more substantial when the impact of multiple projects on the same receivers is considered.

6.15.2 Assessment methodology

The assessment of cumulative impacts focused on the proposed activity's interaction with other projects in the vicinity of the Project, and where construction and/or operational timeframes are likely to be concurrent.

Other projects in the locality were identified based on a search of the following data sources in November 2020:

- DPIE's online major projects database
- Local council websites/ DA tracking databases
- Proponent websites
- Discussion with AGLM.

The projects identified were screened in relation to their potential for cumulative impacts with the Project, based on their nature, size, and proximity to the Project area.

The Projects cumulative impacts on existing industrial facilities within or near the Project area have been considered in **Section 6.1** to **Section 6.14**.

The assessment of cumulative impacts has been limited to desktop review of the predicted impacts of external projects and consideration of where these impacts would overlap with the Project. These potential cumulative impacts have been described in general terms to identify the implications over and above those that would result if the Project were to be constructed in isolation. The assessment draws on the findings of **Sections 6.1** to **Section 6.14**, and environmental impact assessments of other projects.

6.15.3 Other projects in the study area

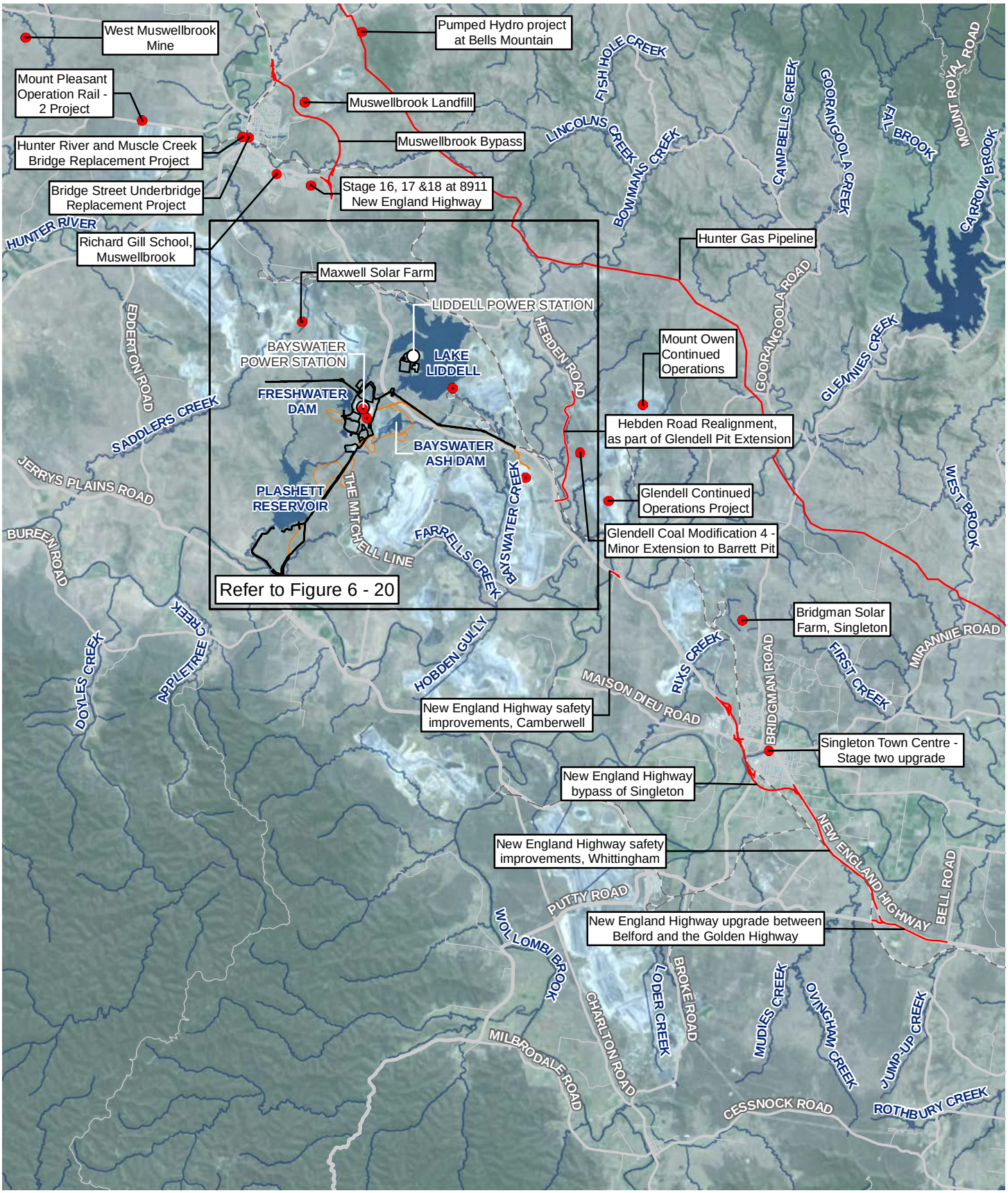
The projects in the locality that were considered to have the potential for cumulative impacts with the Project are listed in **Table 6-45** and shown in **Figure 6-19**. The projects within the AGLM landholding are shown on **Figure 6-20**.

Table 6-45: Existing and proposed projects

Project	Proponent	Description	Type	Status	Location in relation to the project	Construction timing
Glendell Continued Operations Project	Glencore	Extension of mining including extraction of an additional 140 million t of run of mine coal until 2044 at an increased rate of 10 million t per annum.	Mining	Scoping	9 km east of Liddell	Construction proposed to commence in 2021-2022 with an expected 12 month timeframe
Glendell Coal Modification 4 - Minor Extension to Barrett Pit	Glencore	Modification to DA 80/952 to provide for a minor extension to the Barrett Pit at Glendell Mine in order to access an additional 2.5 million t run of mine coal.	Mining	Approved	9 km east of Liddell	At current schedule, mining will cease at Glendell Mine in mid-2022. The proposed modification is expected to be completed by 2023
Maxwell Solar Farm	Maxwell Solar Pty Ltd	The proposal includes the construction, operation and decommissioning of a 25 megawatts photovoltaic solar electricity. The proposal would be located on the rehabilitated site of the Maxwell Project.	Solar farm	Approved	5 km west of Liddell	Construction proposed to commence in 2021 with 12 - 18 months completion
Richard Gill School, Muswellbrook	Richard Gill National Music Academy Ltd	The new school will be housed in the current Muswellbrook Shire Council Administrative Centre building at 157 Maitland Road, Muswellbrook.	Education	Approved	12 km north west of Liddell	Under construction
Muswellbrook Bypass	TfNSW	The bypass will connect with New England Highway at two points north and south of the Muswellbrook town centre, also intersecting with Coal Road.	Road	Scoping	Muswellbrook 13 km north west of Liddell	Construction proposed to commence 2022

Project	Proponent	Description	Type	Status	Location in relation to the project	Construction timing
New England Highway safety improvements	TfNSW	Various safety improvements and upgrades along the New England Highway to reduce the risk of crashes along the highway.	Road	Scoping / approved and in construction	New England Highway	Completion expected by 2024
New England Highway bypass of Singleton	TfNSW	Future New England Highway bypass of Singleton to improve traffic flow, travel times and safety through Singleton town centre by reduced traffic including heavy freight.	Road	Scoping	25 km southeast of Liddell	Expected to commence mid-2023 for completion late 2026
West Muswellbrook Mine	Idemitsu Australia Resources Pty Ltd	The West Muswellbrook Project is a proposed new open-cut coal mine near Muswellbrook	Mine	Scoping	26 km north west of Liddell	No date yet
Muswellbrook Landfill	Muswellbrook Shire Council	Development of a new Muswellbrook Waste Management Facility comprising an upgrade to the existing Waste Management Facility.	Waste	Scoping	On Coal Road, 14 km north west of Liddell	No date yet
Hunter Gas Pipeline	Hunter Gas Pty Ltd	The Hunter Gas Pipeline is a proposal to build an underground natural gas pipeline that will connect Queensland to Newcastle and the Sydney market.	Gas	Approved		Commence construction by October 2024
Lake Liddell Seepage Return Upgrade Project	AGLM	Construction of Pipes and Pump Infrastructure to Return Seepage Water from Lake Liddell Dam Wall to Lake Liddell	Energy	Approved	Below Lake Liddell dam wall accessed via Pikes Gully Road.	Construction due to commence March 2021

Project	Proponent	Description	Type	Status	Location in relation to the project	Construction timing
Bridge Street Underbridge Replacement Project	ARTC	ARTC will remove the structurally fatigued underbridge and replace with a new underbridge, which will include a trail lift to maintain headroom clearance.	Rail	Approved	About 14 km northwest of Liddell	Construction commenced June 2020, expected to be completed June 2022
Ravensworth Composting Facility Expansion	Bettergrow Pty Ltd/Greenspot Hunter Valley	Increase the production capacity of an existing composting facility to 200,000 t per annum.	Mining	Scoping	About 8 km southeast of Liddell	Construction is expecting to take about 6 months. The project has not yet been approved.
Bayswater Power Station Upgrade (WOAOW)	AGLM	Water management and other associated operational works for Bayswater including, ash dam expansion, replacement ash transfer pipelines, salt cake landfill, borrow pits, expanded off-site ash sales and water management infrastructure improvements.	Energy	Under Assessment	Adjacent to BAW components.	Construction work would occur between 2021 and 2035 as a worst-case scenario.
Bayswater Power Station Turbine Efficiency Upgrade	AGLM	Replacement of the turbines in each of the four existing generating units at Bayswater.	Energy	Approved 2018	In the Project area	These works commenced in 2019. One turbine will be replaced per year with works over 50 days per year. BW2 Outage commenced in March 2021.



Legend

- Development site
- WOAOW footprint
- Cumulative impact
- Cumulative impact
- Railway
- Road
- Waterway
- Waterbody

0 5 10km

1:275,000 at A4

Data sources

Jacobs 2021
AGL 2020
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Figure 6 - 19 Cumulative impacts

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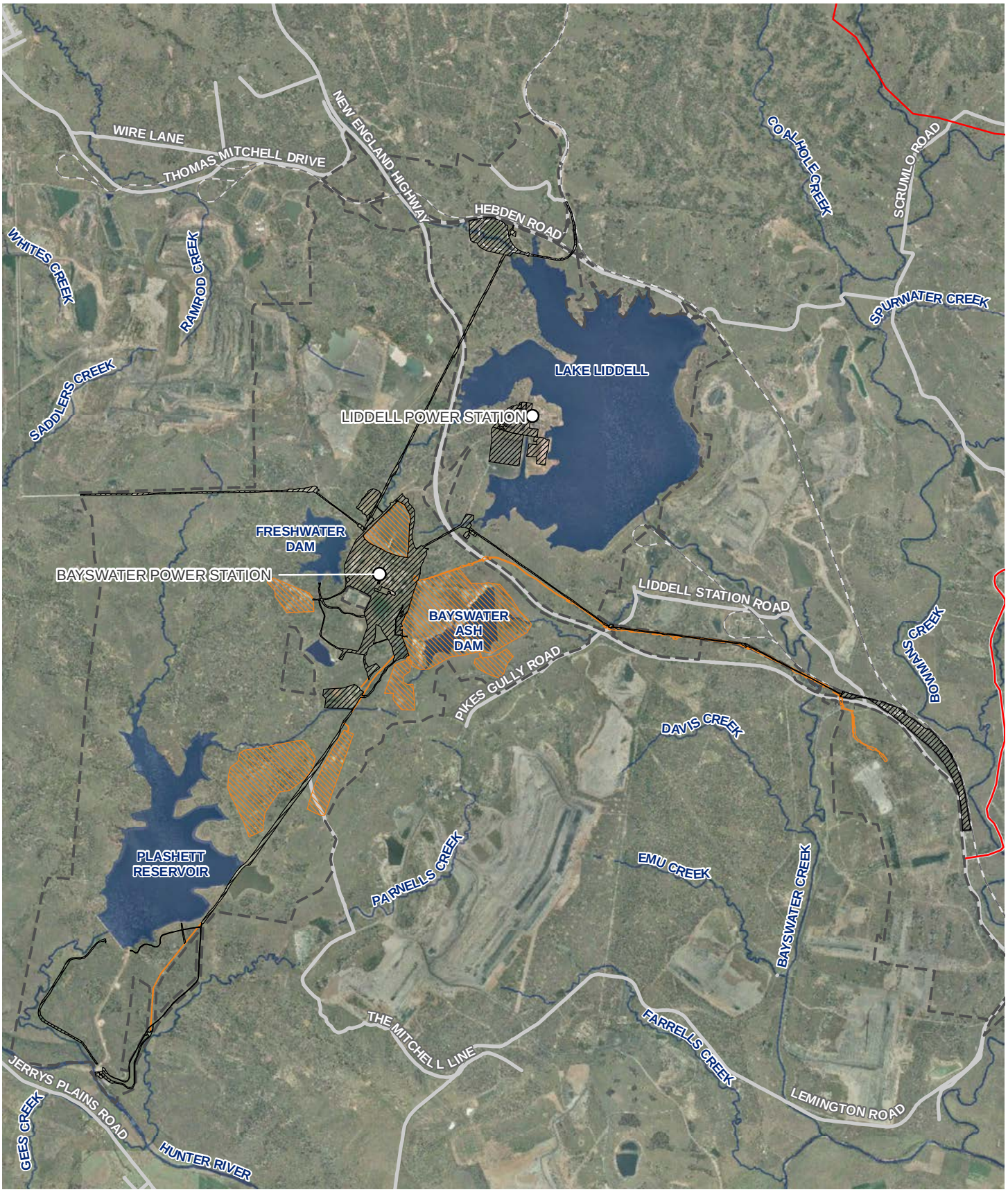

Legend

- Development site
- WOAOW footprint
- Cumulative third party projects
- AGL owned land
- Railway
- Road
- Waterway
- Waterbody

0 2 4km

1:90,000 at A4

N

Data sources

Jacobs 2021
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Figure 6 - 20 Exsiting and proposed projects within the AGLM landholding

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6.15.4 Cumulative impacts with other projects

Construction specific cumulative effects would most likely occur where construction works overlap in terms of timing and / or location with other local projects. Cumulative effects from construction activities usually relate to biodiversity, water, amenity (visual, air quality, noise and vibration), traffic and access. The scale of the impacts largely depend on the type of work, its duration, and the sensitivity of surrounding land uses.

The majority of the projects listed in **Table 6-45** would not interact with the Project in a manner likely to lead to any cumulative impacts due to the distance away from the Project. The other AGLM projects, Glencore projects and the various New England Highway upgrades near the Project do have the potential for cumulative impacts during construction.

The most immediate accumulation of impacts would be from the impacts of the Project in addition to other AGL and Glencore projects as there is an overlap of project areas, and possible overlapping of project construction periods. There is also the potential for cumulative traffic impacts from the various New England Highway upgrades which also may overlap with the Project construction period.

As the Project and other AGLM projects are mostly within the AGLM land holding, which includes extensive buffer lands around the site, minimal cumulative impacts on hazards, amenity (visual, air, noise and vibration), non-Aboriginal heritage and water off site are expected. Noting that the AQIA and NVA results as summarised in **Section 6.2** including cumulative impacts with WOAOW.

In addition, the Project and other AGLM and Glencore projects would implement management measures to reduce or mitigate environmental impacts and the majority of these impacts would be temporary and localised to the AGLM landholding and would unlikely contribute to impact in the broader region.

The other projects in the locality may have a more regional impact on transport, socio-economic and waste.

The cumulative impacts that may occur off site are discussed below.

6.15.4.1 Traffic and transport

Cumulative traffic impacts are expected due to additional traffic volumes that would be generated by the other projects in the locality which share the external road network, in particular the New England Highway.

The TTA (**Appendix C**) considered the cumulative impact of WOAOW, Bayswater Turbine Efficiency Upgrade, Ravensworth Composting Facility and the Liddell Decommissioning. These projects are expected to generate an additional 635 light vehicles and 46 heavy vehicles during the morning and evening peak hours in 2023.

In the future peak year, the cumulative impact of the Project and nearby developments would increase delays slightly, but would not have a large impact the operation of the interchange. This is mostly due to the grade separation of most conflicting movements and the provision of low angle merges. Queue lengths are expected to be very low and would not extend into nor impact the operation of the New England Highway. In addition, the New England Highway and the northbound and southbound entry ramps from the interchange have excess capacity to accommodate the additional cumulative traffic generation.

No impacts to management and emergency vehicle access are expected, as roads would remain open for these vehicles.

No cumulative transport operation impacts are expected.

6.15.4.2 Biodiversity

The Project is located in a part of the Hunter Valley that has had a long history of land clearing and disturbance resulting from development of Power Stations, roads, transmission lines, open-cut coal mines as well as widespread cattle grazing. However, the most immediate accumulation of impacts would be the additional land

clearing within the AGLM landholding from the Project in addition to those of the WAOAW Project. The cumulative direct vegetation removal impacts of the Project and the WOAOW Project is outlined in **Table 6-46.** These projects result in a relatively large cumulative impact occurring in a predominately modified and disturbed landscape.

Table 6-46: Cumulative impacts to native vegetation from the Project and the WOAOW Project

PCT ID No.	Plant community type name	Direct impact from the project (ha)	Direct impact from WOAOW (ha)*	Cumulative impact (ha)
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (moderate/good)	2.3	14.7	17
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Regrowth)	21.6	40.36	61.76
1691	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter – (Rehabilitation)	11.4	3.75	15.15
1691:	Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (Native Grassland)	2	147.77	149.7
1692	Bull Oak grassy woodland of the central Hunter Valley	1.2	61.64	62.84
1731	Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	0.9	2.4	3.3
1071	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	3	0	3
Total Native vegetation		**42.3**	**270.7**	**313.0**

6.15.4.3 Aboriginal heritage

Prior impact to large areas of land in the immediate surrounding region, and across the Hunter Valley overall, have increased the rarity of surviving Aboriginal sites in the region. However, the majority of impacts that would result from the Project are located within already disturbed and impacted areas. The Aboriginal sites the Project would impact are of low significance, being small artefact scatters, and are not rare site types in the Hunter Valley region.

The cumulative impact of the Project is assessed as being low, as the Project would not result in a substantial reduction in the region's Aboriginal archaeological resource.

6.15.4.4 Waste

The Project and other projects in the region would generate waste that would need to be disposed of offsite at a licensed facility. The Muswellbrook waste management facility is noted as a third party project and it is expected that the local waste facilities would have the capacities to accept the additional waste. Should local facilities be unable to accept the waste quantities from all projects, then there may be a requirement to transport the waste further distances to larger or other facilities. This may have the impact of longer and different waste haulage routes and additional traffic movements on the road network.

The Project contributes to cumulative waste impacts in the region and management measures are proposed to reduce waste requiring off-site disposal to the extent reasonable and feasible and as lawfully required.

6.15.4.5 Social and economic impacts

Potential cumulative socio-economic impacts include:

- Increased demand for local workers, directly on projects and in businesses that provide goods and services to various projects, increasing competition for local workers and potentially impacting the availability of local workers to support other industries such as tourism, mining and agriculture
- Increased demand for accommodation by construction workers, resulting in potential shortage of rental accommodation, tourist accommodation for tourists, visitors and seasonal workers and potentially exacerbating impacts on tourism operators and industry such as mining and primary producers.

It is expected that these impacts would be effectively managed through implementation of management measures for the respective projects, along with regular consultation with nearby / adjoining projects and key stakeholders about the timing of activities that have potential to result in cumulative impacts.

No cumulative operation socio-economic impacts are expected as a result of the Project.

6.15.5 Environmental management measures

Environmental management measures for potential cumulative impacts are provided in **Table 6-47.** Other management measures that would address cumulative impacts are presented in **Section 6.1** to **Section 6.14**.

Table 6-47: Environmental management measures for cumulative impacts

Reference	Environmental management measures	Timing
CL1	The CEMP will include a process to review and update management measures if any other development commences in proximity to the Project.	Pre-construction

6.16 Long term management

This section provides a summary of assessments of the potential long term management impacts of the Project to address the following SEARs:

- ***Long Term Management*** *– including an assessment of impacts associated with the operation and maintenance of the proposed facilities, including inspection arrangements and measures to ensure its integrity.*

6.16.1 Assessment methodology

The assessment of impacts associated with operation and maintenance of proposed facilities has taken the following approach:

- Operation and maintenance of existing infrastructure associated with approvals to be consolidated would continue as per existing arrangements with no additional impacts and is not required to be assessed further
- The operation and maintenance of the Project facilities including the Battery, Decoupling and specified BAW components has been described in the Project description (refer to **Section 2.2.3** and **Section 2.6**) and assessed as part of the assessment of specific environmental aspects
- The risk assessment undertaken in **Section 8** has identified residual risks associated with the ongoing operation and maintenance of existing Bayswater ancillary infrastructure and these have been assessed as part of the assessment of specific environmental aspects.

A summary of the findings of assessments of specific environmental aspects as they relate to long term management is provided in the following sections.

6.16.2 Existing environment and management and maintenance context

The Project is within the existing operational areas of Bayswater and Liddell and as such would be subject to an established management and maintenance regime.

Bayswater and Liddell operate under an Environmental Management System (**EMS**) that is integrated with AGL's information management system. The EMS is currently ISO 14001 equivalent. The EMS includes a series of management plans and procedures to assess and mitigate risks associated with air, water, waste, biodiversity, heritage and land management issues. Other important documents include the Pollution Incident Response Management Plan (**PIRMP**) required under EPL 779 and EPL 2122, the Emergency Management Plan and Emergency Response Plan. EPL 779 and EPL 2122 stipulate the discharge points to air and water as well as waste management requirements. The EPLs also stipulate monitoring requirements and limits for discharges from these points.

All site specific plans and procedures are developed to address AGL standards which include:

- AGL-HSE-STD-009.1 – Land Standard
- AGL-HSE-STD-009.2 – Groundwater Standard
- AGL-HSE-STD-009.3 – Surface Water Standard
- AGL-HSE-STD-009.4 – Air Emissions Standard
- AGL-HSE-STD-009.5 – Noise Emissions Standard
- AGL-HSE-STD-009.6 – Biodiversity Standard
- AGL-HSE-STD-009.7 – Waste Standard
- AGL-HSE-STD-009.8 – Cultural Heritage Standard
- AGL-HSE-STD-009.9 – Greenhouse Gas emissions Standard.

The following management plans of relevance to the Project are implemented on site:

- AGLM-HSE-PLN-009.01 Land Management Plan
- AGLM-HSE-PLN-009.02 Water Management Plan
- AGLM-HSE-PLN-009.02.1 Tinkers Creek Trigger Action Response Plan
- AGLM-HSE-PLN-009.02.2 Groundwater Trigger Action Response Plan
- AGLM-HSE-PLN-009.02.3 LD EPL_12 _13 Trigger Action Response Plan
- AGLM-HSE-PLN-009.04 Air Quality Greenhouse Gas and Noise Management Plan
- AGLM-HSE-PLN-009.04.1 Dust Trigger Action Response Plan
- AGLM-HSE-PLN-009.07 Waste Management Plan
- AGLM-HSE-PLN-010.02 Pollution Incident Response Management Plan Version 18
- AGLM-HSE-PLC-008.01 Environment Directory
- AGLM-PSSI-HSE-40 Power Stations Standing Instruction No. HSE 40/1 Bushfire Risk Management Plan.

These plans would be reviewed and updated as required to incorporate the environmental management commitments and any conditions of approval for the Project.

6.16.3 Potential impacts

The Project would introduce the following new infrastructure requiring revised management measures:

- The Battery

- Transformer compounds associated with Decoupling and the Battery connection to the Liddell switchyard
- Emergency Power System
- Formalised waste storage area
- New water management infrastructure associated with the environmental improvement projects
- Brine concentrator return water pipe.

The predicted and potential operational impacts of the Project are considered for each environmental aspect in **Section 6.1** to **Section 6.14**. **Table 6-48** summarises the Project's potential impacts arising from the operation and maintenance of the proposed infrastructure and how it has been assessed.

Table 6-48: Summary of operational and maintenance impacts

Environmental Aspect	Impact mechanism	How assessed	Summary of impact
Access	The operation of the Battery would require approximately three additional workers. No other Project component would require an increase in operational traffic.	Traffic impact assessment has considered cumulative impacts associated with the Project.	Traffic impacts associated with operation and maintenance would be significantly less than construction movements assessed and indistinguishable from variability within existing background traffic numbers.
Air	▪ The normal operation of Project components would not introduce emissions to air beyond existing operations. ▪ Testing and use of Emergency power system would involve combustion of diesel consistent with the existing scenario.	Use of emergency power system assessed qualitatively in air quality assessment and considered part of background conditions.	No increase over existing air quality impacts.
Amenity - Noise	▪ The operation of the Battery and Decoupling would introduce new noise sources. ▪ Maintenance of existing and proposed infrastructure within the BAW footprint has associated noise impacts typical of existing situation.	Operational noise impacts assessed in Noise and Vibration Impact Assessment (Refer to **Section 6.4.4** and **Appendix J**).	No exceedances of operational noise criteria predicted.
Biodiversity	Operation and maintenance of existing and proposed infrastructure would require vegetation clearing limited to the disturbance footprint associated with construction impacts.	Biodiversity impacts are assessed in BDAR (refer to **Section 6.6** and **Appendix E**).	The ongoing clearing of regrowth within the Disturbance site would be required and results in the ongoing reduction of biodiversity values which has been assessed and would be offset in accordance with the BOS.
Built environment	The Battery and Decoupling infrastructure may be visible from publicly accessible locations.	Impacts to the built environment are assessed in the VIA (Refer to **Section 6.10** and **Appendix K**).	Existing and proposed infrastructure is in keeping with the existing built environment which is dominated by energy generation and transmission infrastructure.
Social and Economic	▪ The maintenance of the Project would provide employment for three people associated with monitoring and maintenance of the Battery.	Consideration of Project alignment with Strategic policy context of the NEM. The economics of the Project would be	The Project operation is considered to have positive economic impacts in addition to the significant private investment that would be associated with construction.

Environmental Aspect	Impact mechanism	How assessed	Summary of impact
	▪ The Battery operations would contribute to the stability and reliability of the NEM with energy storage a key component of the identified least cost future of electricity supply (AEMO, 2020) associated with renewable generation. ▪ The Decoupling and BAW facilitates the ongoing operation of Bayswater identified as critical to the NEM as it transitions to a low carbon future and the continued operation of other infrastructure operations which rely on power supply via the Liddell station transformers.	considered by AGLM in their financial investment decision.	
Hazards and risks	As described in the PHA (**Appendix G**).	A PHA has been undertaken considering operational and maintenance risks and hazards (Refer to **Section 6.1** and **Appendix G**).	Hazards and risks associated with Project operation are able to be reduced as far as reasonably practicable and would not result in offsite impacts.
Heritage	Operation and maintenance of existing and proposed infrastructure would require ongoing use of the disturbance footprint associated with construction. No non-Aboriginal heritage has been identified as present on site and as such no potential for impacts from operations is likely.	Heritage impacts are assessed in the Aboriginal cultural heritage impact assessment (Refer to **Section 6.8** and **Appendix F**).	No additional heritage impacts are identified as resulting from operation and maintenance of existing or proposed infrastructure.
Land	The operation of existing and proposed infrastructure has land and contamination risks consistent with existing operations.	The land and contamination impact assessment contains assessment of operational risks (Refer to **Section 6.7** and **Appendix D**).	With the implementation of standard environmental controls, no significant land and contamination impactsare likely to result.
Water	The operation of existing and proposed infrastructure would not affect how water is used and stored on site. Water supplies would be taken from existing AGLM allocations.	**Section 6.12** assesses Water impacts including for operations.	The operation of the Project would not change the water use or the site water management system or require any new water discharge points under the EPLs held for the sites.

6.16.4 Environmental management measures

The existing environmental management plans and procedures applying to the operation and maintenance activities of Bayswater and Liddell would be updated to accommodate additional infrastructure and activities occurring on site. No additional controls specific for operations and maintenance beyond those identified under specialist assessment of specific environmental aspects are deemed necessary.

The management and management measures recommended for the Project discussed and summarised in **Section 7**. The acceptability of residual impacts are assessed in **Chapter 8**.

7. Management and monitoring measures

This chapter provides a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS, and how these measures would be integrated with the existing environmental management, monitoring and reporting regime for Bayswater.

7.1 Existing arrangements

As described in **Section 6.16.2**, Bayswater and Liddell operate under an EMS, which includes a series of management plans and procedures to assess and mitigate environmental risks. Other important documents include the PIRMP required under EPL 779 and EPL 2122, the Emergency Management Plan and Emergency Response Plan. These plans/ procedures would be reviewed to incorporate the environmental management commitments and any conditions of approval for the Project.

7.2 Project environmental commitments

7.2.1 Ongoing design strategy

Detailed design for the Project is yet to be completed. The EIS is based on a current design status for each Project component which may be amended through the detailed design process. Construction methods may also vary subject to design refinements and the selection of the construction contractor.

The assessment of the Project within the EIS is based on consideration of reasonable worse case environmental impacts to allow flexibility in design and construction methodology. The ongoing design of Project components would deliver the identified performance outcomes for the Project as identified in the EIS.

Following the engagement of a contractor for each Project component, a risk assessment would be completed on the actual methods to be implemented and an environmental management plan prepared that incorporates the Project commitments and conditions of approval. Further consultation with relevant agencies would be undertaken and necessary approvals of final designs and methods sought. AGLM would comply with any pre-construction compliance obligations prior to the commencement of all Project components. The risk assessments, final design plans and management plans would be used to confirm that no greater impact than that assessed in this EIS would occur.

7.2.2 Construction environmental management strategy

Given the various Project components, individual construction packages most likely would be tendered and delivered by a variety of contractors, each implementing construction works in accordance with their own management systems and processes. To manage this AGLM proposes to develop an overarching Construction Environmental Management Strategy (**CEMS**) for the Project that would be adopted and implemented through the development of contractor's CEMPs. The CEMS would document the required environmental performance outcomes, management commitments and conditions of approval for the Project and each CEMP would document reasonable and feasible measures for the Project component to to implement and document these requirements.

7.2.3 Operational environmental management strategy

The existing operational EMS for Bayswater and Liddell would be reviewed to incorporate commitments and approval conditions associated with the Project. In particular, the Battery component represents a new operation that would warrant new or revised management plans. This would include the preparation of an emergency response plan as recommended by the PHA.

7.3 Consolidated summary of environmental management measures

A summary of environmental management measures for the Project are shown in **Table 7-1**. Given the design status of the Project, mitigation measures are largely management based or prescriptive.

Table 7-1: Summary of environmental management measures

Reference	Environmental management measures	Timing
Hazard and risk		
HR1	During detailed design for the Project: ▪ A detailed bushfire threat assessment will be conducted for the Project, including establishment of an APZ, in consultation with the **RFS** ▪ The separation distance between infrastructure within the Battery will be determined in accordance with applicable Codes and Standards and manufacturer's recommendations so that the preferred strategy of allowing a fire in one Battery enclosure or inverter to burn without the risk of propagating to other infrastructure can be maintained without the need for external firefighting ▪ The separation distance within the Battery will be determined in accordance with applicable Codes and Standards and manufacturer's recommendations to allow safe escape in case of a fire The need for active firefighting requirements at the Battery will be determined in consultation with RFS and the DPIE. Detailed fire fighting response and any need for fire water containment will be assessed and reported (e.g. in the format of a Fire Safety Study) post development approval, for review by DPIE, Fire rescue NSW and the RFS ▪ The health and safety associated with EMF on the site and the potential exposure to EMF will be considered for AGLM staff and contractors as part of AGLM's obligations for their health and wellbeing under the Work Health and Safety Regulations ▪ Measures to prevent a leak occurring from the brine pipeline, the emergency diesel generators and at the Battery, and for secondary containment should a leak occur, will be be included as part of the detailed designof the Project. The likelihood of a significant loss of containment event associated with this Project (Level 4) will be designed to Rare in accordance with AGL's Risk Management and Assessment Standard The register of commitments (Appendix 1 of the PHA (Planager Pty Ltd, 2021)) will be integrated into the management for the Project. This includes integration of 84 individual commitments, including for the design, installation and maintenance of the Battery automatic shutdown system on exceedance of safe limits; installation of deflagration venting and fire protection inside the Battery enclosures; design of the brine pipeline, waste oil facility, emergency diesel generators and the Battery such that the risk of pollution from a release is reduced to ALARP; installation of protective barriers, including at the transformers; and application of a rigorous and formal management of	Detailed design

Reference	Environmental management measures	Timing
	change process for the Project, including detailed hazard identification and risk assessment processes.	
HR2	Design and selection of all electrical equipment is to minimise EMF levels and comply with ICNIRP reference levels	Detailed design
HR3	Risks associated with the Project will be managed through a Management of Change process. AGLM implements an Asset Change Management Standard, and any major change (defined as a change that has major implications to the strength, stability, operation and design of the asset and/or health and safety of employees) must undergo a detailed risk assessment using the AGL Risk Management and Assessment Standard to assess the risks that may be introduced by the proposed change. This will be undertaken for all Project components and appropriate controls implemented to reduce the risk to an acceptable level.	Prior to construction
HR4	Storage and management of dangerous goods and hazardous materials (if required) will occur in a safe, secure location consistent with the requirements of applicable Australian Standards.	Construction/ operation
HR4	The need to store or handle additional dangerous goods or hazardous substances will be subject to additional risk consideration prior to being undertaken.	Construction/ operation
HR5	Refuelling will take place in a designated area within the works area, away from ignition sources and trees or vegetation and with appropriate controls to prevent any spills coming into contact with the ground.	Construction/ operation
HR6	Appropriately stocked emergency spill kits will be available at all work areas at all times. All staff will be made aware of the location of the spill kit and trained in its use.	Construction/ operation
HR78	Temporary construction compounds will be maintained in a tidy and orderly manner to minimise potential fuel loads in the event that any construction compounds are affected by fire.	Construction
HR8	Construction activities involving flammable materials and ignition sources (for example, welding) will be proactively managed to ensure that the potential for fire is effectively minimised. High risk construction activities, such as welding and metal work, would be subject to a risk assessment on total fire ban days and restricted or ceased as appropriate. Construction personnel will be inducted into the requirement to safely dispose of cigarette butts.	Construction
HR9	An emergency response plan for the Battery would be prepared for the Project and provided to the Local Emergency Management Committee.	Construction/ operation
Air quality		
AQ1	The following will be undertaken to manage fugitive emissions from stored chemicals: ▪ Limiting the quantity of chemical products stored at the site to the extent practical ▪ Ensure that all storage tanks are fitted with the appropriate controls in-line with the Protection of the Environment Operations (Clean Air) Regulation 2010.	Construciton /operation

Reference	Environmental management measures	Timing
AQ2	During loading and unloading of materials, the following will be undertaken: ▪ Water sprays as applicable ▪ Minimising drop heights ▪ Reviewing and where necessary modifying or suspending activities during dry and windy weather and elevated background air quality conditions.	Construction
AQ3	While hauling materials in trucks, the following will be undertaken: ▪ Regular watering of unsealed haulage routes ▪ Regular inspection and removal of debris from plant and equipment to avoid the tracking of materials on to the adjacent road network.	Construction
AQ4	The following will be undertaken to manage exhaust emissions from plant and equipment: ▪ Inspecting all plant and equipment before it is used on-site ▪ Ensuring that all vehicles, plant, and equipment are operated in a proper and efficient manner ▪ Switching off all vehicles, plant and equipment when not in use for extended periods ▪ Avoiding the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.	Construction
AQ5	Activities will be co-ordinated between the Project and the WOAOW project to limit the potential for cumulative dust impacts where possible.	Construction
AQ6	The following will be undertaken to manage wind erosion from stockpiles and exposed surfaces: ▪ Watering stockpiles and exposed surfaces ▪ Progressive rehabilitation of exposed surfaces (as feasible) where no longer required for construction.	Construction
Greenhouse gases		
GHG1	The CEMP will include requirements for identification and minimise GHG during construction.	Construction
Noise and vibration		
NV1	The CEMP would identify project construction activities with the potential to have noise impacts and the controls required to avoid, minimise and mitigate these impacts. The standard techniques for controlling noise impacts during construction are presented in the ICNG. During construction relevant standard measures as outlined in Section 6 of the ICNG will be implemented.	Construction
Traffic and transport		
TT1	The haulage contractor will prepare and implement a CTMP for oversized overmass vehicle movements, which will include: ▪ Identification of the routes ▪ Measures to provide an escort for the loads	Pre-construction and construction

Reference	Environmental management measures	Timing
	▪ Times of transporting to minimise impacts on the road network ▪ Communication of strategy and liaising with emergency services and police.	
TT2	An oversized vehicle permit will be sought for all OSOM movements where required. The OSOM movements would be in accordance with the permit requirements and be outside of peak traffic periods where possible.	Pre-construction and construction
TT3	The CEMP and general site induction will inform construction and operational personnel of the risk of collisions, particularly with animals during rain or periods of low light.	Construction and operation
Biodiversity		
B01	Opportunities to limit the extent of vegetation clearance required would be considered as part of detailed design and construction planning. This would include: ▪ Detailed design to avoid PCTs with higher integrity scores to the extent practicable ▪ Confirmation of actual disturbance footprint for each Project component ▪ Recalculation of biodiversity credit requirements ▪ Provision of final layout plans and agreement of associated biodiversity credit requirements to DPIE and BCD ▪ Retirement of biodiversity credits prior to commencement of construction for each Project component (or sub-component).	Pre-construction
B02	The regime for managing biodiversity impacts would be documented and implemented through a Flora and Fauna Management Plan and include the following requirements: ▪ Clearly delineate the boundaries of the development site as refined through the detailed design process to prevent any unnecessary clearing beyond its extent. This would include delineation and protection of the 2.04 ha patch of PCT 1691 to the west of Bayswater which is to be retained. ▪ Ensure vehicle and equipment parking areas and stockpile areas are identified and sited to avoid areas containing ecological value ▪ Install appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' ▪ Identify and communicate the location of any 'No Go Zones' in site inductions ▪ Speed limits within the Project area would be limited to 40 km/hr to minimise the risk of vehicle collision with fauna. The Flora and Fauna Management Plan would also consider measures to mitigate impacts on flora and fauna from noise, vibration, waste, and air pollution, in accordance with the mitigations identified in this EIS. The Flora and Fauna Management Plan would also include how impacts to biodiversity would be reported and is expected to include documentation of evidence of commitments and conditions of approval being implemented for inclusion in post approval compliance auditing and reporting.	Pre-construction

Reference	Environmental management measures	Timing
B03	The following measures will be established to manage impacts to vegetation adjacent to the development site: ▪ Materials, plant, equipment, work vehicles and soil/rock stockpiles will be placed to avoid damage to surrounding vegetation and outside tree drip-lines. Construction workers and vehicles will not access areas beyond the delineated development site. Detailed design will determine if further retainment of native vegetation is possible ▪ Erosion and sediment controls will remain in place until rehabilitation has been completed. Drainage lines will be protected from runoff and stockpiling of spoil ▪ Limits of the development site (only where native vegetation exists) will be accurately and clearly marked out prior to commencement of works. No activities including parking and turning of vehicles and plant / equipment will occur beyond the development site in association with the Project.	Design, pre-construction, construction
B04	An inspection of native vegetation to be impacted (within the development site) will be conducted by an ecologist immediately prior to vegetation clearing works (to confirm absence of fauna species). A Spotter/Catcher ecologist will supervise vegetation clearing. Construction machinery will be checked for sheltering fauna prior to use. In the unlikely event that fauna is present, works should cease until animals can be captured and removed from the development site. Construction crews will be made aware that any native fauna species encountered must be allowed to leave site without being harassed. Trenches / holes will be inspected each morning and any trapped fauna will be removed or a mechanism for fauna to escape will be provided, such as a soil or timber ramp.	Pre-construction, construction
B05	The following measures will be in place to manage impacts to soil and soil seed bank: ▪ Where native vegetation is removed, top soil will be retained from excavation areas within the development site (where possible). Top soil stockpiles must be delineated and protected from machinery compaction and contamination during construction. Following construction and infill, top soil will be re-spread over impacted native vegetation areas (to retain native seedbank and assist with natural revegetation). Stockpiling in the vicinity of drainage lines will be avoided ▪ Woody debris (logs and mulch) produced during vegetation clearing will be re-spread over any cleared areas to protect the soil surface from erosion and to aid habitat restoration where appropriate.	Construction
B06	If required, weed control will be undertaken by suitably qualified and / or experienced personnel. This may include: ▪ Manual weed removal in preference to herbicides ▪ Replacing non-target species removed / killed as a result of weed control activities ▪ Protecting non-target species from spray drift ▪ Using only herbicides registered for use within or near waterways for the specific target weed	Construction

Reference	Environmental management measures	Timing
	▪ Not applying herbicide if it is raining or if rain is expected ▪ Mixing and loading herbicides and cleaning equipment away from waterways and drains. The CEMP will detail the procedures for management of weeds on the development site (which will be in accordance with the requirements of the *Biosecurity Act 2015*).	
B07	Pathogen management measures will be in place to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi. The CEMP will provide a protocol for construction vehicles driving to and from site to prevent the spread or introduction diseases.	Construction
Land and contamination		
L01	The internal bunding and environmental controls for hazardous substances management suitable for the Battery and transformers will be in accordance with applicable guidelines.	Detail design
L02	Potential contamination-related impacts associated with the Project will be managed by the implementation of a CEMP that includes (but not limited to): ▪ An unexpected finds protocol for the appropriate assessment and management of encountered contamination to mitigate impacts to the development ▪ Procedures to ensure that all material excavated during the construction of the development is appropriately assessed and classified before being disposed of in accordance with environmental laws ▪ Specific control measures to mitigate impacts to soil, water, air, noise, traffic, structures and clear protocols for measurement of affected media and validation of results during construction of the development.	Construction
L03	The Asbestos Management Procedure would be updated as required to provide appropriate control measures during the construction phase (as well as the operational phase if maintenance activities are required) to mitigate any risks of worker exposure to airborne asbestos fibres during work activities.	Construction/ operation
L04	Detailed design of each Project component would consider and address geotechnical stability risks in accordance with applicable design standards.	Detailed design
Aboriginal heritage		
AH1	A Cultural Heritage Management Plan (CHMP) will be developed. It will include the methodologies developed in the ACHAR (Section 11.1, 11.2 and 11.3). It will specify that project works will be restricted to the disturbance site. It will include provisions to ensure workers are made aware of cultural heritage places and their value, for example through project inductions. The CHMP will include provisions to guard against indirect impact to the Aboriginal sites near the development site.	Pre-construction
AH2	If repair or maintenance works on the Liddell to Jerrys Plains High Pressure Pipeline are required, the area of works will be subject to	Pre-construction

Reference	Environmental management measures	Timing
	surface collection in accordance with Section 11 of the ACHAR (**Appendix F**) of impacted sites. The sites that maybe impacted include: ▪ Liddell Jerrys Plains Pipeline AS1 (37-2-6280) ▪ Liddell Jerrys Plains Pipeline IF2 (37-2-6281) ▪ Liddell Jerrys Plains Pipeline AS3 (37-2-6279) ▪ Liddell Jerrys Plains Pipeline IF4 (37-2-6291) ▪ Liddell Jerrys Plains Pipeline AS5 (37-2-6290) ▪ Liddell Jerrys Plains Pipeline AS6 (37-2-6289) ▪ Liddell Jerrys Plains Pipeline IF7 (37-2-6287) ▪ Liddell Jerrys Plains Pipeline IF8 (37-2-6288) ▪ Liddell Jerrys Plains Pipeline AS9 (37-2-6286) ▪ Liddell Jerrys Plains Pipeline AS10 ▪ BAYS AS06 (37-2-6145). If no works are required in the vicinity of a site, the site will be conserved.	
AH3	If practicable, the design and construction of the Brine Pipeline will avoid the two recorded site areas (Liddell Pipeline AS1 (37-2-6285) and Liddell Pipeline AS2 (37-2-6282)). The sites will be protected with high visibility fencing. If impact cannot be avoided, the sites will be salvaged through surface collection.	Design, pre-construction, construction
AH4	During any works on the Liddell M1 Conveyor the site (Liddell M1 Conveyor AS1 (37-2-6284)) will be conserved and protected by high visibility exclusion fencing to prevent impact.	Construction
AH5	The Unanticipated Finds Protocol in the ACHAR will be followed for any previously unidentified Aboriginal heritage objects found during the works.	Construction and operation
Non-Aboriginal heritage		
NAH1	Should any historical archaeological remains be discovered during construction, all works will stop, the area cordoned off and a heritage professional engaged to examine and advise on the significance of the archaeological finds. If deemed to be of significance, under section 146 (**s146**) of the Heritage Act, a s146 form would be submitted to notify the Heritage Council of the discovery of relics. Further investigation may be required, and appropriate management will be agreed through consultation with Heritage NSW.	Construction
NAH2	In the unlikely event that human remains are uncovered, all work must cease immediately in the vicinity of the remains and the area cordoned off. The local NSW Police must be notified, who would make an initial assessment as to whether the remains are part of a crime scene, or Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be contacted as per AH4.	Construction
Landscape character and visual		

Reference	Environmental management measures	Timing
V1	Retention and enhancement of existing landscape features (areas of scrub, individual trees) will be considered where feasible.	Design
V2	Colour of proposed structures and built form will be considered in a suitable muted palette to visually integrate the Project within the landscape where possible.	Design
V3	Where possible, consider minimal use of reflective surfaces to avoid drawing attention to the site within views due to reflective glare.	Design
V4	Limit the area of disturbance during construction where possible.	Construction
V5	Mitigation tree and shrub planting will be considered to visually integrate the Project within the surrounding landscape.	Construction
V6	▪ All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and will be removed from the site following the completion of construction ▪ Stockpiles will be stabilised to prevent erosion by wind and water and avoid the development of dust plumes adversely impacting air and visual quality ▪ On completion of the work disturbed areas will be stabilised and rehabilitated.	Construction
Waste		
WR01	A Waste Management Plan will be developed for the Project with the following criteria: ▪ A hierarchical waste management approach will be used, from the most preferable (reduce, reuse or recycle wastes) to the lease preferable (disposal) to prioritise waste management strategies to avoid waste generation ▪ The plans will promote the use of materials with minimal packaging requirements, removal of packaging offsite by suppliers and fabrication of parts offsite ▪ Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors ▪ All waste types will be separated at source for recycling ▪ A licensed service provider will be appointed to collect waste during construction and operation ▪ Each waste type will be classified for transport to ensure correct handling. ▪ Any waste that cannot be recovered or recycled will be disposed of at a suitably authorised or licensed treatment or disposal facility where it will be treated and disposed of according to its classification.	Detailed design
WR02	▪ Cleared vegetation will be either mulched for onsite reuse or used to created habitat piles, noting that any weeds and pathogens will be managed according to requirements under the *NSW Biosecurity Act 2015.*	Construction
Water (surface water and groundwater)		

Reference	Environmental management measures	Timing
W1	The specific requirements for water quality controls will be confirmed as the detailed design develops and prior to commencement of construction of each Project component, to ensure the objectives of the Project are achieved.	Pre-construction
W2	The following measures will be undertaken to manage activities in proximity to waterways: ▪ Works within waterfront land will be managed in accordance with the relevant guideline as deemed appropriate ▪ Implementing practices to minimise disturbance of banks and undertake bank stabilization ▪ Appropriate drainage features will be incorporated into the design of the Project components by a suitably qualified and experienced professional. All Project components will be designed and constructed in accordance with relevant guidelines.	Pre-construction and construction
W3	Stockpiles would be managed to minimise the potential for mobilisation and transport of dust, sediment and leachate in runoff. This would include: ▪ Minimising the number of stockpiles, area used for stockpiles, and time that they are left exposed ▪ Locating stockpiles away from drainage lines, waterways and areas where they may be susceptible to wind erosion Stabilising stockpiles, establishing appropriate sediment controls and suppressing dust as required.	Construction
W4	Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and Volume 2D commonly referred to as the "Blue Book" where appropriate. Additionally, any water collected from worksites will be treated and discharged (where able) to avoid any potential contamination or local storm water impacts. Measures will be designed in accordance with the relevant guideline where appropriate.	Construction
W5	Water use during construction will be minimised where possible and measures to reduce water use will be applied.	Construction
W6	The Bayswater site operational water quality monitoring program will be updated and implemented as required.	Pre-operation and operation
Social and economic		
SE1	AGLM will keep the community and stakeholders updated on the project via the existing community engagement forum and AGL website	Pre construction
SE2	Identify opportunities to maximise the use of local suppliers, labour and businesses in the provision of goods and services for construction.	Construction
SE3	Consultation with local tourist accommodation providers to identify peak tourist periods and consider timing of these periods in the planning of non-time-critical construction activities.	Construction
Infrastructure		

Reference	Environmental management measures	Timing
I1	AGLM will continue to consult with TransGrid and ETMC regarding any perceived impacts on the Liddell switchyard.	Pre-construction
I2	AGLM will consult with Ausgrid as the network provider responsible for other onsite supply regarding continued supply.	Pre-construction / construction
Cumulative		
CL1	The CEMP will include a process to review and update management measures if any other development commences in proximity to the Project.	Pre-construction

8. Environmental risk assessment

This chapter outlines the environmental risk analysis process and identifies key environmental risks associated with the Project. This assessment addresses the following SEARs:

- ***Environmental Risk Analysis*** *- Notwithstanding the above key assessment requirements, the EIS must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed management measures and potentially significant residual environmental impacts after the application of proposed management measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the EIS.*

8.1 Assessment methodology

The process to assess environmental risk has involved:

- Undertaking a preliminary environmental investigation as part of the *Liddell Battery and Bayswater Ancillary Works -scoping Report* (Jacobs, 2020c) to identify key environmental issues, support the SSD application for the Project, and help to inform the Project SEARs
- Assessing the key issues presented in the SEARs that were issued for the Project as summarised in Chapter 6 (see **Appendix A** for a complete list of the SEARs)
- Undertaking an environmental risk analysis to confirm the potential environmental issues associated with the Project following the outcomes of the detailed assessments presented in **Chapter 6** and implementation of management measures presented in **Chapter 7** as presented in this chapter.

The risk assessment has adopted the general approach outlined in the DPIE (undated) *Preparing a Scoping Report State Significant Development Guide: Exhibition Draft*. This approach emphasises consideration of the scale and nature of impacts and sensitivity of the receiving environment. The risk assessment is as such more descriptive than traditional risk rating approaches.

The environmental risk analysis was carried out to identify those issues that would require a more detailed assessment in this EIS to ensure environmental impacts were properly identified and project specific management measures are developed. As required by the SEARs, the identification and assessment of key issues has continued during the preparation of the EIS. Emphasis was placed on using the detailed information gathered during the assessment process to review the environmental aspects of the Project. More specifically, the analysis:

- Identified potential impacts, including issues identified in the SEARs and other issues identified whilst undertaking detailed environmental assessments
- Identified environmental management measures in relation to each identified impact
- Identified residual environmental impacts that may remain following the implementation of identified environmental management measures for each impact.

The key environmental issues identified in the SEARs and other issues identified for the Project are assessed in **Chapter 6**. **Chapter 7** presents a summary of the management measures, while cumulative impacts that may be associated with the Project are assessed in **Section 6.15**.

The management approaches for residual impacts are discussed in **Section 8.3**.

8.2 Environmental risk analysis

The assessment of identified environmental impacts was based on the Project as described in **Chapter 2**. Impacts for each identified environmental aspect were assessed at a level commensurate to the degree and significance of the likely impact, with a focus on avoiding or minimising impacts, for example through altering the design or construction method.

To minimise potential impacts to an acceptable level, management measures were developed for those identified impacts that could not be avoided and these are presented in **Chapter 7**.

Environmental management measures will be implemented during construction under a CEMP, while measures to be implemented during operation will carried out as part of AGLM's standard management practices as described in **Chapter 7**.

Detailed design will further seek to avoid and minimise identified environmental impacts where practicable. The identified management measures will also be reassessed during detailed design for their effectiveness and appropriateness.

The environmental risk analysis is presented in **Table 8-1**. The analysis has considered all key issues identified by the SEARs, as well as other environmental issues identified through the preparation of the EIS that have the potential to be impacted by the Project. Refer to **Chapter 6** for detailed assessments of each issue. It is noted that positive impacts, while discussed throughout **Chapter 7**, have not been considered in the environmental risk analysis, as they would not introduce an environmental risk.

Table 8-1: Environmental risk analysis summary

Aspect	How assessed	Summary of findings	Scale of impact	Nature of impact	Sensitivity of receiving environment	Management measure	Residual impacts	Additional assessment or controls required
Access	Specialist assessment including cumulative impacts	While a large number of vehicles are required in construction for deliveries and workers, intersection function is not compromised and roads used have surplus capacity.	The additional vehicle movements associated with construction stages may coincide with other development in the vicinity of the Project. Impacts would be limited to Roads that form part of existing heavy vehicle networks and do not exceed capacity.	Direct impacts in the form of increased traffic forming a small percentage of existing traffic. Cumulative impacts are likely and have been assessed and considered in the findings and development of environmental management measures.	Low. The road network that would be used accommodates significant freight and workforce movements associated with Hunter Valley mining operations and national freight movements and is fit for purpose.	Standard management measures are proposed to reduce impacts to the extent reasonable and feasible.	Residual impacts are considered low.	Assessment has considered all Project impacts. No further assessment is considered necessary. A CTMP would be developed post approval.
Air	Specialist assessment including cumulative impacts	The Project would not result in changes to local air quality outside of historical variations and would not be the cause of exceedances of air quality criteria.		Direct impacts from dust-generating activities during construction. Cumulative dust impacts are anticipated given the Project and the WOAOW project have the potential to take place simultaneously.	Low. The nearest sensitive receiver location is about 1 km from the Project and background concentrations occasionally exceed air quality criteria.	Standard management measures are proposed to reduce impacts to the extent reasonable and feasible. Co-ordination of the Project and the WOAOW project activities would limit the potential for cumulative impacts.	Residual impacts are considered low.	Assessment has considered all Project impacts including a conservative assessment of cumulative impacts. No further assessment is considered necessary.
Amenity (such as noise, vibration,	Specialist assessments and Scoping report	The Project would not have odorous qualities, characteristics or attributes.	During construction amenity impacts would be limited to AGLM personnel, contractors and	Direct visual impact as a result of new infrastructure in the landscape.	Low. The surrounding landscape is already heavily influenced by industrial activity	Standard management measures are proposed to	Residual impacts are considered low.	Assessment has considered all Project impacts. No further

Aspect	How assessed	Summary of findings	Scale of impact	Nature of impact	Sensitivity of receiving environment	Management measure	Residual impacts	Additional assessment or controls required
odour and visual)		Visual impacts during construction would include clearing of vegetation, generation of wastes and construction activities. During operation, new Project infrastructure may introduce a chance in the landscape.	construction workers. During operation, there would be limited views from publicly accessible locations and consistent with the existing surrounding infrastructure.		associated with coal mines, power generation and transportation. The Project would not have a significant impact on local amenity.	reduce impacts to the extent reasonable and feasible.		assessment is considered necessary.
Biodiversity	Specialist assessment	Impacts to terrestrial biodiversity has been largely avoided and/or minimised. The limited amount of native vegetation (mostly rehabilitation or regrowth) that would be disturbed is of poor to moderate quality and threatened species habitats are limited.	The Project may require clearing of up to 42.3 ha of native vegetation/habitat. This includes about 13.9 ha of one BC Act listed TEC.	Direct impacts due to the removal of native vegetation and habitat.	Low. The development site is located within a highly disturbed landscape that does not possess large expanses of intact native vegetation and generally has a low ecological value.	Standard management measures are proposed to reduce impacts to the extent reasonable and feasible.	Residual impacts are considered medium. Biodiversity offsets are required for direct impacts.	Further opportunities to minimise or avoid impacts will be explored during detailed design. A Flora and Fauna Management Plan will be prepared as part of the CEMP.
Built environment	Scoping report	The Project would not impact the public domain, public infrastructure or other built assets.	The Project is predominantly within the AGLM landholding.	The Project would introduce new electrical infrastructure within the context of the existing major energy generation infrastructure occurring within the AGLM landholding.	Low. The Project is not anticipated to involve land uses that are incompatible with the ongoing use of the site for electricity generation.	No management measures have been recommended.	Residual impacts are considered low.	No further assessment is considered necessary.
Economic and social	Desktop assessment	Construction would create direct employment	Employment generation benefits for over a three year period during	Creation of direct and indirect employment opportunities.	The project may have positive indirect benefits for employment	AGLM will Identify opportunities to	Residual impacts are	No further assessment is considered necessary.

Aspect	How assessed	Summary of findings	Scale of impact	Nature of impact	Sensitivity of receiving environment	Management measure	Residual impacts	Additional assessment or controls required
		opportunities. Workers would also support local accommodation, food and services. The Project supports energy security within the NEM ensuring reliable and affordable energy.	construction. The Project may also generate a number of indirect jobs in local, regional and national businesses and industries from increased economic activity and spending at businesses providing goods and services to support construction activities.	Direct impact on energy security.	opportunities and business due to increased demand.	maximise the use of local suppliers, labour and businesses in the provision of goods and services for construction.	considered low.	
		Potential impacts on local tourism businesses due to impacts on availability of tourist accommodation.	Unlikely to be significant given accommodation.	Increased demand for rental housing during construction may put pressure on rental prices resulting in increased rents.	Low: Accommodation providers are scaled for peaks in mining activities and readily deal with existing fluctuation associated with Bayswater and Liddell outages.	None proposed	Residual impacts are considered low.	
		The Project supports energy security within the NEM ensuring reliable and affordable energy.	Significant private investment in future grid stability.	Direct impact on energy security.	Low: The market is well aware of the ongoing transition occurring in the NEM.	No management measures have been recommended.	Positive impact	
Hazards and risks	Specialist assessment and desktop assessment	There is a risk of a fire event associated with the Battery initiated through a thermal runaway or an electrical fault inside the Battery. In addition, the Project may alter the EMF on the site.	The hazards are confined to the to the AGLM site and it is unlikely that the Project would have an off-site impact on the community.	The Project would introduce new electrical infrastructure which would introduce new risks.	Low: The PHA found that the Project can be managed in accordance with the established risk criteria and in accordance with as low as reasonably practicable (**ALARP**) principles.	A number of management measures have been recommended as per **Section 6.1.4.** These measures include a fire study,	Residual impacts are considered low.	Detailed design requires a fire safety study. Detailed design is also required to consider sizing and requirements for controlling hazardous substances.

Aspect	How assessed	Summary of findings	Scale of impact	Nature of impact	Sensitivity of receiving environment	Management measure	Residual impacts	Additional assessment or controls required
						application of applicable design requirements and Standards, separation distances and setbacks, physical protection, and control systems.		
Heritage	Specialist assessment and desktop assessment	There are 12 Aboriginal heritage sites which may be harmed in their entirety, and one site which may be partially impacted by construction of the Project. No listed non-Aboriginal heritage items or features are likely to be impacted by the Project.	Impacts would be limited to the construction phase. The landscape is already considered highly disturbed.	Direct impact to Aboriginal heritage sites. Aboriginal sites are located outside the Project area but in close proximity may be at risk of inadvertent impact during construction works.	Low. The majority of impacts that would result from the Project are located within already disturbed and impacted areas. The Aboriginal sites the Project would impact are of low significance, being small artefact scatters, and are not rare site types in the Hunter Valley region.	Standard management measures are proposed to reduce impacts to the extent reasonable and feasible. This includes measures for unanticipated heritage finds.		A surface collection walkover will be carried out to collect all surface Aboriginal heritage material identified to be impacted.
Land	Specialist assessment and desktop assessment	Targeted contamination assessments have previously been conducted across AECs at the AGLM site. These areas were identified as having the potential to be impacted from power station activities conducted since	The contamination assessment has concluded that based on the analytical dataset and knowledge of the historical development of the site, it is considered that widespread gross contamination is unlikely	There is the is the potential to encounter contamination during the construction works	Low; Overall, it is considered that the existing potential contamination risks present in the development site is not an impediment to the implementation of the Project and that the Project will not give rise to	Standard management measures are proposed to manage contamination and will be include in the CEMP.	Residual impacts are considered low.	The internal bunding and environmental controls for hazardous substances management suitable for the Battery and transformers will be in accordance with applicable guidelines.

Aspect	How assessed	Summary of findings	Scale of impact	Nature of impact	Sensitivity of receiving environment	Management measure	Residual impacts	Additional assessment or controls required
		Bayswater and Liddell were initially constructed.	to be present in the development site.		any new contamination related risks to human health or the receiving environment provided that appropriate controls are implemented.			Asbestos Management Procedure would be updated.
Water	Desktop assessment	Construction activities have the potential to impact water quality, hydrology and groundwater as a result of erosion, sedimentation and spills/leaks and increase in permanent impervious surfaces.	The majority of the Impacts would be limited to the construction phase and within the AGLM land holding.	Direct impact from ground disturbance, stockpiling and transportation of materials during construction. .	Low. Waterways in the Project area are already disturbed and are not classified as sensitive receiving environments.	Standard management measures are proposed to reduce impacts to the extent reasonable and feasible. Operational impacts would be managed through the incorporation of appropriate drainage features in the Project design.	Residual impacts are considered low.	The specific requirements for water quality controls will be confirmed as the detailed design develops and prior to construction. The Bayswater site operational water quality monitoring program will be updated and implemented as required.

8.3 Residual impacts

The risk analysis outlined in **Table 8-1** has identified that while residual impacts exist, all impacts are able to be managed through the application of standard environmental management measures as documented in **Chapter 7**. The Project would not result in significant off-site impacts.

Opportunities would be identified during detailed design to further reduce residual impacts including:

- Design refinement to avoid clearing and ground disturbance as far as possible
- Develop effective construction methodologies and planning to ensure that management measures can be effectively implemented
- Completion of fire safety study on selected technology and layouts to confirm APZs
- Implement a process of review, correction and audit for the management measures that were identified in **Chapter 7**.
- A process of continuous improvement will allow for management measures to be updated and improved during construction and operation where feasible and reasonable.

9. Evaluation of Merits

This chapter presents an evaluation of the Project as a whole, drawing conclusions on the overall merits of the Project.

9.1 Justification

The Project is necessary to facilitate the efficient, safe and reliable continuation of electricity generating works from the AGLM landholding. The essential nature of the Project is considered to outweigh the identified adverse impacts. While some environmental impacts cannot be avoided, in all cases they would be minimised to the extent possible through the design process and implementation of environmental management measures. The Project as described in **Chapter 2** is considered to best meet the Project objectives when compared to all other alternatives and options (refer to **Section 1.5**).

The Site is largely developed as a power station and the Project represents a continuation of the electricity generation uses, being a form of industrial development, currently carried out on the site and does not conflict with the ongoing operations or any other currently proposed land uses.

Clause 7(1)(f) of Schedule 2 of the EP&A Regulation require an EIS to provide '*the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4)*'. The principles of ecologically sustainable development (**ESD**) are discussed in **Section 9.1.1** and the biophysical, economic and social considerations are as following:

- Biophysical costs and benefits: The Project would result in the direct removal of up to 46.2 ha of vegetation, of which about 42.3 ha is native vegetation. Where impacts on biodiversity cannot be avoided or minimised, appropriate offsets would be provided
- Economic and social considerations: Most social impacts are localised and would be temporary during construction. Economic benefits are anticipated for local businesses during construction due to increased demand for goods and services and direct and indirect employment opportunities for up to 250 people. During operation, the Project would help to facilitate the transition towards a low-carbon future by providing network services not able to be otherwise provided by renewable energy projects. Therefore, the project supports the planned transition to a low carbon energy future The Battery storage benefits and employment benefits and requirement to continue to support Bayswater which remains critical to ongoing generation security for NSW
- The Project isconsidered to be in the public interest. The Project represents a significant and cost-efficient private investment in electricity infrastructure. It that overall would results in strong net public benefits by delivering the Battery which would provide essential energy storage and firming capacity as part of the energy transition. The Project will furthermore and facilitateing the efficient, safe and reliable continuation of electricity generation at Bayswater until its planned retirement in 2035
- In addition, the Project is consistent with the ISP, COP21 and the *NSW Climate Change Policy Framework* and not inconsistent with the *Net Zero Plan*.

9.1.1 Ecologically sustainable development

ESD is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD were an integral consideration throughout the development of the Project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD and how the Project responds to these principles are discussed below.

9.1.1.1 The Precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during development of the Project. The precautionary principle has guided the assessment of environmental impacts for this EIS and the development of management measures.

This EIS assesses the environmental impacts associated with the Project. The EIS was prepared adopting a conservative approach, which included assessing the worst case impacts and scenarios. Management measures are proposed to address identified impacts. These management measures would be implemented during the Project. No management measures have been postponed as a result of lack of scientific certainty. No threat of serious or irreversible damage is considered likely as a result of the Project.

9.1.1.2 Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations. The principle states: "the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations".

The Project may impact on inter-generational equity through the consumption of resources during construction and operation, including fuel and raw materials. Nevertheless, the Project facilitates the transition to a low carbon energy generation future necessary to achieve NSW and Australia's GHG reduction targets recognised at a global level as essential for avoiding or reducing climate change implications for future generations.

The Project would be designed and implemented to achieve the most viable manner from an economic and social perspective.

9.1.1.3 Conservation of biological diversity and ecological integrity

Biodiversity values were considered in the development of the concept design of the Project. Conservation of biological diversity and ecological integrity is a fundamental consideration of the Project. The design and assessment of the Project was carried out with the aim of identifying, avoiding, minimising and mitigating impacts.

The direct impact of the Project would be the clearing of up to 42.3 ha of native vegetation. Vegetation on site may provide limited habitat for threatened fauna species. Environmental management measures were identified to reduce the severity of direct and indirect impacts of the Project on biodiversity. Where there are likely to be residual impacts associated with vegetation clearance, such impacts would be offset. A preliminary Biodiversity Offset Strategy has been prepared for the Project such that long-term improvements and conservation outcomes for would be achieved.

9.1.1.4 Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Environmental factors were considered throughout the development of the design and in planning for construction and operation of the Project. As a consequence, environmental impacts were avoided or minimised where practical during the concept design development for the Project.

Management measures outlined in this EIS will be implemented during construction and operation of the Project. The cost of these management measures is incorporated into the Project cost, as well as the extent of environmental investigations carried out to inform this EIS.

9.2 Consideration of the objects of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification of the Project can be considered. A summary of this assessment is provided in **Table 9-1**.

Table 9-1: Consideration of objects of the EP&A Act

Object	Comment
a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	Social and economic impacts would occur during the construction phase. The Project would result in amenity (visual, noise and dust) impacts near the Project, generation of additional traffic and would impact community values relating to scenic and landscape amenity as a result of vegetation clearing. During construction, economic benefits are anticipated for local businesses and accommodation owners due to increased demand for accommodation, goods and services. Benefits would also be associated with direct and indirect employment opportunities. During operation, the Project would benefit communities, businesses and industry by increasing the reliability in the NEM. The Project would provide an overall downward pressure on energy prices, supporting reduced electricity costs for households, businesses and industry over the medium to long term while supporting the transition to a low carbon energy future. The socio-economic and community impacts are assessed in **Section 6.13**. Some permanent impacts to biodiversity, visual amenity and heritage values would occur and have been minimised to the fullest extent possible. Management measures have been proposed to manage Project impacts where they cannot be avoided.
b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	As described in **Section 9.1.1**, the Project is consistent with the principles of ESD.
c) To promote the orderly and economic use and development of land.	The development site is located within the AGLM landholding and the Project would not require the acquisition of privately owned land. The Battery and Decoupling components of the Project are located on land that is zoned for infrastructure purposes under the Muswellbrook LEP. The Project is considered compatible with the objectives of this land zoning. Some areas of BAW are located on land zoned for primary production and are permissible under the ISEPP. These works would not restrict the future use of the site for permissible purposes under the Singleton LEP (following the closure of Liddell and Bayswater). The project would promote the orderly and economic use and development of land within the project area by continuing to provide

Object	Comment
	dispatchable energy and other network services to the NEM and facilitating the increased penetration of renewable energy into the network.
d) To promote the delivery and maintenance of affordable housing.	The Project would not affect the delivery and maintenance of affordable housing.
e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Biodiversity was considered in the development and selection of the preferred option, as discussed in **Chapter 4**. Biodiversity impacts are assessed in **Section 6.6**. No significant impacts to biodiversity are expected. Management measures include exploring opportunities to limit the extent of vegetation clearance required as part of detailed design and construction planning. Appropriate offsets will be provided for direct and indirect impacts to native vegetation and threatened species habitats. A preliminary Biodiversity Offset Strategy has been prepared (refer to the BDAR provided in **Appendix E**).
f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	There are 12 Aboriginal items and no items of non-Aboriginal heritage identified within the Project area that would be impacted by the Project. Where impacts to these items are unavoidable, management measures including salvage and archival recording are proposed to contribute further understanding of historical occupation and events. Refer **Section 6.8, Section 6.9** and the ACHAR provided in **Appendix F**.
g) To promote good design and amenity of the built environment.	Good design and amenity of the built environment were considered during project development. Consideration was given to the placement of Project components in the surrounding landscape to minimise operational visual amenity impacts, refer to **Section 6.10**. The Project would be designed and operated in accordance with AGL's public safety and technical requirements.
h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The design, construction and maintenance of the Project would be undertaken in accordance with applicable standards and AGL's existing management systems.
i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	AGLM is seeking approval for the Project under Part 4, Division 4.7, of the EP&A Act. Consultation was carried out with the relevant local Councils and government agencies throughout development of the Project and preparation of this EIS. Consultation carried out to date is described in **Chapter 5**.
j) To provide increased opportunity for community participation in environmental planning and assessment.	The Project development process involved consultation with relevant stakeholders. Consultation undertaken and proposed is outlined in **Chapter 5**. The EIS would be placed on public exhibition by DPIE, in which stakeholders and the community will be able to review the EIS and provide submissions on the Project. Any submissions received would be responded to by AGLM. This process provides further opportunity for community participation in the environmental planning and assessment process.

9.3 Consideration of Section 4.15 of the EP&A Act

In determining an application for development consent, the consent authority must take into consideration such of the matters referred to in section 4.15(1) of the EP&A Act as are of relevance. The factors listed in section 4.15(1) have been considered in **Table 9-2** below in order to summarise the likely impacts of proposed works on the natural and built environment.

Table 9-2: EP&A Act Section 4.15 Consideration

Matter for consideration	Consideration
The provisions of any environmental planning instrument.	▪ EPIs applicable to the site and Project include: ▪ SEPP SRD ▪ ISEPP ▪ SEPP 33 ▪ SEPP 55 ▪ *State Environmental Planning Policy (Koala Habitat Protection) 2020* ▪ *Muswellbrook Local Environmental Plan 2009* ▪ *Singleton Local Environmental Plan 2013.* ▪ The relevant provisions of applicable EPLs are considered in **Section 3.4**. The proposed works are considered permissible under these instruments.
The provisions of any proposed instrument.	No proposed EPIs have been identified as applying to the proposed works.
The provisions of any Development Control Plan.	Under clause 11 of the SRD SEPP, Development Control Plan apply to SSD projects. However the Muswellbrook and Singleton Development Control Plans were still considered and were not deemed to limit the ability of the consent authority to approve the Project or require assessment or consideration beyond that required by the SEARs and relevant EPIs and assessment guidelines.
The provisions of any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4.	No planning agreements affecting the proposed works locations have been entered into or are proposed.
The provisions of the regulations (to the extent that they prescribe matters for the purposes of this paragraph).	Clause 92 of EP&A Regulation identifies matters prescribed for the purposes of section 4.15 (1) (a) (iv) of the EP&A Act, to be taken into consideration by a consent authority in determining a DA. None of the prescribed matters are considered applicable to the Project.
The provisions of any coastal zone management plan	The Project is not within the coastal zone.
The likely impacts of the development, including environmental impacts on both the natural and built environments, and social	Environmental and socio-economic impacts are assessed in **Chapter 6**.

Matter for consideration	Consideration
and economic impacts in the locality.	
The suitability of the site for the development	The site is appropriately zoned and the majority of the Project is within AGLM owned buffer lands of Bayswater and Liddell. The Project design has focused on previously disturbed land to the extent this is sufficient and appropriate for the required purpose of each component.
Any submissions made in accordance with this Act or the regulations.	To be considered by DPIE following exhibition.
The public interest.	Community and stakeholder engagement has been undertaken as described in **Chapter 5** and would inform the final design of each Project element. The Project represents a cost-efficient private investment supporting the transition of the NEM to a low carbon intensity in support of Australia and NSW's GHG reduction targets. The Project also facilitates the ongoing operation of Bayswater whilst this transition occurs. The Project would maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. Although the Project would result in the continuation of existing impacts of Bayswater to 2035, these impacts would continue in the absence of the Project. Some additional traffic, air quality and noise generation would result from the Project but these have been found not to result in significant offsite impacts. While biodiversity and heritage impacts are anticipated, these would be minimised and mitigated to the extent possible. Biodiversity offsets would also be provided in accordance with the BC Act aimed at resulting in a neutral or beneficial biodiversity outcome. As a result, the Project is considered to be in the public interest. A response to submissions report would be prepared to address any issues raised in submissions and this report, along with submissions, is required to be considered by the relevant consent authority (being the Independent Planning Commission or the Minister for Planning and Public Spaces by delegate) in determining whether to approve the Project and, if so, on what conditions.

9.4 Conclusion

The delivery of the Project would contribute to the following outcomes:

- Supporting the ongoing operation of Bayswater by facilitating environmental improvement projects and infrastructure upgrades and the ongoing power supply to ancillary infrastructure through the Decoupling works following closure of Liddell
- Provision of battery storage providing up to 500 MW over a four hour discharge duration of dispatchable energy
- Provision of the following essential networks services required by the NEM to maintain stability:
  - Wholesale energy market services
  - Frequency Control Ancillary Services (FCAS), for all regulation and contingency services
  - Fast Frequency Response (FFR) service
  - System Restart Ancillary Services (SRAS)

- Network Support and Control Ancillary Services (NSCAS), for all service types
- Demand management services for local network service providers (NSPs)
- Reliability support services.

It is considered highly likely that based on these opportunities, the Projectcould be constructed and operated in an economically feasible manner with limited short term construction impacts and long term environmental and social impacts significantly lower than those associated with the existing operation of Liddell.

The benefits of the Project are considered to outweigh any identified adverse impacts of this Project. While some environmental impacts cannot be avoided, they would be minimised where possible through the implementation of management measures and offsetting. The Biodiversity Offset Strategy would be finalised and implemented to address the residual impacts of the Project on biodiversity values.

A consultation program with community and government stakeholders has been carried out throughout Project development, and would continue through EIS display, response to submissions, detailed design and construction, to ensure that all stakeholder interest is understood, documented and addressed.

The environmental performance of the Project would be managed by the implementation of the CEMS. The CEMS would also ensure compliance with relevant legislation and any conditions of approval. With the implementation of the proposed mitigation and management measures, the potential environmental impacts of the Project would be adequately managed.

This EIS provides a description of the Project, existing information on environmental context and potential for environmental impacts. The EIS considers all available information that is relevant to the environmental assessment of the Project.The EIS has been prepared to support AGLM's application for approval of the Project in accordance with the requirements of Part 4, Division 4.7 of the EP&A Act. The Project was referred and determined not to be a controlled activity under the EPBC Act. The EIS addresses the environmental assessment requirements of the SEARs, dated 23 September 2020.

On the basis of the findings detailed in the assessments within this EIS and with the implementation of the proposed management measures, the Project could be carried out without any significant long term impacts on the local environment and as such is considered justified.

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