Bayswater Water and Other Associated Operational Works Project

Environmental Impact Statement

IA215400_Bayswater WOAOW EIS | Final

4 June 2020

AGL Macquarie Pty Ltd

Bayswater WOAOW Environmental Impact Statement

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Client Name:	AGL Macquarie Pty Ltd
Project Manager:	Kirsty Farmer
Author:	Kirsty Farmer
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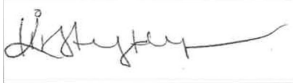
Document history and status

Revision	Date	Description	By	Review	Approved
04	03/12/19	First draft EIS	Kirsty Flynn	Thomas Muddle	Thomas Muddle
05	04/06/2020	Final EIS	Kirsty Flynn	Thomas Muddle	Thomas Muddle

Statement of Validity

Details	Bayswater Power Station Water and Other Associated Operational Works Project
Applicant name	AGL Macquarie Pty Limited
Applicant address	Bayswater Power Station, New England Highway, Muswellbrook, New South Wales, 2333.
Land to be developed	Bayswater Power Station operational area, with a component of works extending to the Ravensworth rehabilitation area. The majority of the works would be undertaken within the AGL Macquarie Landholding except for a small parcel of Crown land, Singleton Council owned land and Transport for New South Wales owned land.
Formal identifier	Lot 601 DP 1019325 Lot 112 DP 1059007 Lot 2 DP 1095515 Lot 1 DP 113655 Lot 1 DP 1142103 Lot 2012 DP 1151790 Lot 1 DP 1158700 Lot 120 DP 1174907 Lot 1 DP 1175303 Lots 1 & 2 DP1193248 Lot 910 DP 1123501 Lot 3 DP 1193253 Lot 10 DP 1204457 Lots 4, 6, 9 & 11 DP 247943 Lot 13 DP 247945 Lot 1 DP 252530 Lot 5 & 6 DP 966589 Lot 107 DP547864 Lot 4 DP 1193254 Lots 1 & 2 DP 574168 Lot 2 DP 327372 Lot 1 DP 616024 Lot 1 DP 616025 Lot 2 DP 619383 Lot10 DP 700554 Lots 19, 30, 62, 75, 86, 88, 89, 150, 151 & 331 DP 752468 Lots 1 & 2 DP 774679 Lot 1 DP 369326 Lot 102 DP 1053098 Lot 14 DP 1193430
Proposed development	SSD 9697 (EPBC 2020/8623) – Development for the purposes of the Bayswater Power Station water management and other associated operational works including: • augmentation of the existing Bayswater ash dam including water management upgrades • increasing coal ash recycling production • Coal handling plant water management upgrades • New Ravensworth ash pipelines • Borrow Pits • New Salt cake landfill facility • Ancillary works including vegetation clearing • Consolidation and voluntary surrender of specified existing consents. The Project, excluding the surrender of existing consents, is referred to as Bayswater Power Station Water Infrastructure Upgrade Project under EPBC 2020/8623.
Prepared by	Jacobs Group (Australia) Pty Ltd
Address	Level 4, 12 Stewart Avenue, Newcastle West, NSW, 2302 Australia
Author	Kirsty Farmer BSc Environmental Science (on going), The Open University, MA Environment and Politics, Kings College London, UK (First class honours), BA History and International Relations, Royal Holloway, University of London.
Reviewer	Thomas Muddle Bachelor of Environmental Science, University of Newcastle and Graduate Diploma of Urban and Regional Planning, University of New England.
In respect of	State Significant Development 9697 & Controlled Activity EPBC 2020/8623
Certification	I certify that I have prepared the contents of the Environmental Impact Statement in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and the Secretary's Environmental Assessment Requirements dated 30 November 2018 and supplementary Environmental Assessment Requirements issued 28 April 2020. This Environmental Impact Statement contains all available information that is relevant to the environmental assessment of the development and to the best of my knowledge the information contained in the Environmental Impact Statement is not false or misleading.
Signature	 
Name	Kirsty Farmer Thomas Muddle
Date	4 June 2020

Contents

Figures

Glossary of Terms and Abbreviations

Terms and Abbreviations	Description
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACM	Asbestos Containing Material
AEC	Area of Environmental Concern used in relation to potential contamination.
AEMO	Australian Energy Market Operator
AEP	annual exceedance probability (rainfall/flooding)
AGL	AGL Macquarie Pty Ltd as the proponent of the Project
AGLE	AGL Energy Limited
AHIMS	Aboriginal Heritage Information Management System
ANCOLD	Australian National Committee on Large Dams
Ash Dam augmentation	Expansion of the existing Bayswater Ash Dam to provide additional ash storage capacity and improvements to water management structures and systems to ensure continued collection and reuse of process water and return waters from the Baywater Ash Dam.
Ash harvesting upgrades	Increasing coal ash recycling activities to produce up to 1,000,000 tonnes per annum of ash derived product material and reuse of coal ash and upgrades to existing fly ash harvesting infrastructure including the installation of weighbridges, construction of a new 240 tonne silo, tanker wash facility and additional truck parking.
ASS	Acid Sulfate Soils
BAM	Biodiversity Assessment Method
Bayswater	Bayswater Power Station
BC Act	New South Wales Biodiversity Conservation Act 2016
BCD	Biodiversity and Conservation Division of the Department of Planning, Industry and Environment
BDAR	Biodiversity Development Assessment Report
BFPL	Bush Fire Prone Land
BWAD	Bayswater Ash Dam
CAOE	Coal Ash Order and Coal Ash Exemption
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CEMS	Construction Environmental Management Strategy
CHP	Coal Handling Plant
CIV	Capital Investment Value
CLM Act	Contaminated Land Management Act
CNVG	Construction Noise and Vibration Guidelines
COAG	Council of Australian Governments
Coal handling plant upgrades	Improvements to the management of water and waste materials within the coal handling plant sediment basin and associated drainage system
COP21	Paris Climate Conference
DA	Development Application
DAWE	Commonwealth Department of Agriculture, Water and Environment
DPIE	NSW Department of Planning, Industry and Environment
DRG	NSW Department of Planning, Industry and Environment Division of Resources & Geoscience
DS Act	NSW *Dam Safety Act 2015*

Terms and Abbreviations	Description
DSNSW	Dams Safety NSW
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EP&A Regulation	NSW Environmental Planning and Regulation 2000
EPA	NSW Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPBC Regulations	Environment Protection and Biodiversity Conservation Regulation 2000
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ESB	Energy Security Board
GDE	Groundwater Dependent Ecosystems
GGBF	Green and Golden Bell Frog
GWH	Gigawatt hours
ha	Hectares
HRSTS	Hunter River Salinity Trading Scheme
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guidelines
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
KFH	Key Fish Habitat
km	Kilometres
Koala SEPP	State Environmental Planning Policy (Koala Habitat Protection) 2019
KPoM	Koala Plan of Management
LALC	Local Aboriginal Land Council
LCO	Liddell Colliery Operations
LCU	Landscape Character Units
LEP	Local Environment Plan
LGA	Local Government Area
Liddell	Liddell Power Station
LoS	Level of Service (in relation to intersection capacity)
LSP	Lime Softening Plant
m	Metres
MAC	Mount Arthur Coal
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
MNES	Matter of National Environmental Significance
MSC	Muswellbrook Shire Council
MW	Megawatt (a unit of power equal to one million watts)
NEM	National Energy Market
NML	Noise Management Level
NPI	Noise Policy for Industry

Terms and Abbreviations	Description
NPW Act	National Parks and Wildlife Act 1974
NSW	New South Wales
OEH	Former Office of Environment and Heritage – Now being Biodiversity and Conservation Division of the Department of Planning, Industry and Environment.
PAD	Potential Archaeological Deposit identified as an area with potential to contain Aboriginal heritage artifacts.
PCT	Plant Community Type
Pipelines Act	Pipelines Act 1967
PM10 and PM2.5	Particulate matter (dust) of10 micrometers or less in diameter and 2.5 micrometers or less in diameter respectively.
POEO Act	Protection of the Environment Operations Act 1997
Project	Upgrades at Bayswater Power Station aimed at improving the environmental performance of ash, salt and water management infrastructure and associated rehabilitation outcomes referred to as the Bayswater water and other associated operational works project as described in detail in Chapter 2 of the Environmental Impact Statement.
RAP	Registered Aboriginal Party
Ravensworth ash line	Construction and operation of a new coal ash pipeline to Ravensworth Void No. 3 for ash emplacement.
RBL	Rating background levels referring to existing noise
RFS	Rural Fire Service
RL	Reduced Level relating to elevation (height)
RMS	Roads and Maritime Services now known as Transport for NSW.
Roads Act	NSW Roads Act 1993
Rural Fires Act	Rural Fires Act 1997
Salt cake landfill	Construction and operation of a salt cake landfill facility to dispose of salt cake waste from the approved salt caking plant to be constructed at the Bayswater water treatment plant.
SANSW	Subsidence Advisory NSW
SC	Singleton Council
SCP	Seepage Collection Pond
SEARs	Planning Secretary's Environmental Assessment Requirements
SEE	Statement of Environmental Effects being a planning assessment document for non-State significant development.
SEPP	State Environmental Planning Policy
SEPP 33	State Environmental Planning Policy No 33 – Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No 55 – Remediation of Land
SEPP SRD	State Environmental Planning Policy (State and Regional Development) 2011
SHR	State heritage Register
SIDRA	Traffic modelling software
Singleton LEP	Singleton Local Environment Plan 2013
SPLs	Sound Power Levels associated with noise impact assessment
SPRAT	Commonwealth Government Species Profile and Threats Database
SSD	State significant development
SSI	State significant infrastructure
TECs	Threatened ecological community
TfNSW	Transport for NSW

Terms and Abbreviations	Description
TSP	Total suspended particulates
WAL	Water Access Licence
WARR Act	NSW Waste Avoidance and Resource Recovery Act 2001
Water Act	Water Act 1912
WM Act	Water Management Act 2000
WOAOW	Water and Other Associated Operational Works
WTP	Water treatment plant
ZVI	Zone of visual impact

Executive Summary

Background

AGL Macquarie as a subsidiary of AGL Energy Limited (referred to throughout as AGL) owns and operates the Bayswater Power Station (**Bayswater**), located south-east of Muswellbrook in the Local Government Areas (**LGA**) of Muswellbrook and Singleton. AGL are proposing to undertake a range of upgrades to Bayswater aimed at improving the environmental performance of ash, salt and water management infrastructure and associated rehabilitation outcomes referred to as the Bayswater water and other associated operational works project (**Project**).

Bayswater was commissioned in 1985 to utility standards of the time. Bayswater has a current generation capacity of 2640 megawatts (**MW**) and approval for efficiency upgrades that would increase capacity to 2740 MW. The approval of the efficiency upgrade recognised the critical importance of the continued operation of Bayswater until 2035.

Bayswater employs technology common to other NSW coal-fired power stations using the following general process:

- Coal is burned in the boiler furnace producing heat for the boiler
- Water is circulated through the boiler and heated by the boiler furnace to produce steam
- High pressure steam from the boiler enters the turbine trains within the generating units
- The turbines drive the generator rotor which produces electricity
- The electricity produced by the generator is transformed to system voltage and fed to the interconnected transmission system via the station switchyard.

Ancillary activities arising out of coal fired power generation at Bayswater include:

- Receipt, storage and transfer of coal within the coal handling plant area
- Pumping of water from the Hunter River under existing water entitlements and storage and treatment of this water, including the management of salt and other impurities, to supply boilers and for cooling purposes
- The management of incombustible coal residue, in the form of bottom ash and fly ash, which is collected and transported to ash disposal areas.

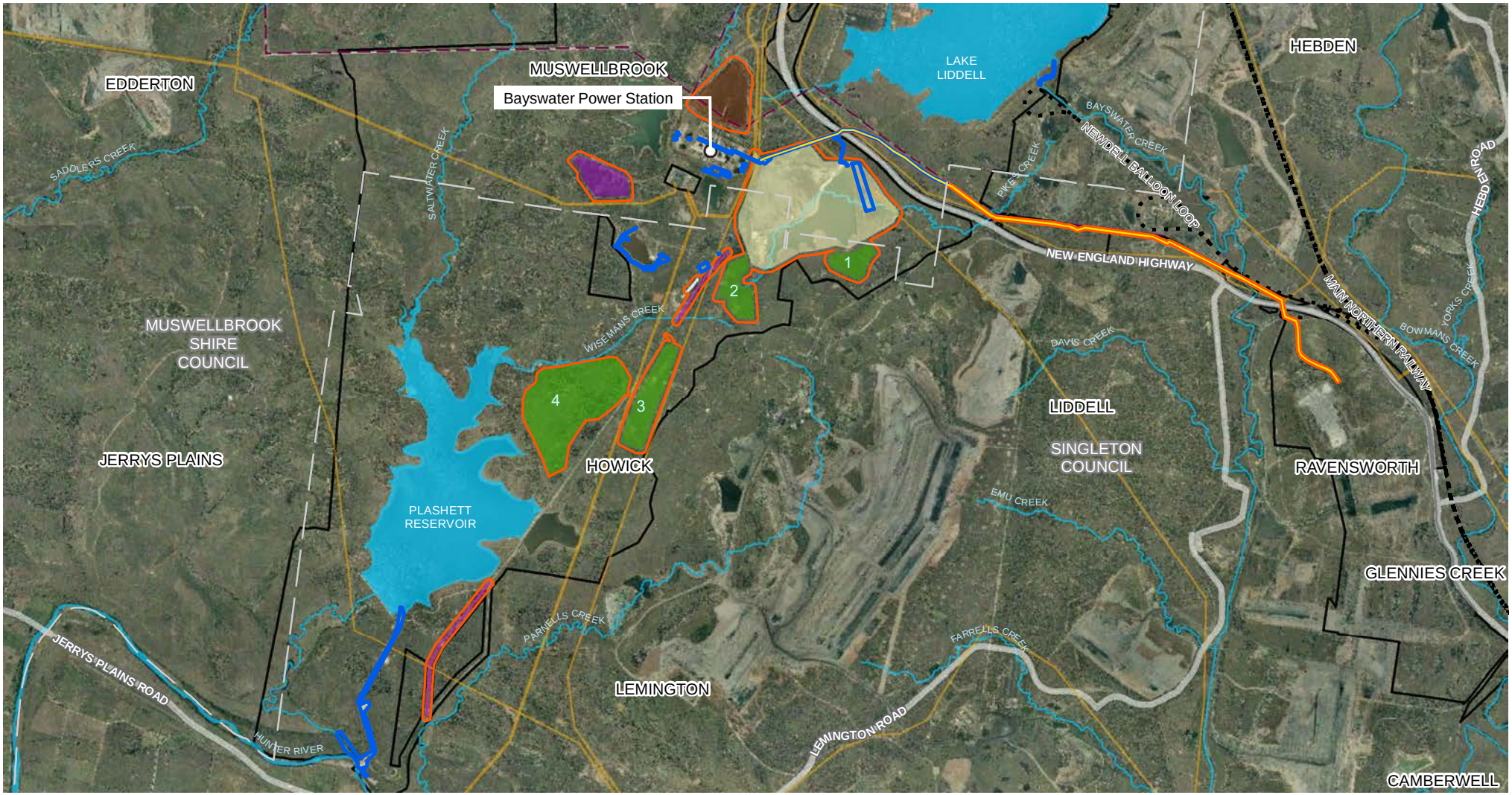
Project overview and purpose

The purpose of the Project is to improve the management of ancillary processes over the remaining operating life of Bayswater and to facilitate an improved rehabilitation outcome for the ash disposal area involving:

- Optimising and improving ash management including augmenting the existing ash disposal area, replacement of the Ravensworth ash transfer pipeline and increasing the capacity of the existing ash harvesting and recycling facilities
- Creation of a salt cake disposal landfill to complete the alternative process for managing water impurities and reduce the reliance on the Hunter River Salinity trading scheme
- Improvements to water management around the coal handling plant area.

The Project will include the following elements (Refer to Figure E1):

- Augmentation of the existing Bayswater Ash Dam (**BWAD**) to provide additional ash storage capacity (**Ash Dam augmentation**)
- Improvements to water management structures and systems to ensure continued collection and reuse of process water and return waters from the BWAD (**Ash Dam augmentation**)
- Improvements to the management of water and waste materials within the coal handling plant (**CHP**) sediment basin and associated drainage system (**Coal handling plant upgrades**)
- Increasing coal ash recycling activities to produce up to 1,000,000 tonnes per annum of ash derived product material and reuse of coal ash (**Ash harvesting upgrades**)
- Upgrades to existing fly ash harvesting infrastructure including the installation of weighbridges, construction of a new 240 tonne silo, tanker wash facility and additional truck parking (**Ash harvesting upgrades**)



- Study area
- Local Government Area boundary
- Footprints of approvals to be surrendered
- AGL owned land
- Railway
- Electricity transmission line
- Coal supply conveyor

Project elements:

- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Ravensworth Ash Line
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Salt Cake Landfill

0 2 4 km

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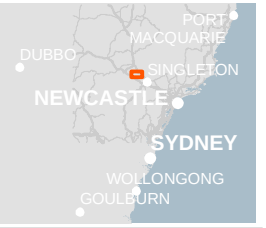

Data sources
Jacobs 2019
AGL 2019
NSW Spatial Services 2019

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Figure E1 AGL Site Plan and Project Elements

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- Construction and operation of a new coal ash pipeline to Ravensworth Void No. 3 for ash emplacement (**Ravensworth ash line)**
- Construction and operation of a salt cake landfill facility to dispose of salt cake waste from the approved salt caking plant to be constructed at the Bayswater water treatment plant (**Salt cake landfill**)
- Construction and operation of borrow pits on AGL land to facilitate the improvements proposed for the Project and other works on AGL land (**Borrow Pits 1 to 4**)
- Ancillary infrastructure works including repositioning of underground pipelines to above ground, replacement or upgrading of ageing pipelines, vegetation clearing associated with maintaining existing infrastructure, including along existing pipeline corridors as is necessary (**HP Pipe clearing, and LSP Pipe clearing**).

AGL are also proposing to consolidate and voluntarily surrender certain existing development consents where the operation of the Project would supersede these approvals.

Location and existing environment

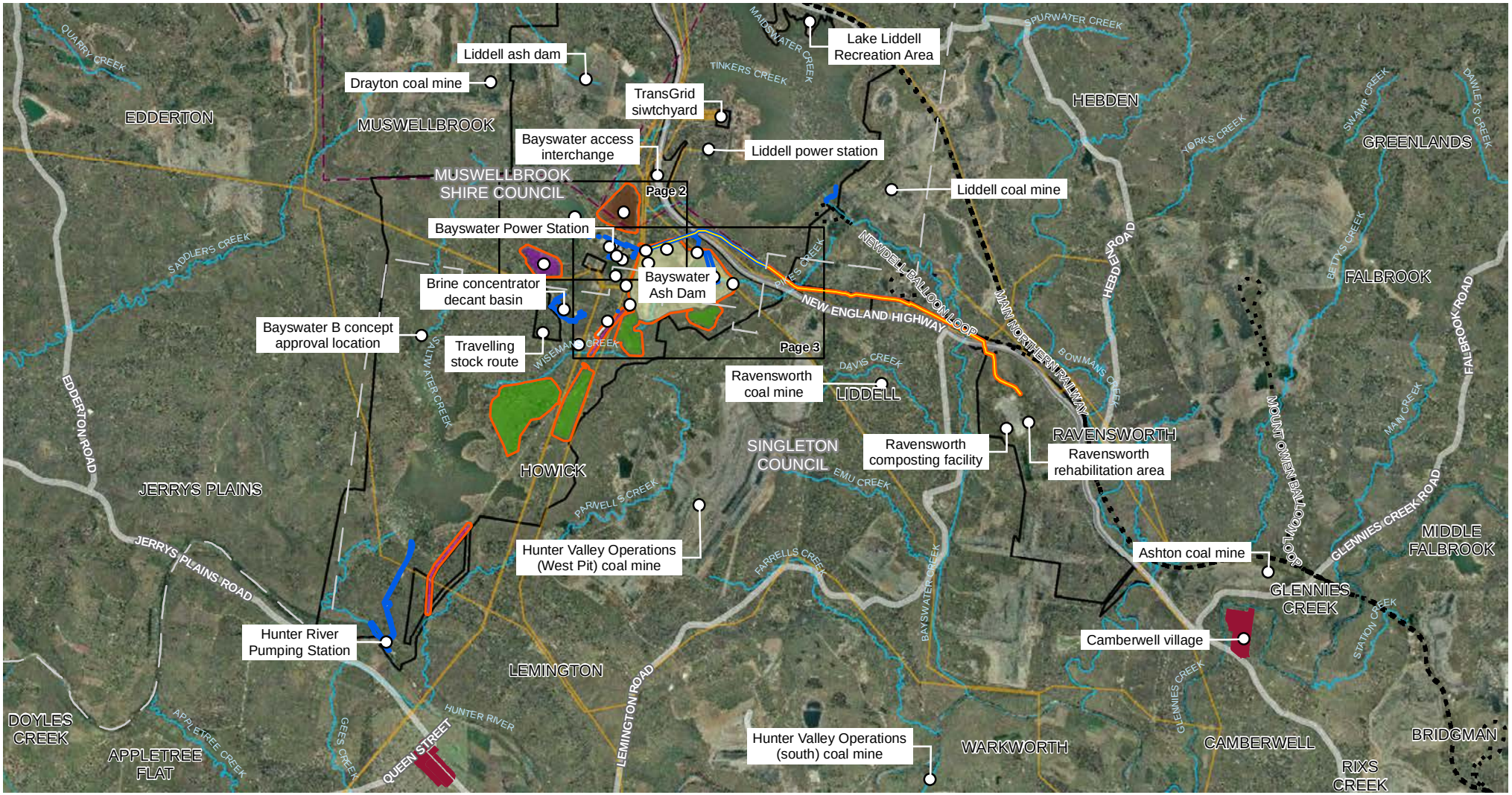
The Project is largely within the AGL owned lands established as a buffer to allow Bayswater to operate without significant amenity impacts on surrounding land uses. Some Project infrastructure also crosses road reserves owned by Transport for New South Wales (**TfNSW**), Singleton Council, and a small area of NSW Crown Land (**Crown land**). The site is appropriately zoned and the Project design has focused on previously disturbed land to the extent this is sufficient and appropriate for the required purpose of each Project component.

Existing development neighbouring Bayswater includes Liddell Power Station (**Liddell**), coal mines, the Main Northern Railway Line and the New England Highway. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGL landholding.

The village of Camberwell is located over seven kilometres (**km's**) south east of the Ravensworth ash line. The village of Jerrys Plains is located approximately two km's south of the nearest HP Pipe clearing and over five km's from the southern extent of the Borrow Pits.

The closest residential area is the Antiene subdivision, which is located behind a ridge line approximately five km's north of the Project. The nearest residential receiver is located approximately 1.8 km's south southwest of the HP pipe clearing works.

An overview of the key environmental and other land use constraints that have influenced the Project design is provided in the Figure series below.



- Study area
- Local Government Area boundary
- Footprints of approvals to be surrendered
- AGL owned land
- Residential
- Infrastructure location
- Railway
- Electricity transmission line
- Coal supply conveyor

Project elements:

- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Ravensworth Ash Line
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Salt Cake Landfill

0 2 4 km

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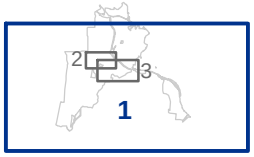

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

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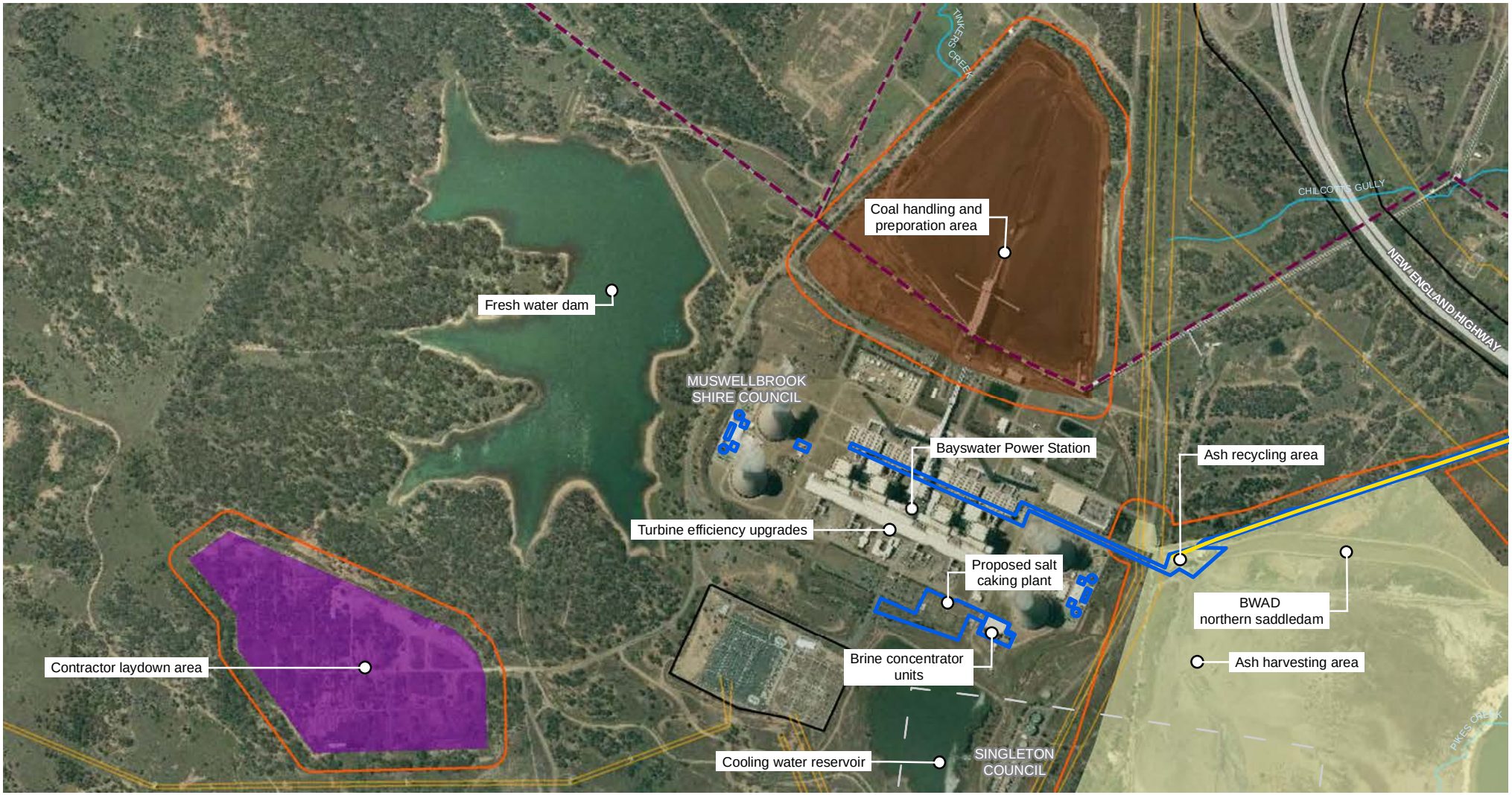
Figure E2a Surrounding land use context and infrastructure



Study area
Local Government Area
Footprints of approvals to be surrendered
AGL owned land
Infrastructure locations
Electricity transmission line
Coal supply conveyor

Project elements:

Ash Dam Augmentation, Ash Harvesting and Water Management Works
Coal Handling Plant Water and Wastewater Infrastructure Upgrades
Ravensworth Ash
Salt Cake Landfill

0 250 500 m

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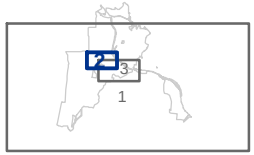

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

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Figure E2b Surrounding land use context and infrastructure

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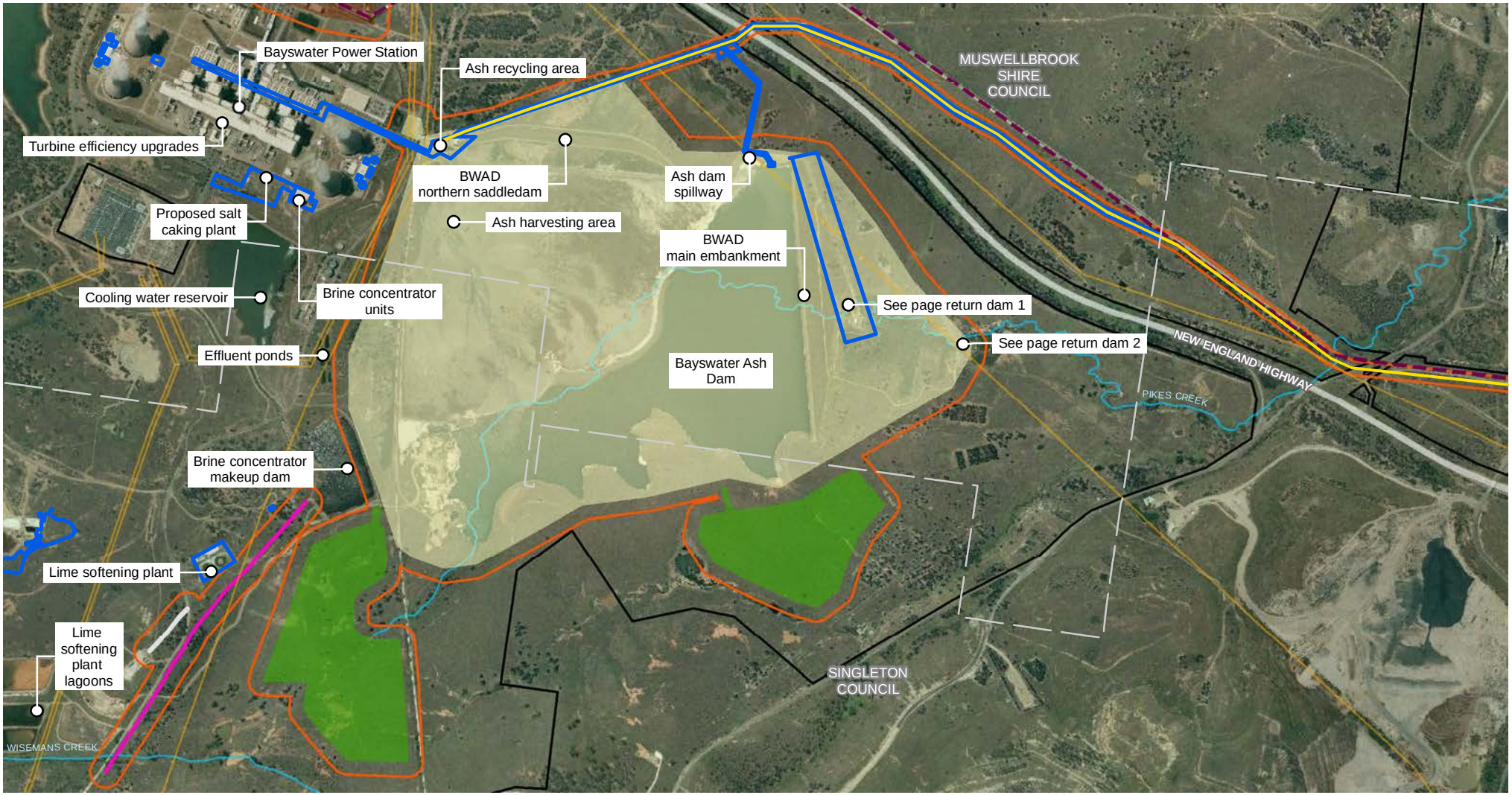

Study area
Local Government Area boundary
Footprints of approvals to be surrendered
AGL owned land
Infrastructure locations
Electricity transmission line
Coal supply conveyor

Project elements:

Ash Dam Augmentation, Ash Harvesting and Water Management Works
Coal Handling Plant Water and Wastewater Infrastructure Upgrades
Ravensworth Ash Line
HP Pipe Clearing
LSP Sludge Line Clearing
Clay Borrow Pits

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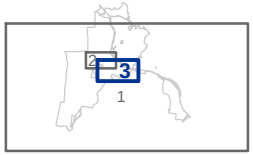

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

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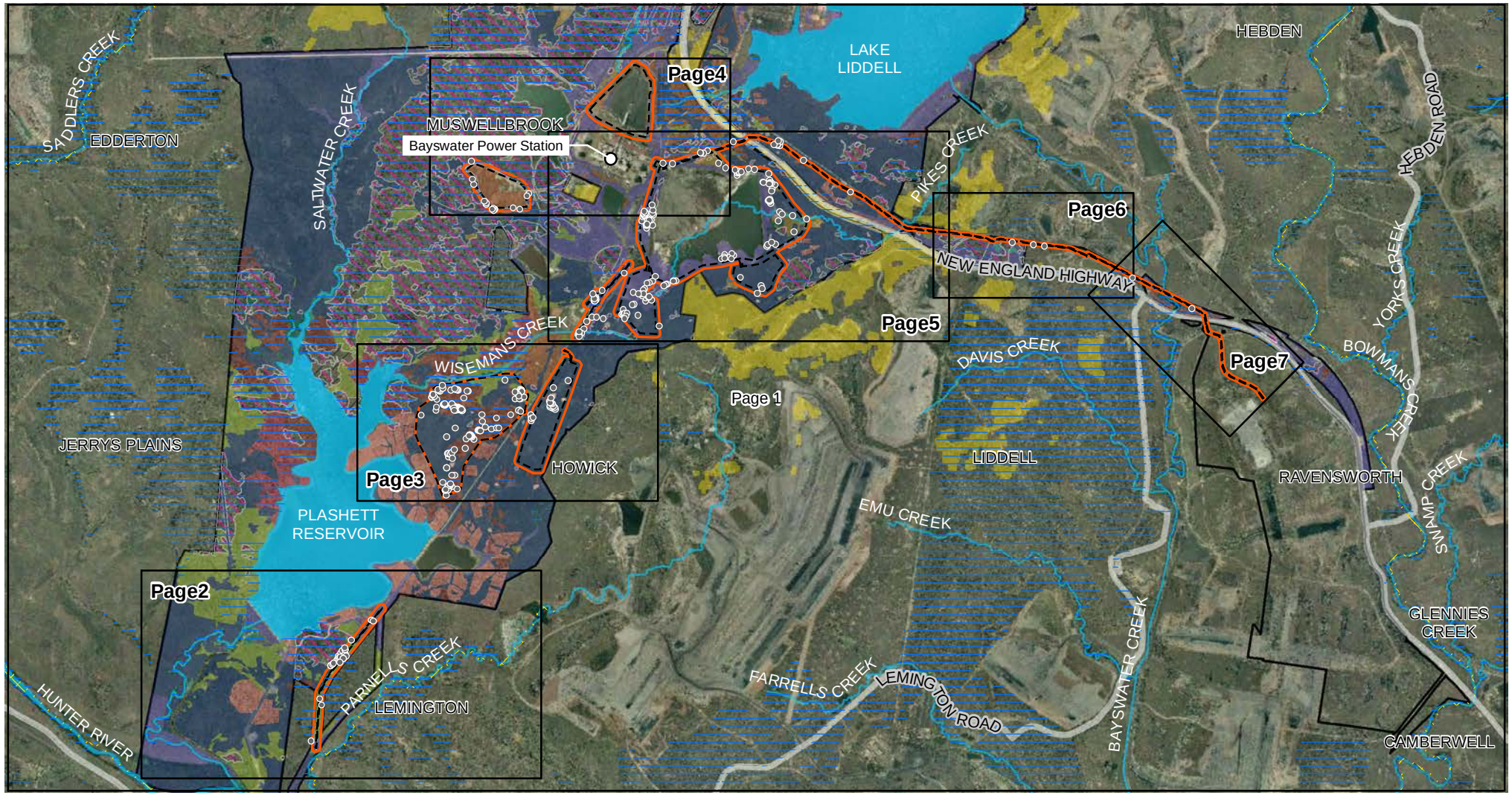
Figure E2c Surrounding land use context and infrastructure



Study area
Proposal area
AGL owned land

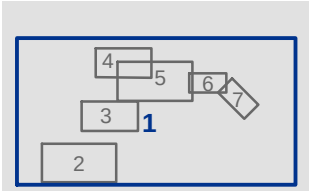
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial
Habitat feature

Vegetation communities within AGL Macquarie lands (Kleinfelder)

- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Valley River Oak Forest
- Hunter Valley Weeping Myall Woodland
- Plantation
- Rehabilitation
- Slaty Gum Woodland
- Wetland/Dam (with wetland vegetation)

0 1 2 km

1:75,000 at A4



Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

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Figure E3a Environmental Constraints

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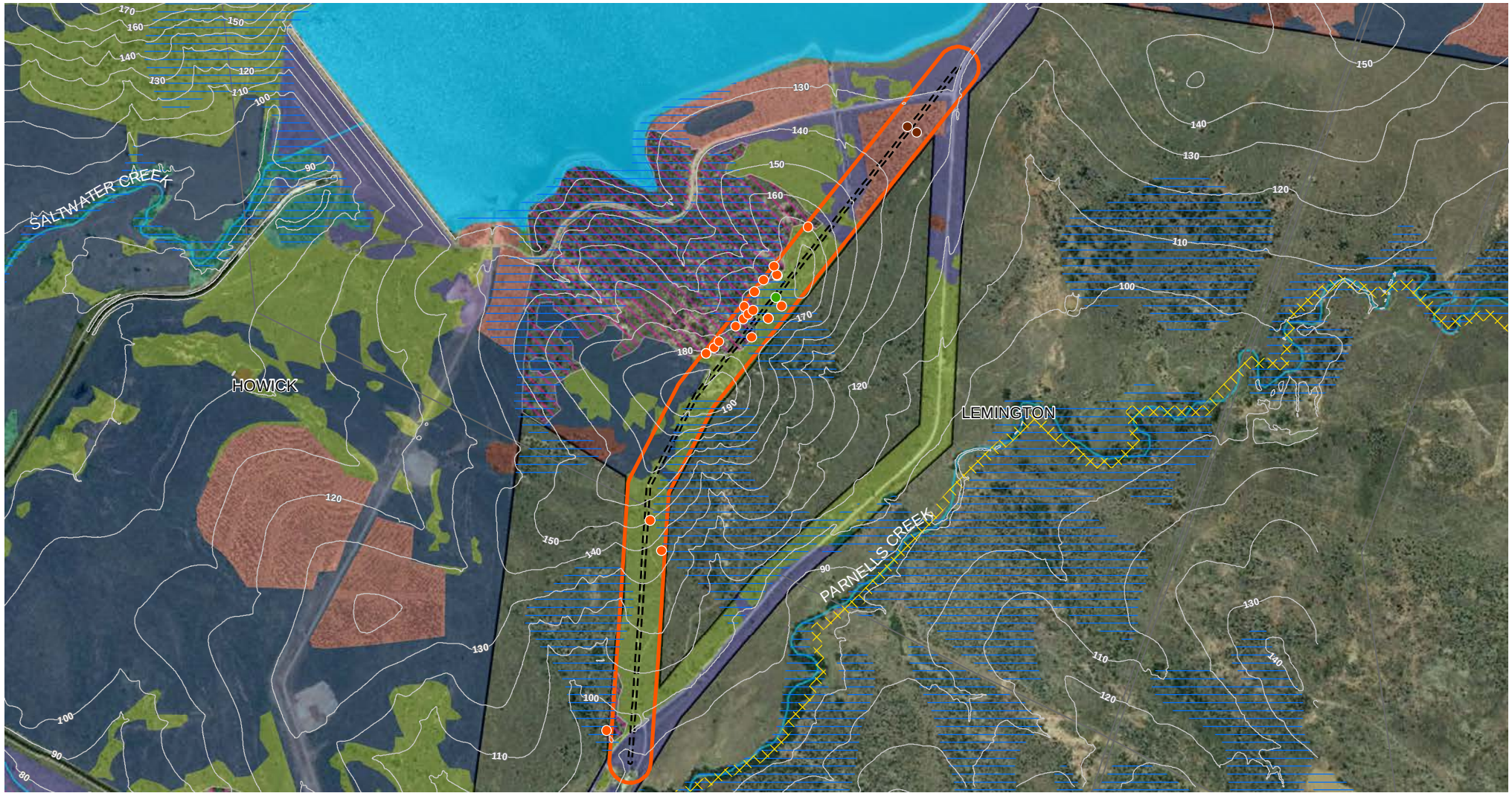

Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Valley River Oak Forest
- Plantation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

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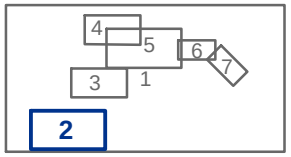
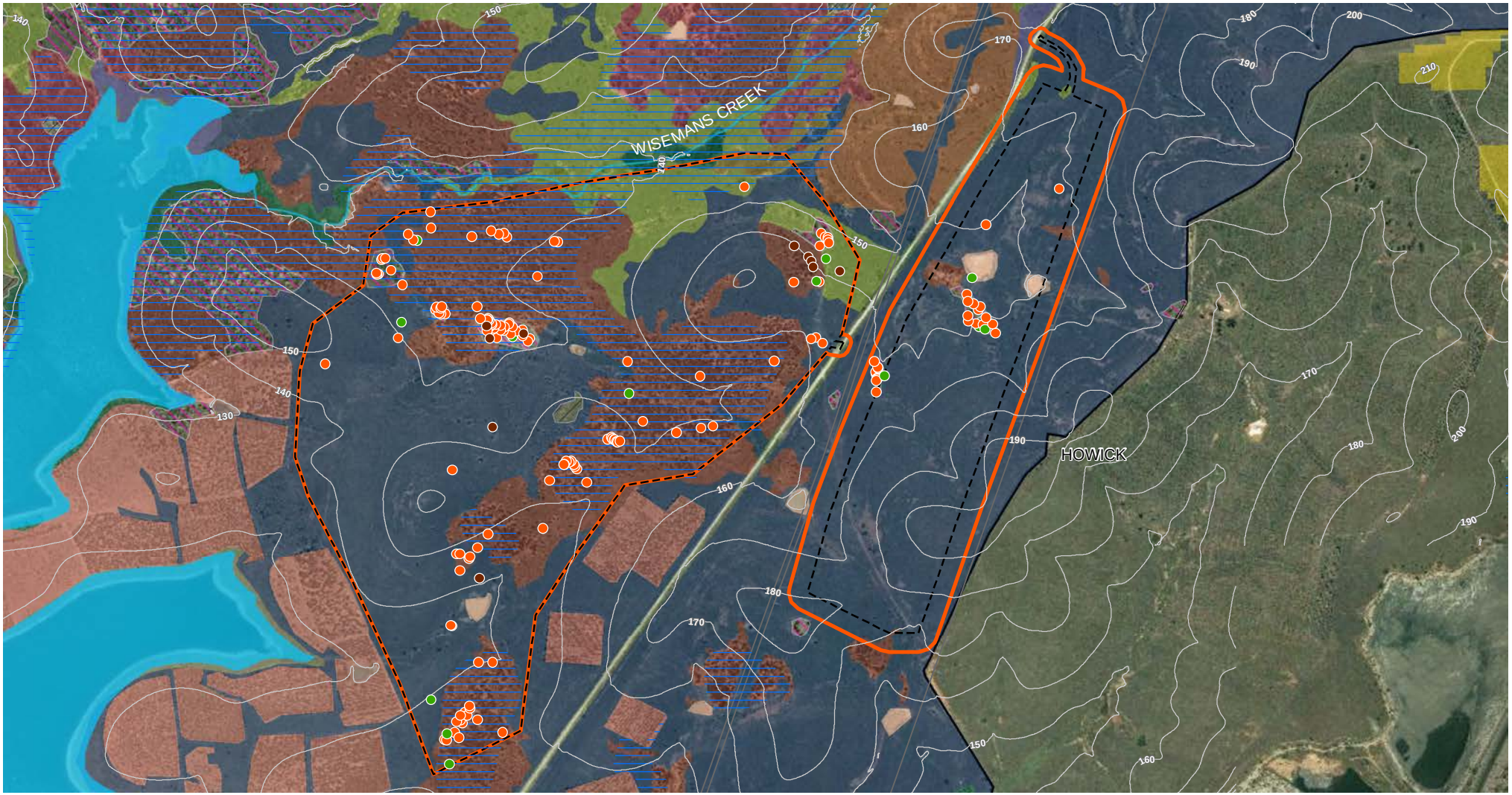


Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure E3b Environmental Constraints



Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Plantation
- Rehabilitation
- Slaty Gum Woodland
- Wetland/Dam (with wetland vegetation)

0 250 500 m

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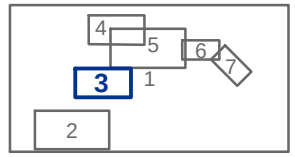

Data sources
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OEH 2019
Kleinfelder 2019

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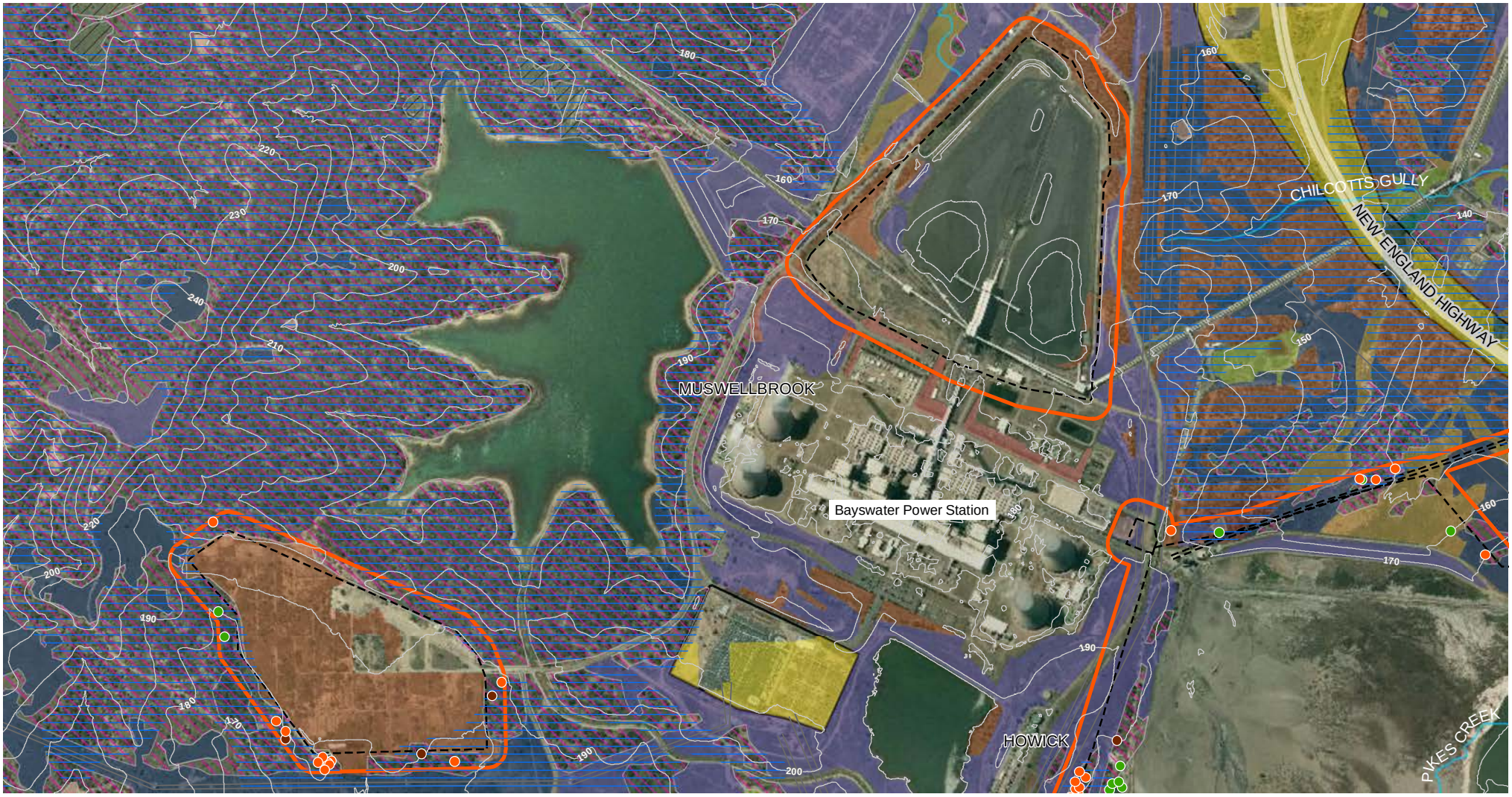
Figure E3c Environmental Constraints



Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Valley Weeping Myall Woodland
- Plantation
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

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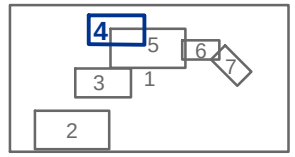

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OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure E3d Environmental Constraints

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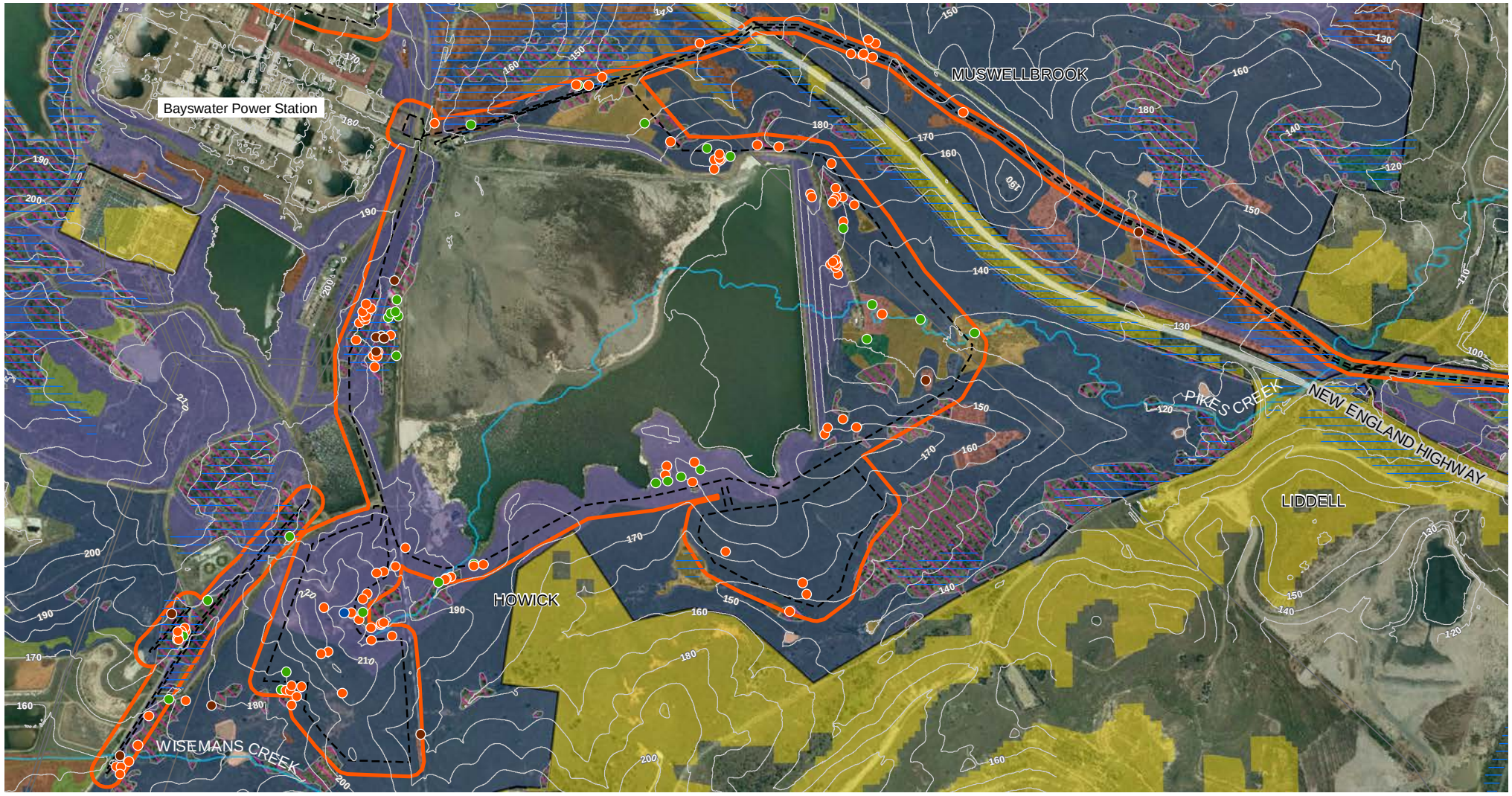


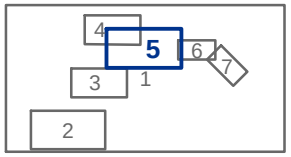
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest
- Water feature

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Plantation
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:20,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure E3e Environmental Constraints

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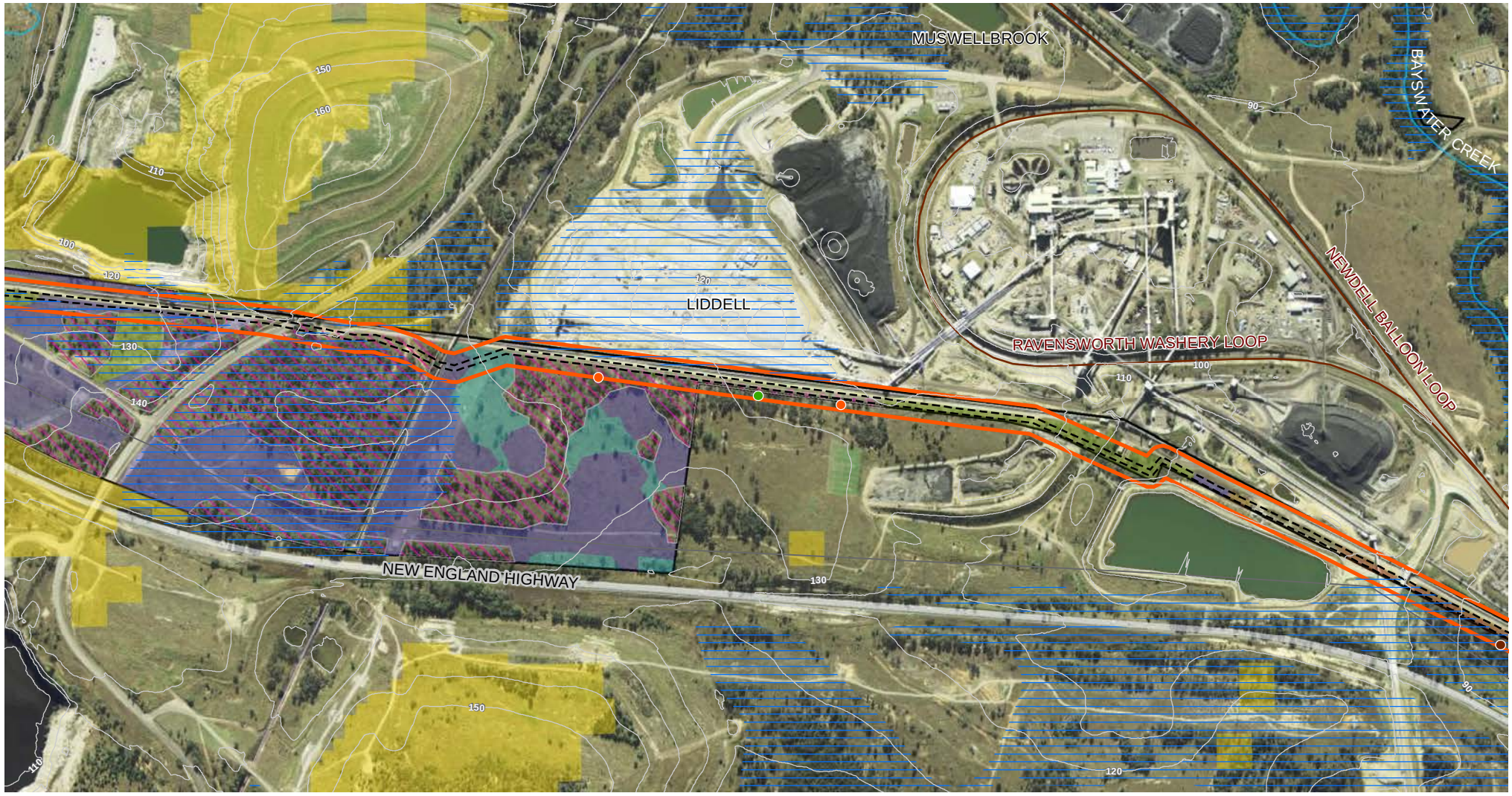


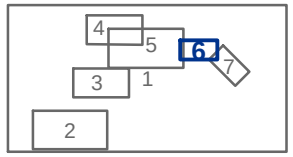
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Dam
- Exotic Grasslands
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:10,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

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Figure E3f Environmental Constraints

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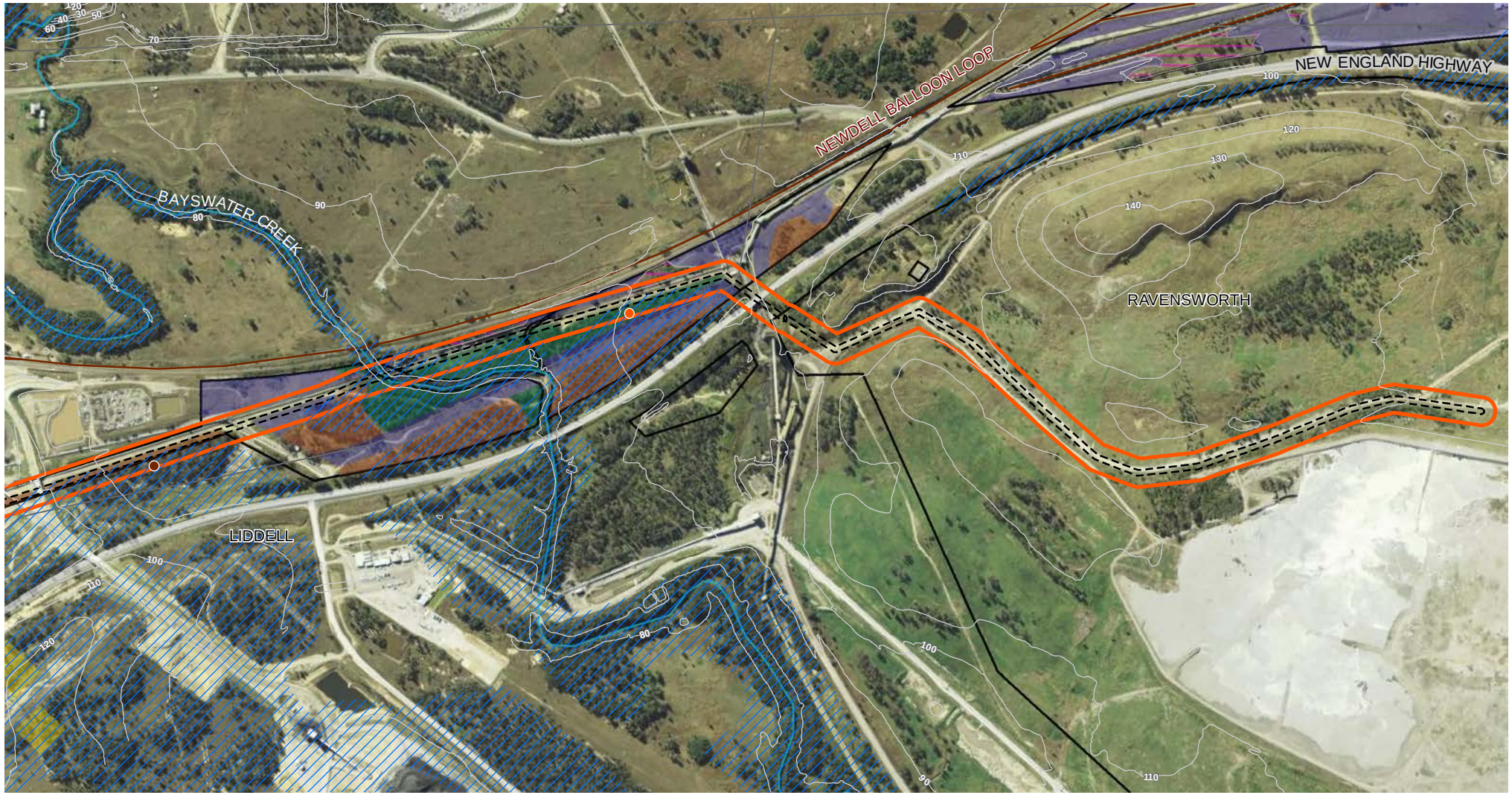
Created by : XX | QA by : XX



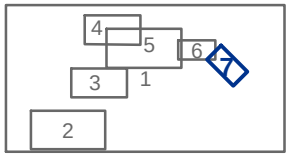
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
Hollow-bearing Tree
Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
Central Hunter Box - Ironbark Woodland
Central Hunter Swamp Oak Forest
Exotic Grasslands
Rehabilitation

0 250 500 m

1:10,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure E3g Environmental Constraints

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Statutory context

The Project is located within the Muswellbrook and Singleton Local Government Areas (**LGAs**) and 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 required to support the ongoing operation of Bayswater and so constitutes development for the purpose of "electricity generating works" and has a capital investment value of more than $30 million. The Project is accordingly State significant development (**SSD**) under the State Environmental Planning Policy (State and Regional Development) 2011 (**SEPP SRD**). On this basis, the Project is declared to be SSD and requires assessment in accordance with Division 4.7 of the Environmental Planning and Assessment Act 1979 (**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 4.7 of the EP&A Act.

The Project is a controlled action under the Environment Protection and Biodiversity Conservation Act 1999 (**EPBC Act**) with the controlling provisions being listed threatened species and communities under sections 18 and 18A. The Project will be assessed under the Bilateral Agreement (*Amending Agreement No.1*, 2020) between the Commonwealth and NSW Governments.

This EIS has been prepared addressing the Planning Secretary's Environmental Assessment Requirements (**SEARs**) issued by the NSW DPIE on 30 November 2018 and addendum SEARs issued 20 April 2020 and focuses on key issues of biodiversity, heritage, water, traffic, noise and vibration, air and socio-economic impacts. 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 issues identified in the SEARs is provided in the following sections.

Water

The EIS provides a summary of a supporting Surface Water, Groundwater and Flooding Technical Paper prepared to address the SEARs.

Existing environment

The existing environment as it relates to surface water, groundwater and flooding is characterised as highly disturbed with limited natural pathways to offsite water users or receivers. Due to the anthropogenic activities that are undertaken in the Project area, waterways within the study area have been classified as highly disturbed ecosystems. No waterways within the Project footprint area have been classified as sensitive receiving environments on the following basis:

- No waterways within the footprint area are part of the drinking water catchments for any of the surrounding townships
- Commercial fishing is prohibited in waterways within the area, and no waterways are classified as aquaculture areas
- No threatened fish listed under the EPBC Act or Fisheries Management Act 1991 are likely to be present in any of the waterways located within the Project area
- While Lake Liddell, Plashett Reservoir and Bayswater Creek have been mapped as Key Fish Habitat (KFH) (DPI, 2019), they have been classified as Type 3 minimal key fish habitat (DPI, 2013) as no threatened species are predicted to occur and only minimal suitable aquatic habitat features appear to be present along the banks of the waterways
- No other waterways within the Project footprint have been mapped as KFH.

AGL extracts water from the Hunter River and after treatment supplies drinking water to Jerrys Plains. While 35 licensed groundwater bores are present within the locality, only two are used for water supply and these are over 3.5 km's from the nearest Project elements.

While Groundwater Dependent Ecosystems (**GDEs**) are present within the groundwater study area, only 'Low potential terrestrial GDEs – from regional studies' occur within modelled impact extent from Project components with potential to influence groundwater levels or quality.

The Project elements that are considered to have potential to impact on flood behaviour are generally located within the catchment areas of Lake Liddell and Plashett Reservoir with both catchments ultimately reporting to the Hunter River. The New England Highway and other infrastructure are located within these catchments. No residential or recreation areas are present.

Surface water findings

The Project's potential to negatively impact overall catchment or waterbody water quality is considered limited to sedimentation resulting from ground disturbance and run-off as well as chemical spills from plant and equipment. The Project does not introduce new contaminants into the catchment on the following basis:

- The salt proposed to be disposed of in the Salt cake landfill is currently managed on site through discharge under the Hunter River Salinity Trading Scheme
- Ash proposed to be recycled, disposed of within the BWAD or transferred to Ravensworth Voids for rehabilitation purposes would continue to be generated and managed on site consistent with current operations with only the overall capacity retained within the BWAD, the subject of this EIS
- Process water and coal fines generated within the CHP would remain consistent with existing approved operations with only improvements to management proposed.

The water management upgrades as part of the Project are anticipated to improve water quality and quantity as follows:

- The Salt cake landfill facilitates the commencement of operations of the separately approved salt caking plant which is a component of the upgraded water treatment plant. The upgrade to the water treatment plant was proposed to improve the removal of salt from water obtained from the Hunter River prior to use at Bayswater. As such, there would be an overall reduction of salt within the Hunter River system as a result of the Project
- The upgrades to the BWAD seepage collection system would increase the volume of BWAD seepage loss flows that are captured by the seepage collection ponds and pumped back to BWAD and reduce seepage loss to downstream environments
- The upgrades to the CHP water and wastewater infrastructure, whilst presenting a minimal risk to water quality during the construction of the upgrade, is expected to result in better water quality of Tinkers Creek and Lake Liddell during operation. This would result from the separation of stormwater inflows into Tinkers Creek from the CHP, increased re-use of water within the coal plant system and enlargement of the coal settling basin, if deemed practical, all resulting in better treatment of water prior to discharge due to increased detention time.

Overall, with the implementation of the proposal mitigation measures, the Project is expected to have minimal impacts on existing water quality during the construction phase. Whilst some potential risks to water quality have been identified during the operational phase, there would also be an improvement to water quality associated with the upgrade of the CHP and seepage management measures associated with BWAD.

Groundwater Findings

With the exception of potential salinisation associated with the risk of seepage from the proposed Salt cake landfill, the Project is expected to generate negligible impacts to groundwater and as such risks to groundwater are assessed as low. This conclusion is based on a detailed review of background groundwater level and quality data, along with an analysis of the existing environmental setting and an assessment of the Project elements.

Saline/briny water may migrate to underlying and surrounding groundwater systems, if the Salt cake landfill liner were to leak. Modelling of potential salt migration from the proposed Salt cake landfill and the worst case model

were reviewed by the Project ecologist, Kleinfelder, and assessed as unlikely to impact surrounding endangered or critically endangered ecological communities.

The ultimate potential sink for the saline/briny water would be Plashett Reservoir, which is wholly within the boundary of AGL owned land. Groundwater discharge rates into Plashett Reservoir would be negligible relative to surface water inflows and therefore saline/briny water migrating to Plashett Reservoir would be readily diluted.

No long-term water table drawdown or groundwater pressure head reduction is anticipated to occur as a result of the Project. High priority GDEs are not mapped near the site and are therefore not relevant.

The Project does not meet the minimal impact consideration with regards to groundwater quality in the event of a landfill liner failure. However, the potential change to groundwater salinity is not anticipated to affect the long-term viability of dependent ecosystems (EECs and CEECs) within the adopted planning horizon period (1,000 years).

Risks associated with accidental spills or leakages of hazardous materials (such as fuels, lubricants and hydraulic oils) during the construction and operational phases of the Project elements would be mitigated through appropriate management measures.

Flooding findings

Construction of the Project elements has the potential to cause adverse impacts on flooding if management measures are not implemented, monitored and maintained throughout the construction phase. The following construction activities have the potential to impact on flooding:

- Removal of vegetation, general earthworks, including stripping of topsoil and excavation
- Stockpiling of topsoil, vegetation and construction materials
- Temporary works (e.g. waterway crossings, embankments, outlet works, diversion of waterways etc).

Potential operational impacts of the Project on flooding include the following:

- Any failure of the augmented BWAD would result in similar, however slightly enlarged inundation area than the existing BWAD. Being a Significant Consequence Category Dam, the augmented BWAD needs to satisfy the current regulatory requirements
- The Salt cake landfill facility may encroach on the floodway for the 1% annual exceedance probability (**AEP**) event and may have adverse impacts on flooding
- The Borrow Pits have the potential to divert and re-distribute flood flows which may result in adverse impacts on scouring and bank erosion
- The Ravensworth ash line could be damaged or destroyed by flooding and the pipeline could have adverse impacts on flooding
- The flooding assessment for the CHP water and wastewater infrastructure upgrade options needs to be updated to confirm impacts.

While the design is not at a stage to model actual likely flooding impacts, it is evident from the assessment undertaken that the downstream environment of the affected catchments is low risk with only ash dam failure likely to threaten significant infrastructure under the existing and proposed development scenario. It is considered the detailed design and operational management by AGL could achieve water management outcomes that would result in no significant change in flood behaviour. The detailed design of the Project would involve additional flood modelling to provide for appropriate mitigation such that no significant flood impacts would eventuate.

Land

The EIS provides a summary of a supporting Land Contamination Constraints Assessment prepared to address the SEARs.

Existing Environment

Bore data present within Bayswater indicate soil depths across the study area range from less than 1 metre to approximately 11 metres, with soil depth for the borrow pit drilling programme boreholes and groundwater monitoring bores ranging from approximately 0.7 metres to 8 metres. These boreholes encountered clayey soils.

The Project is predominately situated across Liddell soils, where minor to severe sheet erosion is common, with some minor rill erosion and moderate gully erosion in drainage lines where salting may be a feature. Borrow Pit 4 and the majority of Borrow Pit 3 are located across Bayswater soils, where moderate sheet and gully erosion is common on slopes and salt scalds and associated erosion are common in some areas.

The Project area has modelled soil electrical conductivity considered ‘non saline’ as per soil salinity class ranges. The eSPADE profile data in the broad vicinity of the Project indicates the soil salinity values range from ‘non saline’ to ‘highly saline’ as per the soil salinity class ranges.

All land within the Project area is mapped as a ‘low probability of occurrence’ for acid sulphate soils, with a ‘very low’ level of confidence. Acid sulphate soil is not anticipated based on elevations within the Project area. The land within the Project area ranges from ‘Severe’ to ‘Very Severe’ limitations, which corresponds to Land and Soil Capability Class 5 and 6 respectively. These limitations and classes are identified as largely restricting land use to grazing, some horticulture (orchards), forestry and nature conservation.

Based on the consideration of known and potentially contaminated sites, a total of six areas were identified as potential Areas of Environmental Concern within the vicinity of the Project that warranted further consideration.

Given the typically rural setting of areas surrounding Bayswater, and the absence of any foreseen interaction with groundwater as part of the proposed Project works, no off-site potential sources of contamination have been identified during this assessment that would have an impact upon the Project.

Land Contamination Constraints Assessment findings

Asbestos is present within the above ground pipelines and in surface soils beneath pipelines along the northern and western boundaries of the Ash Dam Augmentation Area. Asbestos has also previously been identified in surface soils at one location on the eastern boundary of the Coal Storage Area. The Project would not involve works that would interact directly with these locations and as such, the risk of worker exposure to airborne asbestos fibres is considered to be low. The remediation of these areas is not proposed as part of the Project.

The chemical concentrations identified in soil and groundwater within the study areas are unlikely to represent a significant risk to human health and/or the environment given appropriate management and the continued use of the site as a power station. Based on the results of the assessment and conceptual site model presented within the Land Contamination Constraints Assessment, the potential contamination risk associated with the study areas are considered, overall, to be low and acceptable. The Project is therefore considered to be acceptable and potential contamination risks should not be viewed as an impediment to the Project. As no change of use to a more sensitive land use is currently proposed, remediation is not required or included as part of the Project.

The Project does not involve the decommissioning and remediation of Bayswater and only provides consideration of the decommissioning of Project components. The decommissioning, demolition and remediation of Bayswater would be subject to future assessment and approval.

Transport

The EIS provides a summary of a supporting traffic and transport impact assessment for the Project.

Existing Environment

Bayswater is connected to the surrounding road network via an access road and grade-separated interchange to and from the New England Highway. The Ravensworth Ash Line is also accessed from Pikes Gully Road.

The key surrounding roads are:

New England Highway – The New England Highway is a Federal Highway that links Newcastle to Brisbane. The highway connects with the Pacific Highway and the D'Aguilar Highway, facilitating access to Sydney and Queensland, respectively. Near the site, the New England Highway is dual carriageway with two lanes in each direction and a central median. The speed limit is 100 km/h in the section of road near the power stations.

Bayswater Access Road – Bayswater is accessed from the New England Highway via an interchange that is shared with Liddell Power Station. The interchange connects with the power stations via an unnamed east-west access road. The access road is single carriageway with one lane in each direction. The road has a posted speed limit of 60 km/h.

Pikes Gully Road - Access to the Ravensworth Ash Line is available via Pikes Gully Road and would be used for construction, maintenance and operation of the Project. Pikes Gully Road is a single carriage way with access from the New England Highway via both right-in and left-in dedicated turning lanes. North bound entry to the New England Highway is via a slip lane while south bound has a short acceleration lane. The New England Highway is single carriage way with a single lane in each direction at the access to Pikes Gully Road.

The average weekday traffic volumes on the New England Highway are approximately 9,400 vehicles per day with 30 per cent of these volumes being heavy vehicles. Peak traffic periods occur in the hours starting 8:00am and 4:00pm. Traffic volumes are similar to volumes during the peak hours between 5:00am and 6:00pm.

Approximately 2,200 (1,100 in and 1,100 out) vehicle movements were recorded through the Bayswater access interchange on a daily basis during a maintenance shutdown period where 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 operation at Bayswater. The morning peak hour is 6:00am – 7:00am and evening peak hour is 5:30pm – 6:30pm. Heavy vehicle volumes at the interchange make up between 5 and 10 per cent of the total volume of traffic.

Heavy vehicle routes to and from Bayswater would only use the existing oversized and over-mass load approved road network. This includes the use of New England Highway and the Bayswater access road. No public transport services operate on the road network near the Project.

Findings

The peak construction traffic movements related to the Project (to and from Bayswater) are expected to be approximately:

- 180 light vehicles (90 in and 90 out per day)
- 50 heavy vehicle movements (25 in and 25 out per day).

In addition, up to 8 (four in and four out) oversized vehicle movements could be expected for the delivery of weighbridges and the ash silo.

During operation, it is expected the Project would generate approximately 360 heavy vehicle movements (180 trucks in and 180 out) and 50 light vehicle movements (25 in and 25 out) on a daily basis. Operational truck movements would be associated predominantly with ash recycling.

Modelling using SIDRA Intersection 7 indicates that the interchange currently operates at excellent levels of service with abundant spare capacity. The cumulative impact of the Project and nearby developments would increase delay slightly within the interchange but will not significantly impact operation. 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.

The New England Highway and the southbound entry ramp from the interchange have excess capacity to accommodate the additional cumulative traffic generation.

Noise

Existing Environment

The nearest sensitive receivers are located several kilometres from the Project. Intervening terrain features between Project activity areas and the identified nearest sensitive receivers are present.

Non-sensitive receivers such as Yancoal's Hunter Valley Operations North and Glencore's Liddell Coal and Ravensworth Complex are located closest to the Project, with the nearest industrial building located approximately 400 metres away.

Winds blowing from the southeast were 'significant' during evenings in Autumn and frequency of occurrence of temperature inversions in winter months was also 'significant' such that noise-enhancing meteorological effects require consideration.

In the absence of monitored background noise levels minimum rating background levels (**RBLs**) to be used for the purpose of noise assessment.

Noise and Vibration findings

The key activities considered to have the potential to generate noise and vibration during the Project include:

- Earthworks associated with the BWAD augmentation, Salt cake landfill, Borrow Pits 1 to 4, and Ravensworth ash pipeline
- Upgrades to the existing infrastructure
- Vegetation removal
- Construction and operational traffic movements.

Overall sound power levels (**SPLs**) were predicted for each activity and phase associated with the Project. These were determined based on sequencing and plant and equipment agreed with AGL. The overall SPLs were estimated with reference to individual plant and equipment levels presented in national and international standards and guidelines, as well as from Jacobs measurement database.

Given the large setback distance of these nearest sensitive receivers from the Project, the resulting noise contributions at each location was predicted to be less than 30 dB(A). When considered with the adopted background noise levels, the highest predicted resulting noise level was 31 dB(A) which is below the Noise Management Levels established for the Project. As such it can be concluded that noise from construction activities at the Project would not result in off-site impacts at surrounding residential receivers. Levels were also predicted to remain below the Interim Construction Noise Guideline Noise Management Levels at the nearest industrial receivers.

Considering the estimated additional traffic along the New England Highway generated during construction and operations at the nearest receiver location (approximately 60 metres away), the resulting change was predicted to be 0.2 dB(A) or less, below the 2 dB(A) criterion that would warrant additional consideration under relevant traffic noise guidelines.

Some vibration-intensive equipment is planned to be used during the Project including excavator mounted rock breakers, under boring equipment and vibratory rollers. The setback distances to the nearest sensitive receivers exceed the safe distances by several orders of magnitude. As such it was concluded that any vibration resulting from the Project would not be of any concern to the nearest sensitive receptors.

Biodiversity

A Biodiversity Development Assessment Report (**BDAR**) has been prepared in accordance with the Biodiversity Assessment Method (**BAM**) to assess the biodiversity impact and offsetting obligation of the Project under the *Biodiversity Conservation Act 2016* (**BC Act**). The BAM is also recognised under the Bilateral Agreement (*Amending Agreement No.1*, 2020) between the Commonwealth and NSW Governments and the BDAR includes assessment of matters of National Environmental Significance.

The Project occurs within the northern portion of the Sydney Basin Interim Biogeographic Regionalisation for Australia (**IBRA**) Region and the northern portion of the Hunter IBRA sub-region (Department of the Environment and Energy, 2012). Existing infrastructure and open cleared areas dominate the Project area however, some areas of intact vegetation occur across the site, particularly in the western portions where it connects to patchy vegetation in the broader landscape.

There are no important wetlands within or adjacent to Bayswater. The closest SEPP (Coastal Management) Coastal Wetland (Hunter River - Estuarine) is located over 65 km to the south-east of the Project. There are no areas of geological significance within the Project area and no areas of outstanding biodiversity value mapped within the Project area.

The total Development site is 561 ha, and includes all land required for construction and operation of the Project. Native vegetation surveys conducted within the Study Area identified three Plant Community Types (PCTs) consisting of:

- 206.82 hectares (**ha**) of PCT 1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the central and upper Hunter is present in six vegetation zones
- 61.64 ha of PCT 1692: Bull Oak grassy woodland of the central Hunter Valley is present in two vegetation zones
- 2.40 ha PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley is present in one vegetation zone.

Additionally, areas of non-native exotic grassland (55.82 ha), wetlands/dams with non-native vegetation (11.3 ha) dams with no wetland vegetation (1.47 ha) and excluded areas (221.77 ha; existing Ash Dam footprint and other existing pieces of infrastructure) occur.

A total of 20.32 ha of the Development site across three vegetation zones were identified as constituting Threatened Ecological Communities under the BC Act and/or the EPBC Act. This consists of:

- 6.7 ha of the Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions Endangered Ecological Community listed under the BC Act
- 5.53 ha of the Central Hunter Valley eucalypt forest and woodland Critically Endangered Ecological Community listed under the EPBC Act
- 8.09 ha of meeting both listing criteria.

Targeted threatened species surveys identified the following:

- Three mammals, four bird and one reptile species detected within the Study Area listed as Vulnerable under the BC Act consisting of:
  - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) was identified near the dam in Borrow Pit 3
  - Southern Myotis (*Myotis macropus*) was identified near the large dam on the eastern side of the BWAD
  - Squirrel Glider (*Petaurus norfolcensis*) was identified within Borrow Pit 4 and has been added as a candidate species, as it is not associated with any of the PCTs within the Development Site
  - Little Lorikeet (*Glossopsitta pusilla*) was identified flying over the salt cake landfill area
  - Hooded Robin (*Melanodryas cucullata*) was identified in Borrow Pit 4
  - Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) was identified at multiple locations within the Development Site and Study Area including multiple nesting locations
  - Speckled Warbler (*Chthonicola sagittata*) was identified in Borrow Pit 4
  - Striped Legless Lizard (*Delma Impar*) was identified on two occasions in the same area in Borrow Pit 4
- One planted *Acacia pendula* within the threatened population, *Acacia pendula Endangered Population in the Hunter Catchment*, listed under the BC Act was identified within the Study Area but outside the Development site and would not be impacted.

Two threatened flora species; *Diuris tricolor* and *Prasophyllum petilum,* were assumed present within the Development site as optimum survey conditions were not met. Targeted survey is proposed within the next

optimal condition flowering season to confirm extent of presence or absence in order to refine impact assessments and offsetting requirements.

Biodiversity Findings

The Project has been designed in consideration of the principals of avoid and minimise. A number of alternatives, including the 'do-nothing' option, were considered prior to selecting the current design. Direct impacts, indirect impacts and impacts on prescribed matters have been avoided and minimised where possible and further efforts are proposed as part of the detailed design process. A range of mitigation and management measures have been incorporated into the Project to reduce impacts on biodiversity during construction and operation.

No Serious and Irreversible Impacts were identified within the Development Site.

The residual impacts of the Project which require offsetting include:

- Impacts on 206.82 ha of PCT 1691, generating a credit obligation of 3,904 ecosystem credits
- Impacts on 61.64 ha of PCT 1691, generating a credit obligation of 1,275 ecosystem credits
- Impacts on 2.40 ha of PCT 1731, generating a credit obligation of 31 ecosystem credits
- Impacts on Paddock Trees associated with PCT 1691 requires a total of 31 ecosystem credits
- Impacts on 166 ha of *Diuris tricolor* habitat, generating a credit obligation of 2,158 species credits
- Impacts on 166 ha of *Prasophyllum petilum* habitat, generating a credit obligation of 2,877 species credits
- Impacts on 59.05 ha of Squirrel Glider habitat, generating a credit obligation of 1,433 species credits
- Impacts on 8.11 ha of Southern Myotis habitat, generating a credit obligation of 233 species credits
- Impacts on 120.68 ha of Striped Legless Lizard habitat, generating a credit obligation of 2,169 species credits.

The retirement of biodiversity credits will occur in a staged manner as clearing for each portion of the Project will not occur immediately. Not all areas of the Borrow Pits may be required. AGL anticipate the need for a clearing staging plan to be prepared prior to the commencement of works. This plan will set out the biodiversity credit obligation for each stage of clearing and will be approved by DPIE prior to commencement.

As the Project is considered a controlled activity under the EPBC Act and is to be assessed under the accredited process under the assessment bilateral agreement, consideration for impacts to Matters of National Environmental Significance (**MNES**) is included in the EIS and BDAR. An assessment of significance in accordance with the Significant Impact Guidelines 1.1 Matters of National Environmental Significance (DoE, 2013) has been undertaken for all listed Threatened Ecological Communities and threatened species considered relevant to the assessment.

It was concluded that for all except two of the threatened species, all ecological communities and migratory species identified within or as having suitable habitat within the Development Site, the Project is unlikely to have a significant impact. There were two species; Striped Legless Lizard and *Prasophyllum* sp. Wybong, for which impacts are uncertain. The uncertainty is related to the inability to quantify the extent of presence or absence of *Prasophyllum* sp. Wybong which is intended to be resolved prior to impact through additional targeted survey. The potential for significance of impact to the Striped Legless Lizard is due to the study area being at the northern extent of the known population with uncertainty associated with the small numbers identified.

Waste

Key waste management issues associated with the Project are limited to:

- Management of demolition and construction waste with a focus on maximising recycling opportunities
- Changes to management of existing ash and salt waste streams to improve environmental performance.

No new or problematic waste streams require management as part of the Project. Material movements associated with cut and fill would not result in surplus materials with all excavated materials proposed for reuse in BWAD augmentation, Salt cake landfill construction or rehabilitation requirements.

Demolition and construction wastes

Approximately 1,300 metres of an existing abandoned coal conveyor that runs along the western perimeter of the BWAD is to be removed prior to commencing earthworks associated with the BWAD augmentation. The majority of this material (steel) is expected to be recycled. A range of uses for end-of-life conveyer belt including line fences, paths for protection of sand dunes and weed suppression matting and options for reuse would be explored. Any demolition material not able to be recycled would be lawfully disposed of off-site.

Above ground portions of the existing Ravensworth Pipeline would be required to be removed following closure of Bayswater. Where possible, disused materials would be reused on site if it meets appropriate structural requirements. Otherwise waste materials would be disposed of or recycled using an appropriately licensed contractor.

As part of the site clearing for the Salt cake landfill, there would be removal of contractor facilities and materials. These facilities and materials would be relocated to other areas of AGL land, and therefore would not be required to be taken off site for disposal.

The decommissioning of Project components would involve the removal of redundant above ground infrastructure. Such infrastructure is likely to be limited to the new above ground Ravensworth Pipeline components consisting of pipe segments and concrete plinths and the ash recycling infrastructure. Planning for the demolition and disposal of these components would be incorporated into the future planning of Bayswater retirement.

It is anticipated that there would be a small amount of waste generated during the construction process, which would include some material breakage, as well as offcuts and disposable items. These waste streams would consist of typical construction waste and would be recycled or otherwise lawfully disposed of off-site.

The anticipated additional workers on site are likely to generate minor volumes of general waste as part of the construction of the Project. Increased general waste would be incorporated into other waste streams generated through daily operation of Bayswater and disposed of off-site at an appropriately licensed waste facility.

Operational waste

No additional operational waste is anticipated as a result of the Project with the exception of general waste generated by increased employees working on site in association with the ash recycling operation expansion. Discussion of the changed management of operational waste proposed as part of the Project is provided below.

The quantity of ash generated at Bayswater would not change as a result of the Project. Current predictions of ash generation over the remaining operational life of Bayswater are 38,544,000 tonnes consisting of 33,148,000 tonnes of fly ash and 5,396,000 tonnes of bottom ash. 75% of fly ash is intended to be sent to Ravensworth Voids for use in rehabilitation with the remainder requiring disposal within the BWAD, unless able to be recycled. Based on predicted disposal rates and remaining storage calculations, up to an additional 12.5 million m^3 of storage space is required within the BWAD. This would be achieved through the proposed BWAD augmentation. Following the retirement of Bayswater, the BWAD would be decommissioned and undergo rehabilitation that conforms with the industry standard approach.

As is currently the case, fly ash would continue to be transferred via pipeline (in slurry form) to Ravensworth Mine, where it is used to rehabilitate (fill) mine voids under separate approvals. This is the primary disposal mechanism for Fly ash. No change is proposed to the intended use of Fly ash at Ravensworth as part of the Project.

In order to minimise requirements for the augmentation of the ash dam and meet identified potential increase for ash in external construction projects, AGL plans to expand its' ash recycling activity. The Project seeks approval to expand the current operations to up to 400,000 tonnes per annum of fly ash and up to 600,000 tonnes per annum of bottom ash. Ash recycling for offsite use would be undertaken in accordance with Fly ash and Bottom ash sampling plans developed to address waste exemption and reuse requirements. Ash recycling expansion is market driven with material expected to be supplied to large road infrastructure projects and for use as soil

ameliorants such as via the Ravensworth composting facility to support rehabilitation projects including the future rehabilitation of Bayswater and Liddell lands.

Salt requiring management is currently generated by the existing Bayswater water treatment plant which removes naturally occurring salts and solids through the process of cleaning feedwater for the cooling water system. Salt brine is currently stored in the brine concentrator decant basin with Lake Liddell discharge also used to discharge salt from the site under the Hunter River Salinity Trading Scheme. A Salt caking plant has been approved and would be constructed as part of the water treatment plant upgrade (Project approval 06_0047, as modified), which would produce a Salt cake by-product. The commencement of operation of the salt caking plant is subject to a deferred commencement condition requiring the separate approval of an appropriate salt cake disposal method.

The Project includes the construction and operation of a Salt cake landfill facility on site to store the salt cake produced from the approved caking plant. The facility would be designed to accommodate up to 50,000 tonnes of salt cake per year, with approximately 600,000 tonnes of salt cake being deposited over the operational life. Design, construction, operation and capping of the cells would be as per *EPA Environmental Guidelines: Solid Waste Landfills* (EPA, 2016).

Heritage

Non-Aboriginal heritage findings

Searches of National, State and Local heritage databases identified only one heritage item within the vicinity of the Project, being the former Chain of Ponds Inn, located approximately 500 metres from the proposed Ravensworth ash line, on the north eastern side of Bayswater Creek. It is considered to be of sufficient distance from the Project to not be impacted.

A review of historical literature indicates that the land comprising the study area was used primarily for grazing up until the 1950s and 1960s, after which time the power station was built. A site inspection undertaken between 9-13 September 2019 by Jacobs Heritage Consultants confirmed that there were no significant items of non-Aboriginal heritage within the study area and little potential for non-Aboriginal archaeological deposits to remain. A permanent survey marker (trigonometric station Glendower) was identified in Borrow Pit 2, and as a protected element of the State Control Network, would require management prior to project commencement.

As a consequence, it is concluded that there are no significant non-Aboriginal heritage constraints associated with the Project.

Aboriginal heritage findings

The EIS provides a summary of an Aboriginal cultural heritage impact assessment report prepared for the Project in accordance with current assessment guidelines and codes of practice.

An extensive search of the Aboriginal Heritage Information Management System (**AHIMS**) register was carried out on 15 July 2019 for the study area. Fourteen previously recorded sites are present within the search area, one of which is recorded as being destroyed.

Field survey was carried out between 10 to 13 September 2019. The survey investigated the areas proposed to be impacted by the Project and was undertaken on foot by a team of two archaeologists and nine Aboriginal Sites Officers from the Registered Aboriginal Parties (**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. Decisions to exclude areas in this way were made in the field, through a consensus of all field team members.

The field survey identified an additional 23 sites (including isolated artefacts, artefact scatters, areas of potential archaeological deposits (**PAD**), and artefact scatters with associated areas of PAD). Aboriginal cultural significance was assessed through consultation with the relevant RAPs during the archaeological survey and consultation process. Significance of surface artefacts was found to range from low to moderate. The

significance of areas of PAD could not be assessed on the basis of the data gathered during the archaeological survey and future test excavations are proposed.

For the purpose of this assessment, a precautionary approach has been adopted, and it is assumed that all sites and PADs within the Project area would be subject to direct impact, and all items within the study area, however outside the Project area would be subject to indirect impact.

It is noted that impacts to AGL land has been cited by RAPs as a concern due to it being a pocket of relatively undisturbed land in an area that has been subject to extensive impact from mining operations. Prior impact to large areas of land in the immediate surrounding region, and across the Hunter Valley overall, have increased the curiosity that the Aboriginal community has with any possible impacts for future projects. Mitigation measures would be developed to minimise impacts.

Visual

The Project is predominately located on land owned by AGL, although some Project infrastructure also crosses road reserves owned by TfNSW, Singleton Council, and a small area of Crown land. The surrounding area is characterised by mining operations, rolling hills, grazing land and bushland. 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 former Drayton Mine.

The existing surrounding land uses have a low number of sensitive receivers. The nearest sensitive receivers are located 1.8 km's south south-west of the Project. Visibility of Bayswater is limited to users of the New England Highway, where occasional, elevated, open stretches of highway offer broad views across the landscape towards far ridgelines. Much of the route in the vicinity of Bayswater is visually contained on both sides of the road by mature woodland vegetation or landform.

There are no key vantage points in the public domain which afford views to Bayswater with the exception of the cooling towers and stacks.

Visual impacts

The proposed BWAD augmentation is the most visually prominent, and the only potentially visible element of the Project. As such the BWAD augmentation has been used to establish the viewshed for this Project.

The distance over which the proposed, additional 11.5 metres height change could be viewed by the 0.5% vertical field of vision is 1.26 km. The receiving landscape is associated with long term, large-scale industrial operations. Whilst remnants of the pre-existing agricultural landscape remain, the surrounding area has been degraded with feature detracting elements comprising spoil dumps, industrial buildings and associated infrastructure such as above ground pipelines and electricity pylons.

The Project would result in very minor loss or alteration to key elements/features of the remnant agricultural landscape and the changes would be characteristic with the environs of the power stations and mining operations. It is unlikely that the changes would be remarkable within the context of Bayswater and the magnitude of change is therefore negligible. In the absence of any sensitive visual receptor within the Zone of visual impact, overall visual impacts associated with the Project would be minimal.

Air

The Air Quality Impact Assessment followed the EPA's Approved Methods which specifies how assessments based on the use of air dispersion models should be undertaken. The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

Existing Environment

The surrounding landscape is heavily influenced by industrial activity. The nearest sensitive receptor to Project elements with potential to generate air quality emissions is over 5 km.

The monitoring data from the various stations around the Project indicate that the EPA's daily impact assessment criterion were occasionally being exceeded around the nearby representative receiver locations. Annual dust concentrations (PM_{10} and $PM_{2.5}$) and deposited dust levels were also exceeded in some years at some stations.

Background concentrations for the purpose of assessing cumulative pollutant concentrations and levels were estimated using the 2017 concentration (year of modelling) measured at the nearest station or otherwise most conservative (i.e. highest recorded) value.

Air quality findings

The assessment indicated that EPA impact assessment criteria for Total Suspended Particles and PM2.5 would be met at surrounding sensitive receivers, with no additional exceedances of 24-hour averaged PM10 predicted. Negligible (less than 1%) contributions of annually averaged PM10 and deposited dust were predicted. The results indicate that the Project would not result in unacceptable changes in local air quality.

Hazards

Hazardous substances

The existing operation of Bayswater would be considered potentially hazardous when screened under the SEPP 33 Guideline in the absence of appropriate controls. As hazardous chemicals are not stored within the Project area and the Project does not alter how these chemicals are stored or handled, there is no potential for cumulative hazards or for Bayswater land-use safety risk profile to be significantly increased.

The existing separation between the Project and storage locations for hazardous chemicals means there is a low and manageable risk that the Project could interact with existing storage. Therefore, it can be concluded that the Project would not have any hazardous impact on the existing operation or contribute to the escalation of any event in a manner that could impact land inside the plant, within the buffer zone and most importantly to off-site receptors. The Project does not intensify the existing risk profile of the operation of Bayswater and is not considered potentially hazardous.

Dam safety

The BWAD is currently prescribed under the Dam Safety Act. As a result, it has several conditions applied to ensure the safety of the structure and to minimise risk to the downstream population. The Consequence Category of the dam is reviewed at five-yearly intervals within comprehensive surveillance reports, which are submitted to Dams Safety NSW. The last report concluded that BWAD remains within the Significant Consequence Category, under both sunny day and flood conditions.

A dam safety management program is implemented and includes regular surveillance inspections, monitoring and regular reporting. The change in placement strategy, and the augmentation that has been proposed, triggers the need to reassess the consequence category of the BWAD, and any resulting safety requirements would be incorporated into the design, construction and ongoing management program.

Bayswater Ash Dam Augmentation Design Report (Aurecon, 2019) incorporates a Consequence Category assessment of the preferred design option. Aurecon (2019) concludes that the augmented BWAD would remain in the Significant Consequence Category under both sunny day and flood conditions. The detailed design would be subject to consequence category assessment to confirm dam safety risks remain acceptable and appropriately managed.

Bushfire risk

A review of the NSW Rural Fire Service bushfire mapping was conducted to confirm that the Project would be partly located within and near bushfire prone land. During construction, the primary sources of bushfire and potential risks and impacts would be from:

- Hot works such as welding during igniting surrounding vegetation and causing a bushfire

- Inadequate bushfire emergency response system in place resulting in serious injury or death or
- Insufficient training of construction workers dealing with bushfire risk.

Overall, the hazards and risks associated with construction, operation and decommissioning of the Project are considered low and do not introduce new bushfire risks to the site. Risks would be managed with the implementation of AGL's Health Safety and Environment Management Plan and Bushfire Management Plan which would be updated to include the Project.

Socio-economic

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 amenity impacts as summarised above.

Employment

The Project would impact positively on employment through the creation of direct employment opportunities for up to 90 people through the construction phase, with most construction workers expected to be sourced locally and from within NSW where practical. Once operational, the Project would impact positively on employment through the creation of direct employment opportunities such as those associated with the additional ash recycling. It is expected that operation of the Project would generate an additional 25 jobs. The creation of employment opportunities from the Project would benefit local and regional workers and have potential to support improved incomes for individuals.

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.

Accommodation

The nature of the direct employment being generated by the Project is considered typical of major employment generating activities in the region and as such it is likely that the additional workers required to support the Project would mainly be sourced from local and regional communities. The Project is not expected to significantly impact on demand or cost of housing and accommodation in the Muswellbrook or Singleton LGAs. If unable to be sourced locally, additional workers from outside local and regional communities would be accommodated in rental housing or temporary visitor accommodation in towns near Bayswater. Increased demand for rental housing may put pressure on rental prices resulting in increased rents. This would have the greatest impact on affordable rental housing access, resulting in a potential increase in housing stress for some households on low or fixed incomes. Occupancy rates for tourist accommodation peaked at 56% in Singleton and 50.8% in Muswellbrook in most recent data, suggesting that there would be capacity in existing tourist accommodation to accommodate construction workers. The use of some of the available, under-utilised tourist accommodation for temporary workforce accommodation would help to ease demand for private rental accommodation.

Community values

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 is likely to be seen as a positive by communities in the Muswellbrook and Singleton LGAs.

The Project would support improved environmental outcomes in relation to water management through the enhancement and upgrade to existing infrastructure and additional ash recycling. This is likely to be considered a positive by community members, with protection of the environment, waste management and managing and reducing risks from environmental pollution identified as key outcomes for the Singleton Council and Muswellbrook Shire Strategic Plans.

Justification

The benefits of the Project, being the improved environmental performance and rehabilitation outcomes for the continued operation of Bayswater, are considered to outweigh any identified adverse impacts. While some environmental impacts cannot be avoided, they would be minimised where possible through the design process and implementation of mitigation measures.

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 but this would not 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.

Biophysical costs and benefits

The Project involves vegetation clearing. These impacts would be offset in accordance with the BC Act and EPBC Act in accordance with any approval conditions. Air quality impacts have been identified as localised during the operation of the Borrow-pits and construction of the Ash dam augmentation. The Project would facilitate the capping and rehabilitation of the ash dam leading to improved air quality outcomes post Bayswater's retirement.

Economic costs and benefits

The Project has an estimated capital investment value of $51.9 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 possible. 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 the upgraded 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 cost-efficient private investment in improving the environmental and rehabilitation outcomes of Bayswater that would maximise the long-term social and economic benefits, while minimising any perceived long-term negative impacts on communities and the environment.

1. Introduction

This section provides a general Project overview and describes the environmental and historic context in which it would occur.

1.1 Project Overview

AGL Macquarie as a subsidiary of AGL Energy Limited (referred to throughout as AGL) are proposing to undertake a range of upgrades to Bayswater Power Station (**Bayswater**) to improve the environmental performance of ash and salt management infrastructure and associated rehabilitation outcomes.

Bayswater was commissioned in 1985 to utility standards of the time and has a current technical life up to 2035. Bayswater has a current generation capacity of 2640 megawatts (**MW**) and approval for efficiency upgrades that would increase capacity to 2740 MW.

Bayswater employs technology common to other NSW coal-fired power stations using the following general process:

- Coal is burned in the boiler furnace producing heat for the boiler
- Water is circulated through the boiler and heated by the boiler furnace to produce steam
- High pressure steam from the boiler enters the turbine trains within the generating units
- The turbines drive the generator rotor which produces electricity
- The electricity produced by the generator is transformed to system voltage and fed to the interconnected transmission system via the station switchyard.

Ancillary activities arising out of coal fired power generation at Bayswater include:

- Receipt, storage and transfer of coal within the coal handling plant area
- Pumping of water from the Hunter River under existing water entitlements and storage and treatment of this water, including the management of salt and other impurities, to supply boilers and for cooling purposes
- The management of incombustible coal residue, in the form of bottom ash and fly ash, which is collected and transported to ash disposal areas.

The Bayswater water and other associated works project (**Project**) will include the following elements:

- Augmentation of the existing Bayswater Ash Dam (**BWAD**) to provide additional ash storage capacity (**Ash Dam augmentation**)
- Improvements to water management structures and systems to ensure continued collection and reuse of process water and return waters from the BWAD (**Ash Dam augmentation**)
- Improvements to the management of water and waste materials within the coal handling plant sediment basin and associated drainage system (**Coal handling plant upgrades**)
- Increasing coal ash recycling activities to produce up to 1,000,000 tonnes per annum of ash derived product material and reuse of coal ash (**Ash harvesting upgrades**)
- Upgrades to existing fly ash harvesting infrastructure including the installation of weighbridges, construction of a new 240 tonne silo, tanker wash facility and additional truck parking (**Ash harvesting upgrades**)
- Construction and operation of a new coal ash pipeline to Ravensworth Void No. 3 for ash emplacement (**Ravensworth ash line)**
- Construction and operation of a salt cake landfill facility to dispose of salt cake waste from the approved salt caking plant to be constructed at the Bayswater water treatment plant (**Salt cake landfill**)
- Construction and operation of a Borrow Pit(s) on AGL land to facilitate the improvements proposed for the Project and other works on AGL land (**Borrow Pits 1 to 4**) and
- Ancillary infrastructure works including repositioning of underground pipelines to above ground, replacement or upgrading of ageing pipelines, vegetation clearing associated with maintaining existing infrastructure, including along pipeline corridors (**HP Pipe clearing, and LSP Pipe clearing**).

Further details are provided in Chapter 2.

1.2 Statement of Project objectives

The Project's overall purpose and objective is to facilitate improved environmental outcomes and ongoing operation of Bayswater through:

- Providing additional ash storage
- Improved ash recycling and management
- Improved salt management through facilitating operation of saltcake facility and saltcake disposal
- Rehabilitation of the ash dam, borrow-pit and saltcake disposal areas post retirement.

While it facilitates the ongoing operation of Bayswater, no changes are proposed to the existing approved operation or any other component of Bayswater as part of the Project. Bayswater as a whole will continue to be operated and maintained in a manner which responds to market demand and complies with all applicable laws and existing authorisations.

1.3 Project history

Bayswater was commissioned in 1985 and over recent years has produced approximately 15,000 Gigawatt hours (**GWh**) of electricity a year, enough to power approximately two million average Australian homes.

Bayswater was built to utility standards of the time and has a current technical life up to 2035. The existing turbines underwent major overhauls between 2002 and 2006. Generating unit number two was overhauled again in 2017 and unit number one was overhauled in May 2018.

AGL acquired Liddell and Bayswater power stations – previously known collectively as Macquarie Generation – from the NSW Government in September 2014. Over recent years, technology upgrades and improved maintenance have delivered significant environmental and operational gains at both sites.

Planning approval was received for the Bayswater Turbine Efficiency Upgrade Project involving the replacement of the original turbines with modern, more efficient in December 2018. The replacement of one turbine per year is being undertaken such that the efficiency gains will be achieved prior to the closure of Liddell.

As part of the assessment and consultation associated with the Bayswater Turbine Efficiency Upgrade Project AGL acknowledged that Bayswater is regulated under a number of planning approvals and committed to undertake a review aimed at rationalising these. This review sought to take into account future operational requirements with the aim of consolidating relevant approvals, where practicable, as part of future approval applications. The outcome of the review led directly to the commencement, and directed the content, of the Project application.

1.4 Site and Surrounds

Bayswater 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 AGL landholding is approximately 10,000 hectares, including Liddell Power Station (**Liddell**), the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands. Bayswater's operational area occupies approximately 300 hectares. The location of Bayswater is shown in Figure 1-1.

The majority of works associated with the Project would be within Bayswater, with a component of works extending to the Ravensworth rehabilitation area. The Project is predominately located on land owned by AGL as illustrated in Figure 1-2, although some Project infrastructure also crosses road reserves owned by Transport for New South Wales (**TfNSW**), Singleton Council, and a small area of Crown land. The land use zoning for the Project is SP2 Infrastructure (Power Station) or RU1 – Primary Production (Refer to Figure 1-2).

Existing development neighbouring Bayswater includes the former Drayton Mine, Liddell and Hunter Valley Operations coal mines, as well as Liddell and the Main Northern Railway Line. The New England Highway runs parallel to Bayswater, with access from the highway provided by means of a dedicated road network designed to service the power station.

Data sources

Jacobs 2019,
AGL 2019,
NSW Spatial Services 2019

GDA94 MGA56

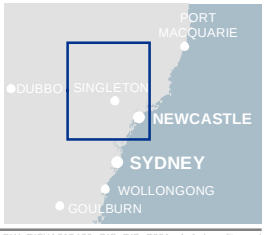

Figure 1 - 1 Project location

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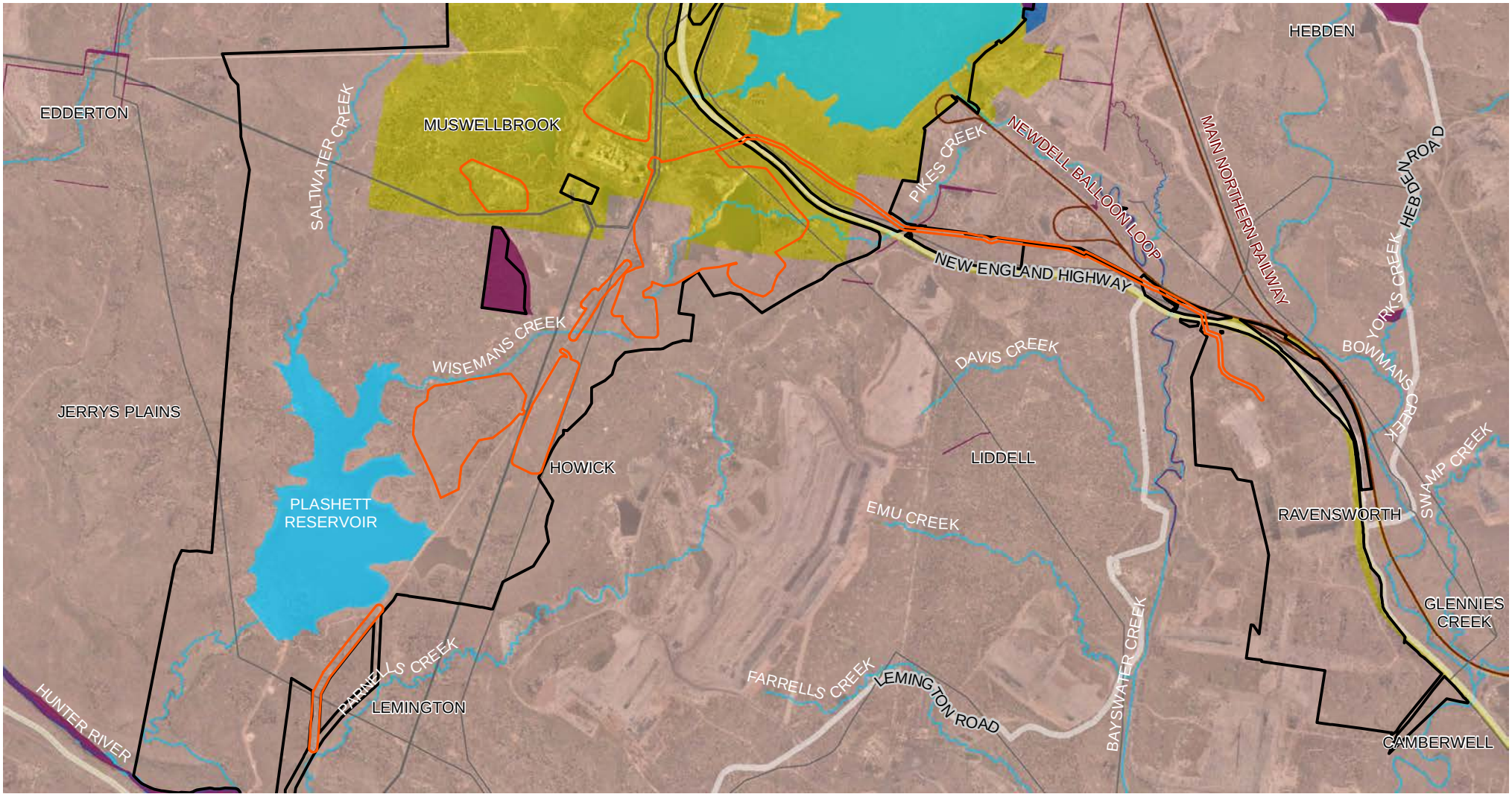


Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019

GDA94 MGA56

Figure 1-2 Land ownership and zoning

The landscape local to Bayswater 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 former Drayton Mine.

Agricultural clearing for the purposes of grazing is also present within and surrounding the AGL landholding. The closest residential area is the Antiene subdivision, which is located behind a ridge line approximately five km north of the Project. The village of Camberwell is located over seven km south east of the nearest Project component (Ravensworth ash line). The Village of Jerrys Plains is located approximately two km south of the nearest Project component (HP Pipe clearing) and over five km from the southern extent of the Borrow Pits.

The Project lies within the catchment area of the Upper Hunter Valley (**Upper Hunter**), which is the largest coastal catchment within NSW. Elevations across the catchment vary from over 1,500 metres above sea level in the high mountain ranges north of the catchment, to less than 50 metres ASL on the floodplains of the lower valley. The largest tributary of the Hunter River is the Goulburn River which joins the Hunter River approximately 25 km to the west of the study area. The Hunter River flows to the west and then around the south of the study area. The Hunter River is located approximately eight km from the study area.

The study area 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 (Anonymous 2019).

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. An overview of the Project environmental constraints is illustrated in Figure 1-3.

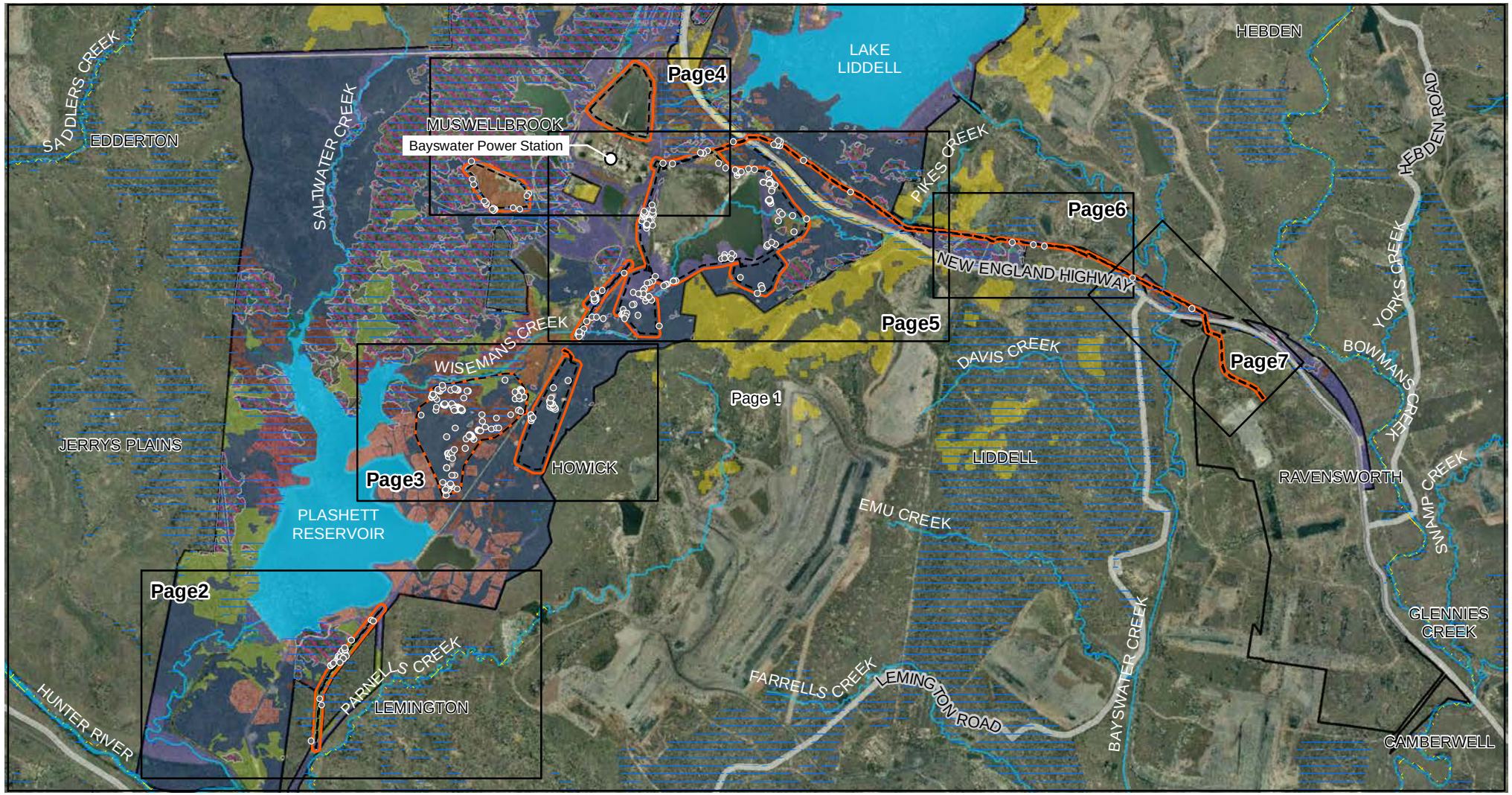
1.5 Proponent

AGL is the owner and operator of Bayswater and is the proponent for the Project. AGL currently produces approximately 12 per cent of the electricity needed by consumers in eastern Australia from assets in the Hunter Valley. These assets include Bayswater, Liddell and the 50 MW Hunter Valley Gas Turbines. AGL acquired these assets from the NSW Government in September 2014.

AGL employs 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 is owned by AGL Energy Limited (**AGLE**) and forms a key components of the company's generation portfolio. AGLE is an Australian publicly-listed company involved in the generation and retailing of electricity and gas for residential and commercial use. AGLE generates energy from a range of sources including thermal power, natural gas, gas storage, coal seam gas, and from renewables including wind, hydroelectricity and solar. AGLE is the largest ASX-listed investor in renewable energy and markets its natural gas, electricity and energy-related products and services to approximately 3.6 million customers. AGLE has announced that the first unit at Liddell is scheduled for closure in April 2022 with the remaining three units scheduled for closure in April 2023. Bayswater, which shares infrastructure with the Liddell site, is scheduled for closure in 2035. Closure will be in accordance with AGLE's Greenhouse Gas Policy in line with the commitments made in AGLEs Rehabilitation Report.

The AGLE Rehabilitation Report outlines how AGLE 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. Until Bayswater is retired, AGLE would continue to invest in Bayswater in accordance with all regulatory requirements and the commitments made in the AGLE Environment Policy.



Study area
Proposal area
AGL owned land

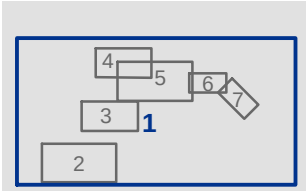
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial
Habitat feature

Vegetation communities within AGL Macquarie lands (Kleinfelder)

Acacia Regrowth
Central Hunter Box - Ironbark Woodland
Central Hunter Box - Ironbark Woodland Regeneration
Central Hunter Bulloak Forest
Central Hunter Swamp Oak Forest
Dam
Derived Native Grasslands
Derived/Modified Native Grasslands
Exotic Grasslands
Hunter Floodplain Red Gum Woodland Complex
Hunter Valley River Oak Forest
Hunter Valley Weeping Myall Woodland
Plantation
Rehabilitation
Slaty Gum Woodland
Wetland/Dam (with wetland vegetation)

0 1 2 km

1:75,000 at A4



Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 1-3a Environmental Constraints

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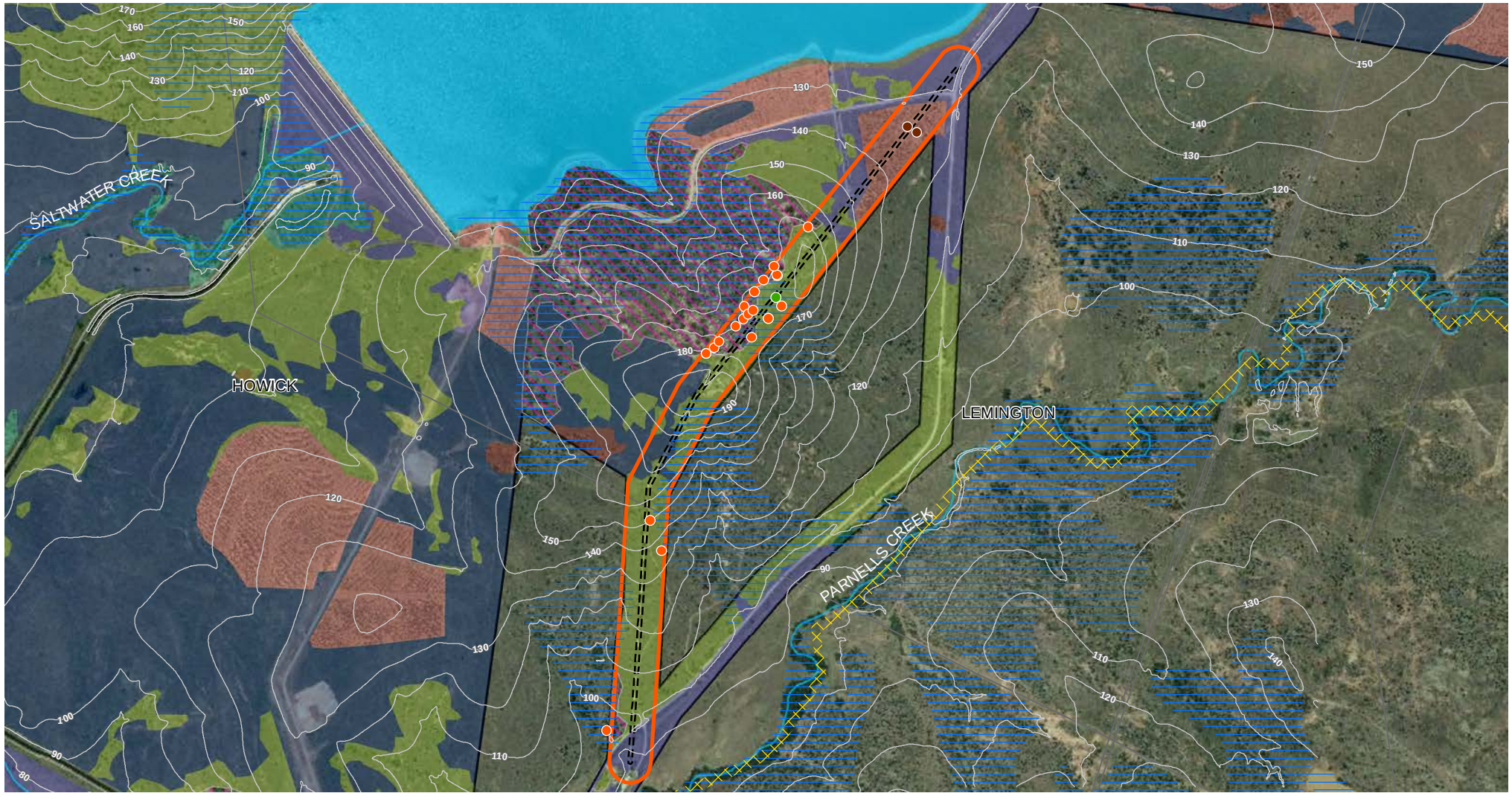


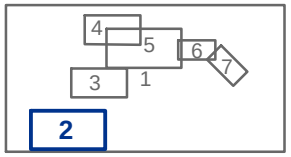
Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Valley River Oak Forest
- Plantation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

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Figure 1.3b Environmental Constraints

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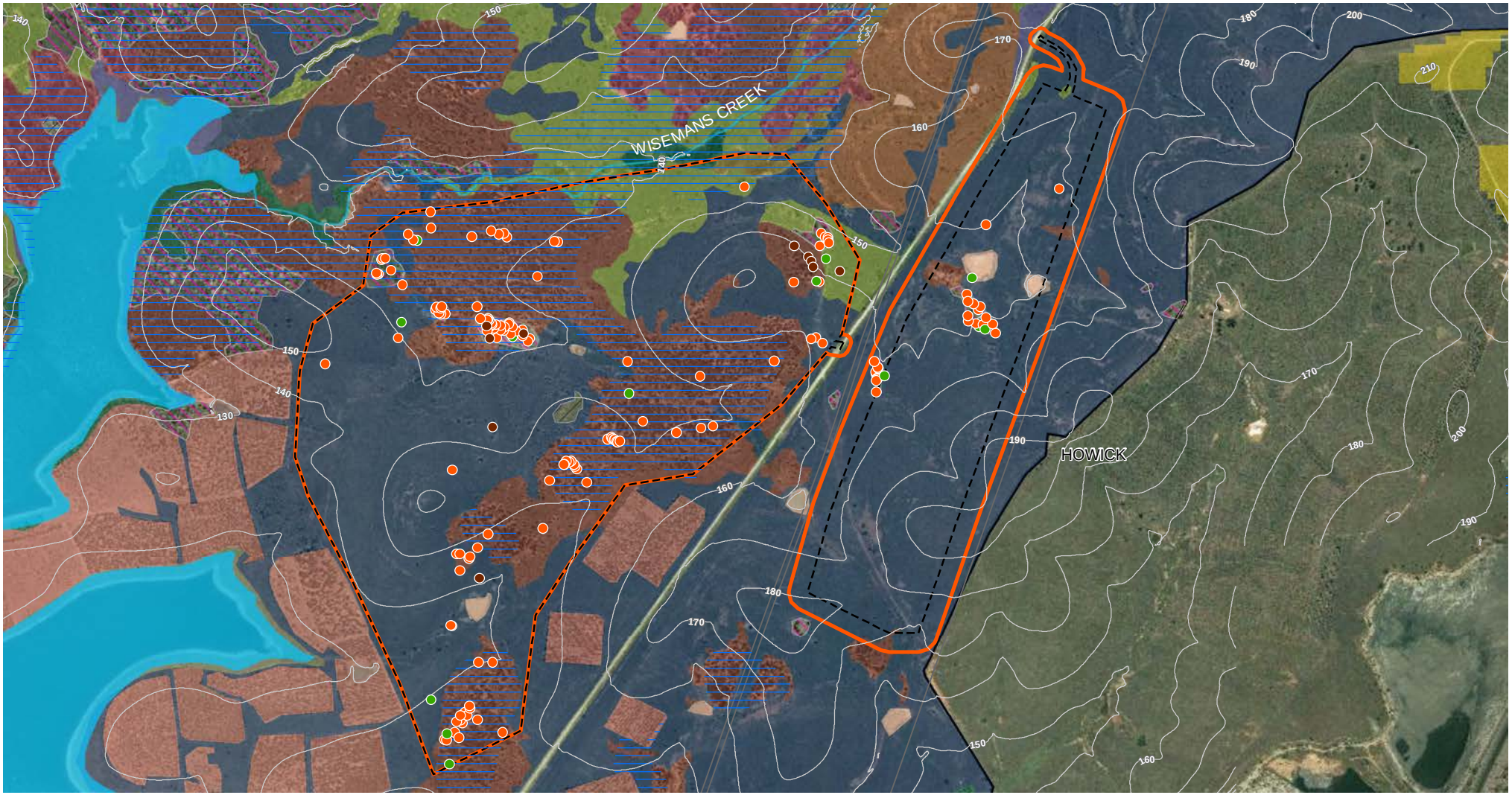


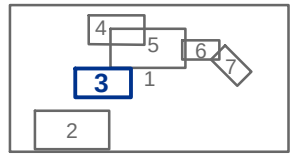
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Plantation
- Rehabilitation
- Slaty Gum Woodland
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

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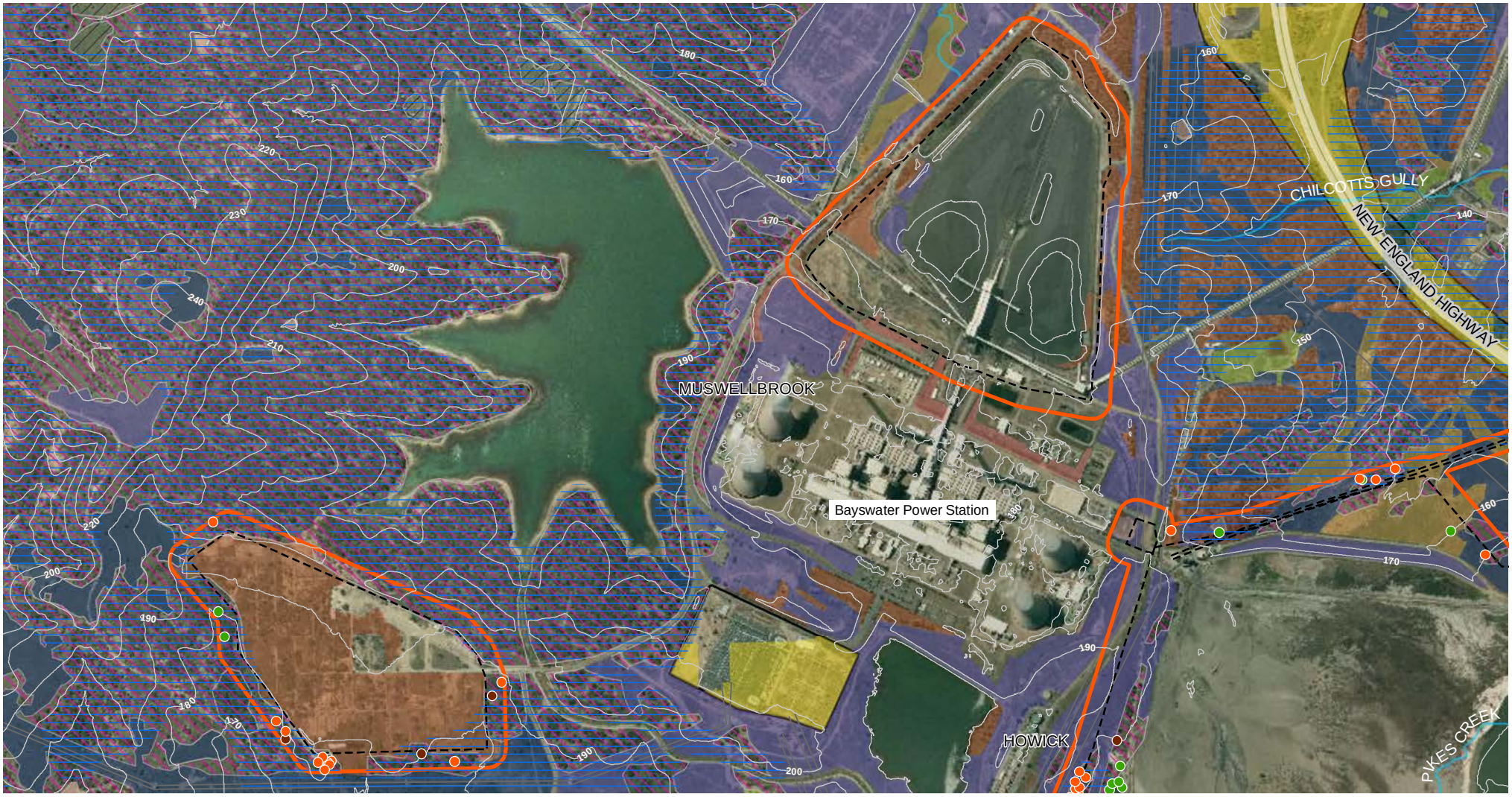
Figure 1.3c Environmental Constraints



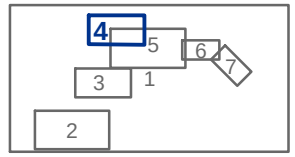
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Valley Weeping Myall Woodland
- Plantation
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

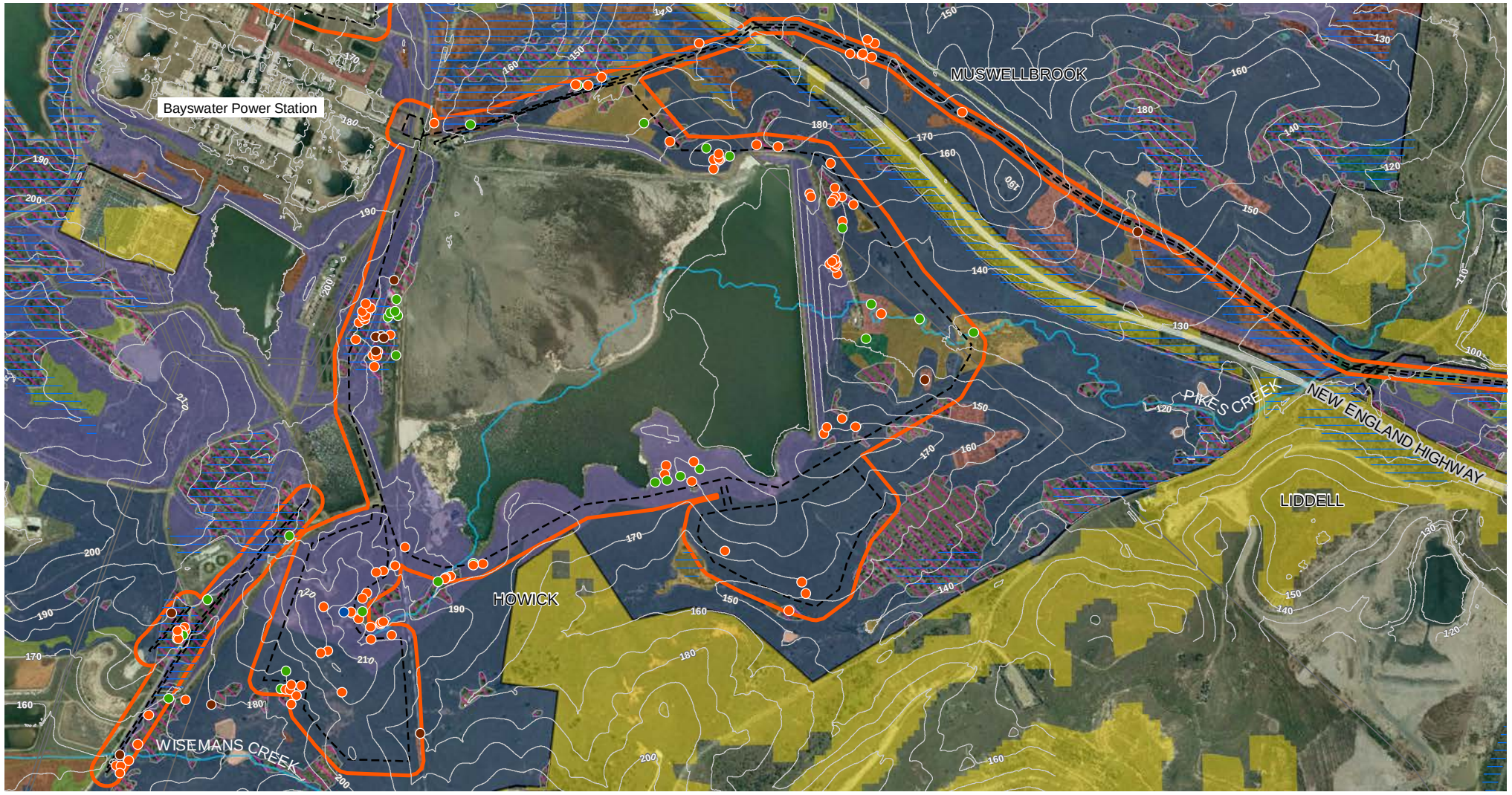
1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 1.3d Environmental Constraints



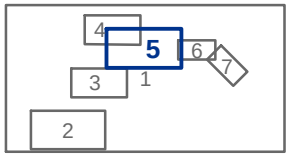
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest
- Water feature

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Plantation
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:20,000 at A4



Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 1.3e Environmental Constraints

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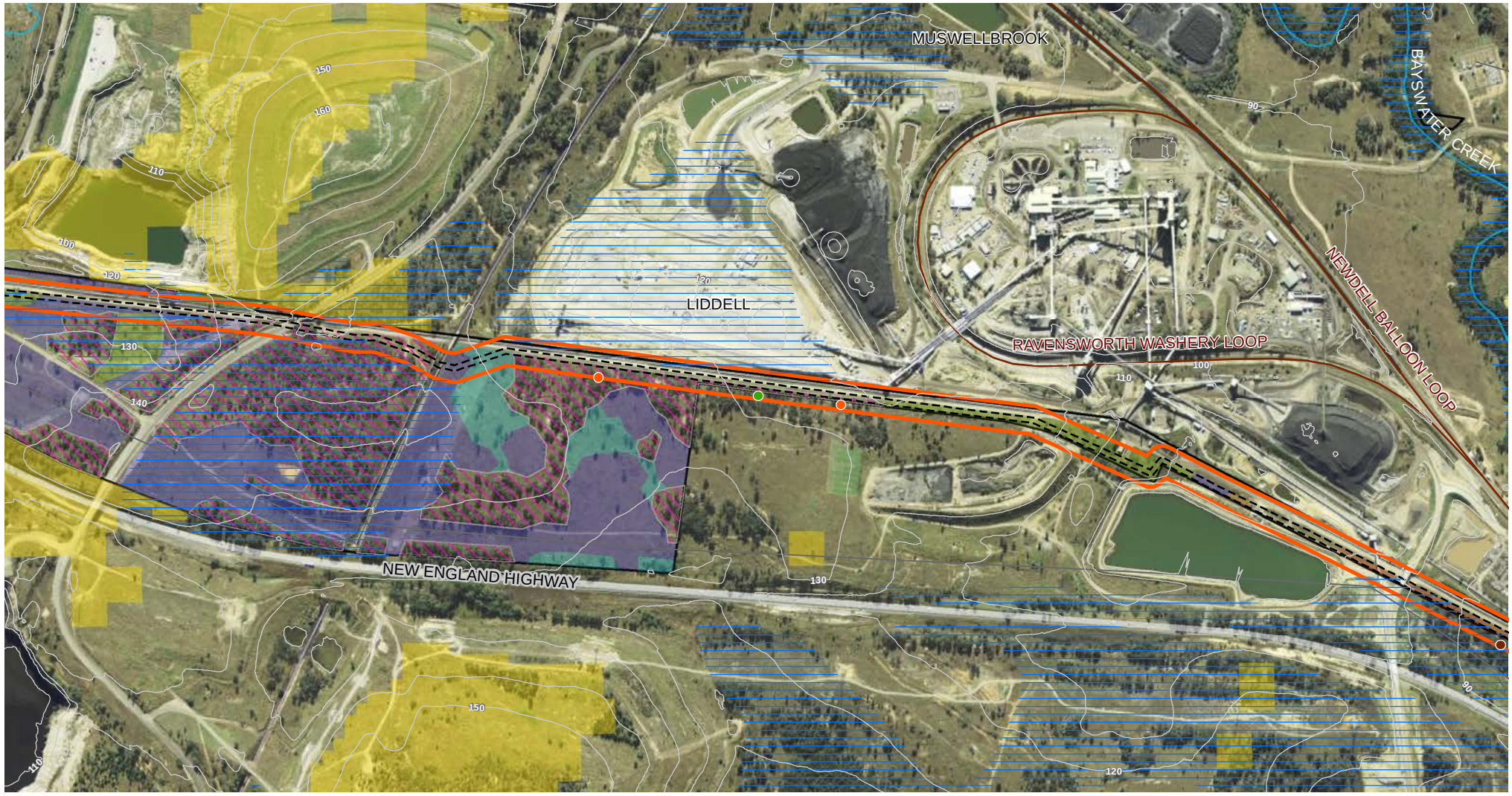


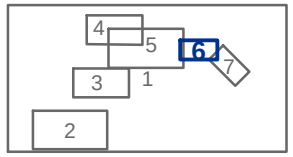
Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Dam
- Exotic Grasslands
- Rehabilitation
- Wetland/Dam (with wetland vegetation)

0 250 500 m

1:10,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 1.3f Environmental Constraints

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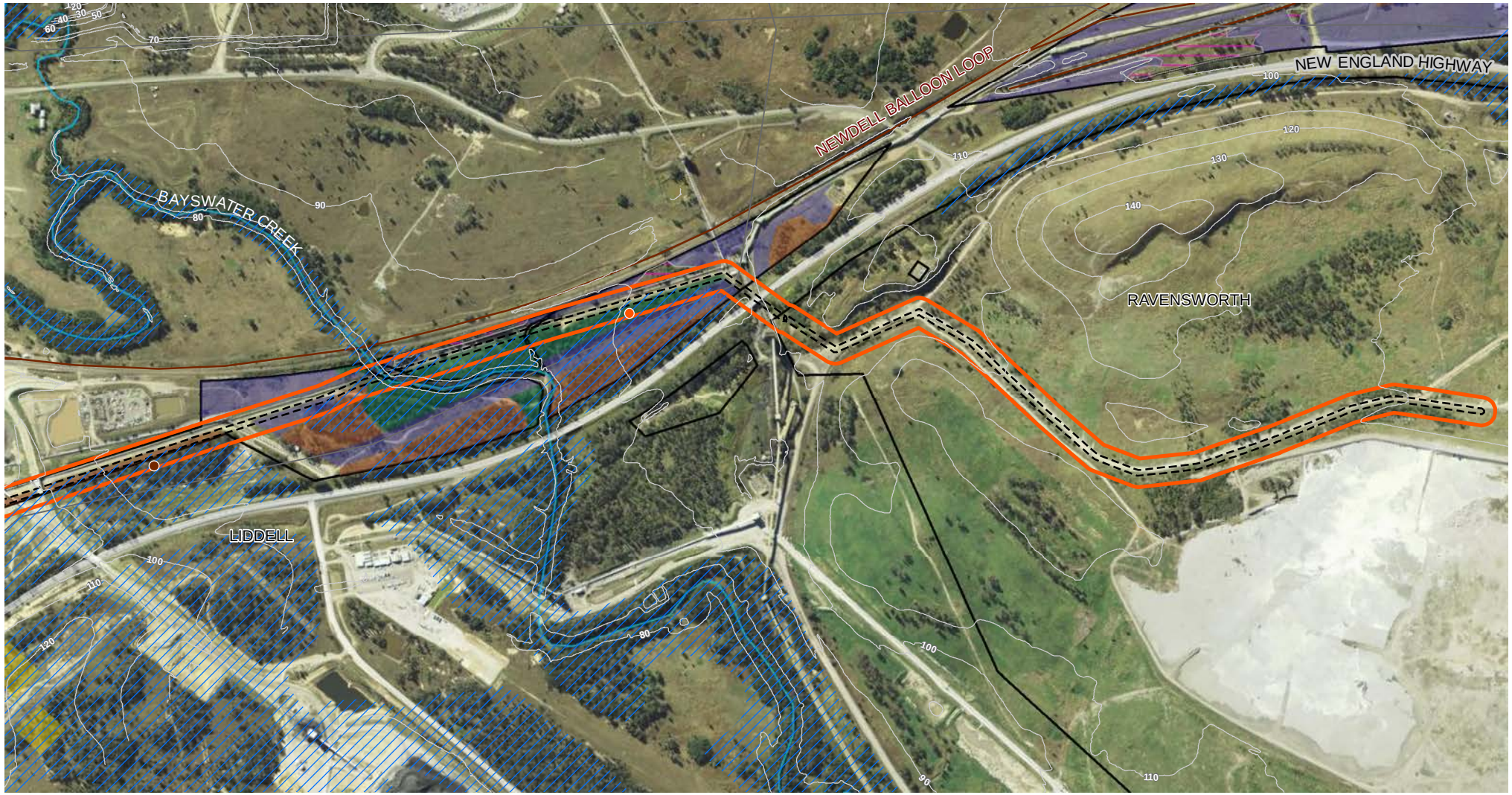
Created by : XX | QA by : XX



Study area
Proposal area
AGL owned land
Ash Dam Augumentation external visibility extent (ground elevation)
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
Hollow-bearing Tree
Nest

Vegetation communities within AGL Macquarie lands (Kleinfelder)
Central Hunter Box - Ironbark Woodland
Central Hunter Swamp Oak Forest
Exotic Grasslands
Rehabilitation

0 250 500 m

1:10,000 at A4

Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 1.3g Environmental Constraints

1.6 Report structure

The environmental impact statement (**EIS**) has been prepared to address the form and content requirements of the EP&A Regulations and EPBC Act and Regulations including Project specific Secretary's Environmental Assessment Requirements (**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
- 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 a strategic justification of the development focusing on the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses
- Chapter 5 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
- Chapter 6 provides a summary of how the likely environmental impacts were identified
- Chapters 7 -19 summarise the findings of the technical environmental assessments that support the development of the EIS
- Chapter 20 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
- Chapter 21 presents an evaluation of the Project as a whole, drawing conclusions on the overall merits of the Project
- Appendix A provides the Project SEARs
- Appendix B provides a SEARs compliance and cross reference table
- Appendix C provides the Project Biodiversity Development Assessment Report
- Appendix D provides a Surface Water, Groundwater and Flooding Technical Paper for the Project
- Appendix E provides the Project Water Balance Modelling Report
- Appendix F provides the Project Air Quality Impact Assessment
- Appendix G provides the Project. Land Capability Assessment
- Appendix H provides the Project Aboriginal Cultural Heritage Assessment Report
- Appendix I provides the Project Non-Aboriginal Heritage Assessment
- Appendix J provides the Project Traffic Impact Assessment
- Appendix K provides the Project Visual Impact Assessment
- Appendix L provides the Current mining and exploration titles and applications mapping.

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 summary

The purpose of the Project is to improve the management of Bayswater's ancillary processes over the remaining operating life of Bayswater and to facilitate an improved rehabilitation outcome for the ash disposal area. This would involve:

- Optimizing and improving ash management including augmenting the existing ash disposal area, and augmentation of the existing ash harvesting and recycling facilities
- Creation of a salt cake disposal landfill to complete the alternative process for managing water impurities and reduce the reliance on the Hunter River Salinity trading scheme
- Improvements to water management around the coal handling plant area.

A summary of project aspects for assessment is provided in Table 2-1 based on worst case consequences likely to result from overlapping project components. Further details of each Project element are provided in subsequent sections.

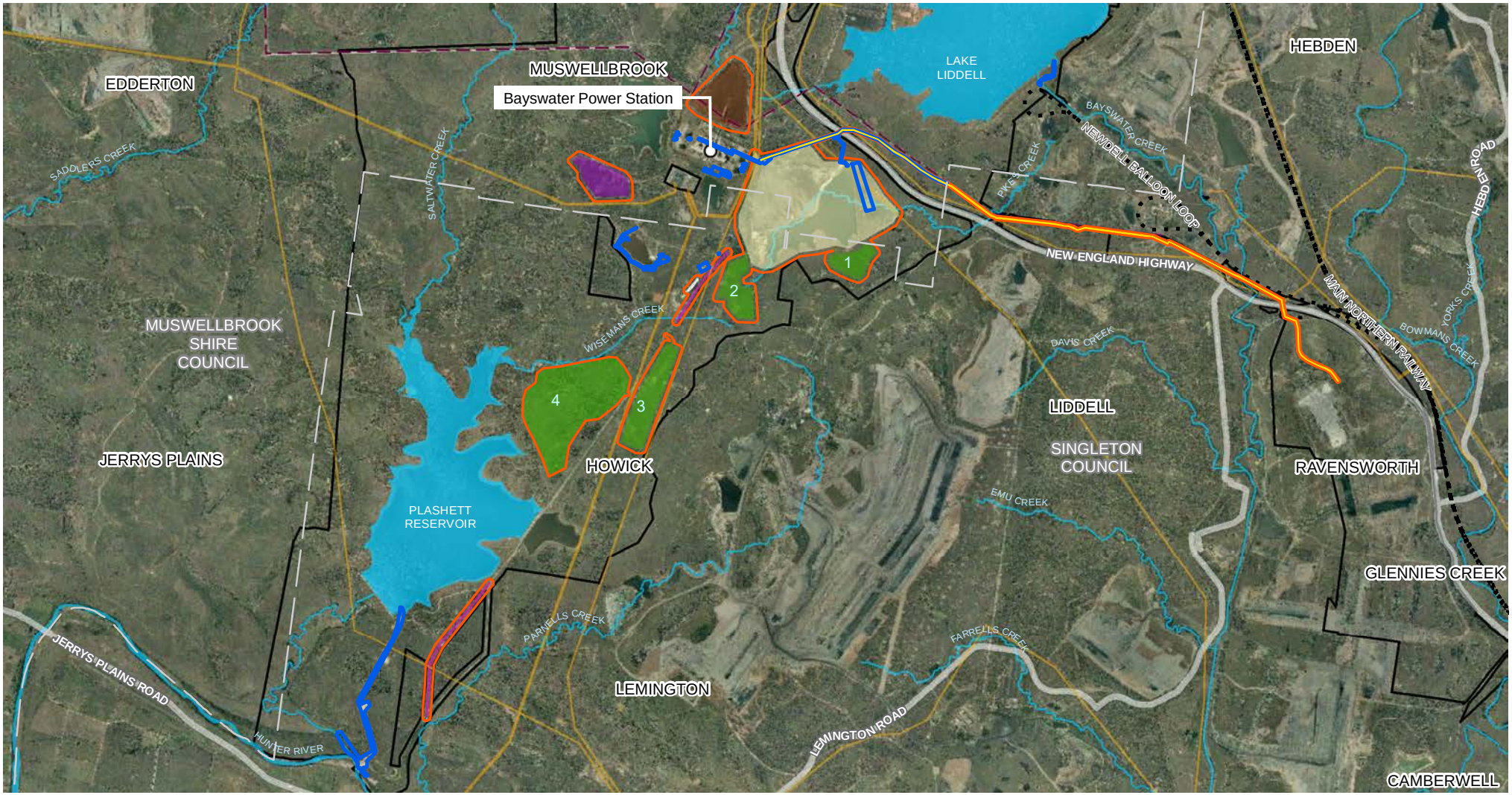
Table 2-1: Summary of Project

Project Element	Summary of the Project	
Site Description		
Local Government Area (s)	Singleton and Muswellbrook	
Project location	Bayswater Power Station operational area, with a component of works extending to the Ravensworth rehabilitation area. The majority of the works would be undertaken within the AGL Macquarie Landholding except for a small parcel of Crown land, Singleton Council owned land and TfNSW owned land.	
Formal identifier	Lot 601 DP 1019325 Lot 112 DP 1059007 Lot 2 DP 1095515 Lot 1 DP 113655 Lot 1 DP 1142103 Lot 2012 DP 1151790 Lot 1 DP 1158700 Lot 120 DP 1174907 Lot 1 DP 1175303 Lots 1 & 2 DP1193248 Lot 910 DP 1123501 Lot 3 DP 1193253 Lot 10 DP 1204457 Lots 4, 6, 9 & 11 DP 247943 Lot 13 DP 247945 Lot 1 DP 616025	Lot 2 DP 619383 Lot10 DP 700554 Lots 19, 30, 62, 75, 86, 88, 89, 150, 151 & 331 DP 752468 Lots 1 & 2; DP 774679 Lot 1 DP 369326 Lot 102 DP 1053098 Lot 14 DP 1193430 Lot 1 DP 252530 Lot 2 DP 327372 Lot 5 & 6; DP 966589 Lot 107 DP547864 Lot 4 DP 1193254 Lots 1 & 2 DP 574168 Lot 1 DP 616024
Zoning	SP2 Infrastructure (energy generation) and RU1 Primary Production	

Project Element	Summary of the Project
Permanent footprint	Much of the permanent facilities associated with the Project would be limited to upgrades of existing infrastructure within areas associated with Bayswater operations, with the exception of: • Additional access tracks associated with increased ash harvesting and recycling • Augmented ash disposal area which would occupy an additional area of approximately 167,000m^2. While the salt cake landfill facility and Borrow Pits would be reinstated progressively, they would result in an altered landform with restricted rehabilitation and as such are considered to form part of the permanent footprint of the Project. Each area would be rehabilitated to an agreed landform.
Access	Access to and from Bayswater is provided by slip-lanes from the New England Highway into an existing site access road. Access to Ravensworth Ash line would be via Pikes Gully Road and Hebden Road.
Construction	
Construction ancillary facilities	Infrastructure including internal access roads, water supply and power services, laydown areas, temporary sheds incorporating offices and associated amenities would either be located within the maximum disturbance footprint or be part of the existing facilities at Bayswater.
Project construction footprint (maximum disturbance footprint assessed)	The study area for the Project is shown in Figure 2-1. This has been defined as the maximum construction footprint, plus an approximately 50-metre-wide buffer area, which has been included in the assessment to account for possible indirect impacts. Where possible, construction activities would be reduced to minimise disturbance of environmentally sensitive areas.
Construction Workforce	The Project would provide employment for up to 90 Full Time Equivalent workers (at peak) over the project duration.
Construction Hours	Works would be undertaken during standard and out-of-hours construction hours. Oversized deliveries would be undertaken in accordance with relevant legislative requirements which could require some works to be undertaken outside of standard hours. Some works may be required to coincide with scheduled outage periods.
Construction schedule	For the purposes of this assessment, it has been assumed that during peak construction periods, construction of all Project elements would be undertaken concurrently, and excavation would be undertaken from one of the four Borrow Pits. The finalised construction schedule would be further developed as part of design refinements, based on AGLs operational requirements and in consultation with delivery contractors. Some works may be staged, as deemed necessary. It is anticipated that the staging of construction works would result in a reduction of construction related environmental impacts.
Daily construction traffic volumes	Traffic generated by the Project construction would involve employees' vehicles and the transportation of containers and construction materials. Light vehicles would be required for workers. It has been assumed that each worker would travel to site in a personal vehicle. However, it is possible that private buses may be used to transport workers. The peak traffic movements related to the Project (to and from Bayswater) are expected to be approximately: • 180 light vehicles (90 in and 90 out per day) • 50 heavy vehicle movements (25 in and 25 out per day).

Project Element	Summary of the Project
	In addition, up to 8 oversized vehicle movements would be expected for the delivery of weighbridges and the ash silo. It is considered that adequate contractor parking is provided on site capable of accommodating the additional construction workforce. Should additional parking be required then this would be made available within the disturbance footprint assessed.
Plant and Equipment	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 the following activities: • Equipment required for earthworks, which would be associated with the BWAD augmentation, salt cake land fill and Borrow Pits, is likely to include: - Front end loaders - Dump trucks - Road trucks - Excavators - Compactors - Water trucks. • Equipment associated with upgrades to existing infrastructure (ash recycling/harvesting, and ash pipeline): - Graders - Elevated work platforms - Crane - Concrete saws and grinders - Compacters and rollers - Scrapers - Backhoe - Concrete trucks - Generators. • Equipment associated with vegetation removal: - Chainsaws - Tractors - Light vehicles - Wood chippers/mulchers. Vegetation removal would be required at various locations across the Project area during the early stages of construction to create access where necessary.
Materials and components	Materials required for the BWAD augmentation and salt landfill works would be sourced from the proposed Borrow Pits. The suitability of extracted materials is dependent on additional geotechnical investigations and testing. Material that is not suitable for BWAD augmentation and salt cake landfill works could be used in areas of landscaping or other works. Should contaminated material be encountered, this material would be managed appropriately in line will relevant legislative requirements. Additional materials required would include: • Ash and effluent pipeline segments • Rockfill • Concrete and other materials required to complete the works • Portable buildings. Oversized deliveries would be associated with the delivery of the weighbridges and ash silo. Water would be required during construction for wash down and dust suppression and would be sourced from the site water supply network and existing water allocations.

Project Element	Summary of the Project
Operations	
Operational life expectancy	Components of the Project would operate through to the anticipated closure of Bayswater. Activities associated with the decommissioning and rehabilitation works for the Project would extend beyond the closure of Bayswater for approximately five years or until rehabilitation and closure activities have been adequately completed.
Operational workforce	Over the duration of the Project it is anticipated employment would be provided for about 25 additional staff.
Daily Operation Traffic Movements	It is expected the Project would generate approximately 360 heavy vehicle movements (ie 180 trucks in and 180 out) and 50 light vehicle movements on a daily basis. Operational truck movements would be associated predominantly with ash recycling.
Decommissioning	
Strategy	Built infrastructure associated with the Project would be removed following closure of Bayswater and the site footprint graded and rehabilitated to a safe, sustainable and non-polluting landform in accordance with the project specific rehabilitation management plan. Generally, this would include returning the site to as near to pre-development condition as practicable, such as removing buildings and infrastructure. Materials required for rehabilitation would be sourced either from within Bayswater, or from Ravensworth compost facility. Decommissioning of the salt cake landfill would be in accordance with the requirements of *NSW EPA Environmental Guidelines for solid waste landfills* (Second Edition, 2016).
Rehabilitation objectives	Rehabilitation monitoring and management would be undertaken for the Salt cake landfill and BWAD until such time as a safe and sustainable landform is confirmed.



Study area
Local Government Area boundary
Footprints of approvals to be surrendered
AGL owned land
Railway
Electricity transmission line
Coal supply conveyor

Project elements:

Ash Dam Augmentation, Ash Harvesting and Water Management Works
Ravensworth Ash Line
Coal Handling Plant Water and Wastewater Infrastructure Upgrades
HP Pipe Clearing
LSP Sludge Line Clearing
Clay Borrow Pits
Salt Cake Landfill

0 2 4 km

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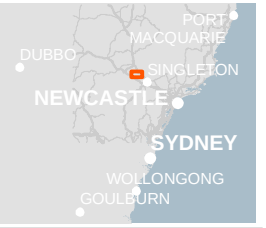

Data sources
Jacobs 2019
AGL 2019
NSW Spatial Services 2019

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Figure 2 - 1 AGL Site Plan and Project Elements

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2.2 Ash Management

The Project includes the following ash management optimisations and improvements:

- Increase in ash recycling activities to reduce ash volumes requiring disposal
- Improvements to the ash transfer system to Ravensworth Ash Disposal Site for disposal under separate approval
- Augmentation of the BWAD to increase capacity and accommodate anticipated volumes requiring disposal.

2.2.1 Ash Dam augmentation and Water Management Improvement Works

The BWAD forms part of the ash disposal system for Bayswater. The projected total annual ash production rate for Bayswater is currently just over two million tonnes. The BWAD initially received both fly ash and bottom ash from Bayswater, but currently receives (mostly) bottom ash, as the majority of fly ash is deposited at Ravensworth.

The existing BWAD is located south east of Bayswater and comprises of a 39 metre high zoned earthfill embankment with a six-metre-wide crest and relative level (RL) of 174 m. The main embankment of the BWAD is located on the eastern boundary, and the saddle dam extends westwards. A 780 metre long saddle dam forms the northern, and part of the western, boundary of the BWAD and has a 6 metre wide crest and Relative Level (RL) of 172.8 metres. An emergency spillway with RL of 172 metres is located in the north east of the saddle dam. The spillway discharges into Chilcotts Creek, and overflows eventually end up in Lake Liddell.

The current ash disposal system consists of bottom ash being transported from Bayswater in slurry form via three above ground basalt lined pipelines and is deposited in the north-western side of the dam. Three pipeline extensions have been added to the pipes, to move the discharge point around within the BWAD for optimal filling. The fly ash dispersion line is currently placed out as a duplication pipeline along the southern most dispersion line.

The process of ash deposition relies on ash dropping out of the slurry to form a delta, or ‘beach’ radiating out from the discharge point. This technique allows flexibility in the locations of discharge points around the ash storage to enable more efficient deposition of ash. The beaching angle is estimated to be less than 1 % in the areas above water, steepening up to approximately 3.5 % once under water.

Slurry water drains to the lower points of the BWAD and is either lost through evaporation and seepage or is drawn from the BWAD via an intake tower, located towards the right abutment of the main embankment. Water from the intake tower is transferred via return water pipelines around the northern perimeter of the BWAD to the return water tanks, located at the western ridgeline for reuse. The return water pipelines are connected to the return water pumps in the pumping station at the toe of the main embankment. Seepage from the BWAD is collected in one of two Seepage Collection Ponds (**SCP**) to manage discharge to Pikes Creek. SCP1 is located directly adjacent to the dam wall and SCP2 is approximately 500 metres downstream. Further downstream of SCP2 is Pikes Creek.

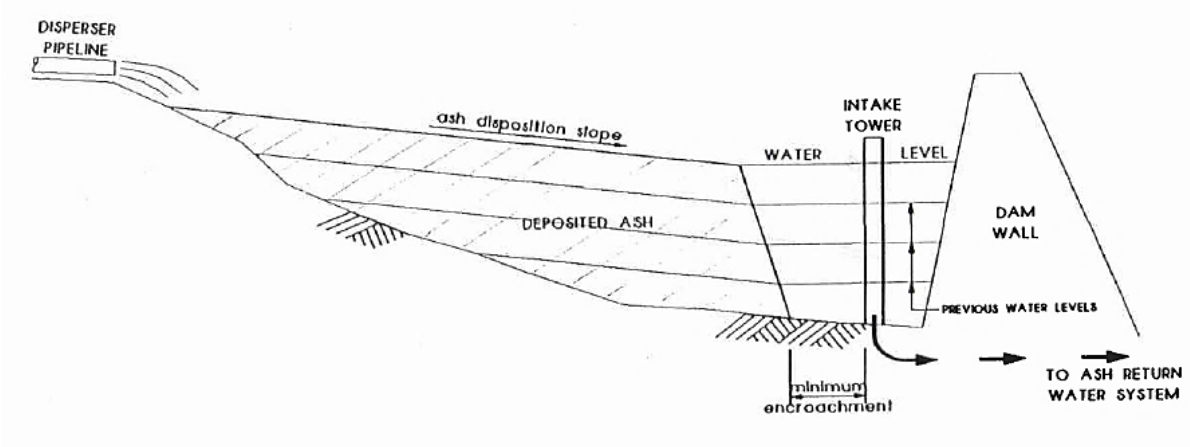


Figure 2-2 Typical ash dam cross section (Source (AECOM, 2017a)

The BWAD augmentation construction works would consist of:

- A levee embankment on the western perimeter to a reduced level (**RL**) of 185.5 metres (an 11.5 metre high earth embankment from existing ground level)
- Increasing the existing saddle dam levee embankment on the northern perimeter to RL 185.5 at the western end down to RL 174 at its eastern end (an approximate 9.5 metres increase at the western and 3.5 metre increase at its existing western end
- Construction of a 1.5 metre high concrete parapet wall along the main embankment crest to increase flood attenuation
- Construction of two new southern saddle dams to prevent ash from spilling out of a low point along the southern ridgeline
- Raising of the spillway to RL 173.7 metres
- Extensions to the ash dispersion and water supply and management systems within the BWAD footprint
- Installation of ash dam divider walls allowing ash discharge to be undertaken in alternating cells and deployment of dust suppression (water sprays or polymers) during dust events where necessary in accordance with existing dust management processes
- Potential relocation/replacement of existing pipelines to current standards
- Upgrade to ancillary infrastructure associated with ash disposal such as pumps, pipelines and power infrastructure
- Water management improvement works associated with the main and saddle dam walls including diversion of clean runoff around the site, installation of new seepage capture and return infrastructure and upgrading existing seepage capture and return infrastructure.

An abandoned 1.3 km long coal conveyor that runs along the western perimeter of the ash storage would require removal as part of these works, and the relocation of four timber power poles within the proposed ash inundation area would also be required.

The augmentation of the BWAD may be undertaken in stages. This staged augmentation would allow ash deposits to consolidate gradually, which would improve the bearing capacity of the BWAD. For the purposes of this assessment, it has however been assumed that the full augmentation would be undertaken.

The ultimate BWAD augmentation has been designed to provide storage for approximately 12.5 million m^3 of fly ash and bottom ash. AGL are proposing to increase the scale of current coal ash recycling activities (see Section 2.2.2) which would reduce the volume of ash requiring deposition on site. The staged construction of the BWAD would mean that only the capacity required would be constructed.

2.2.1.1 Construction

Construction of the augmented BWAD is anticipated to involve the following activities:

- Establishment of appropriate environmental controls including water diversions and protection of existing waterbodies in the vicinity of works, and erosion and sediment controls in accordance with *Managing Urban Stormwater: Soils and construction - Volume 1* (the Blue Book) (Landcom, 2004)
- Clearing works, including the removal and relocation of infrastructure within the ash emplacement footprint
- Construction of foundations at the base of the levee embankments
- Earthworks and construction of levee embankments and internal cell walls
- Construction of a concrete parapet wall
- Earthworks and minor civil works associated with the establishment of the additional southern saddle dams
- Connection of extensions to the existing ash and water management infrastructure.

It is expected that clay materials for augmentation works would be sourced from the proposed Borrow Pits (see Section 2.4 for further information). Other materials required which would be purchased and brought to site include:

- ash and effluent pipelines
- rockfill
- concrete and other materials required to complete the works.

Construction would be undertaken as required by the deposition rates of the ash which is dependent on Bayswater's output, ash recycling rates and availability of the Ravensworth ash line and pumping station. It is assumed that construction of the BWAD augmentation would take up to three years to complete.

2.2.1.2 Operation

The continued operation of the BWAD would remain generally unchanged. Water levels within the BWAD would be maintained at an appropriate level to ensure an adequate freeboard is maintained as required under the *Dam Safety Act 2015* noting that discharge from the spillway is licensed under EPL 779.

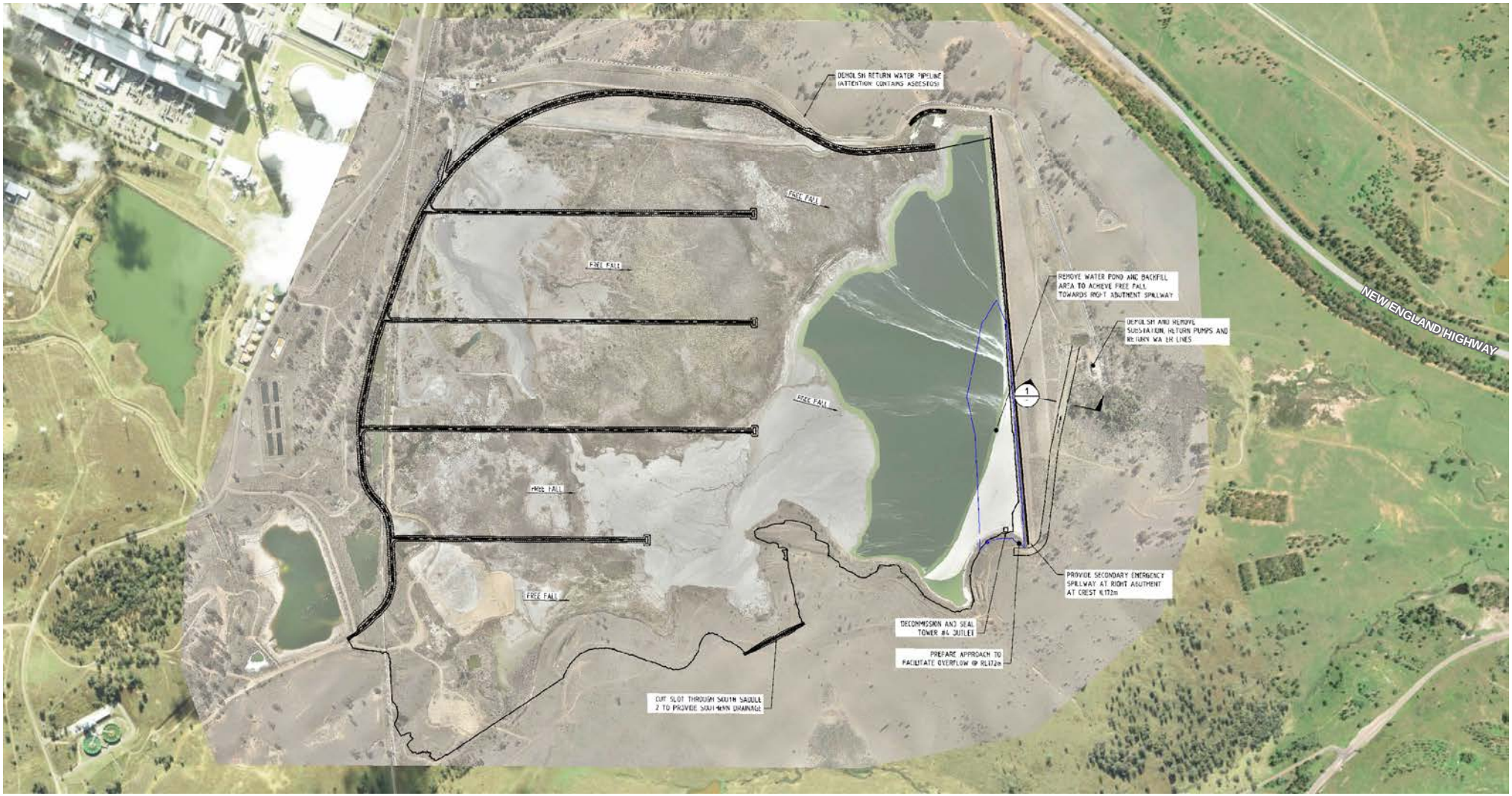
2.2.1.3 Decommissioning

Once the augmented BWAD has reached capacity, rehabilitation would be undertaken to integrate the BWAD within the existing landform as far as possible. Rehabilitation would be undertaken in accordance with AGL's Rehabilitation Management Plan and would include capping, measures to prevent any ponding or disruption to water flows, stabilisation and revegetation.

Post closure, AGL would look at alternative land uses for the site and where these are not appropriate, limit land use to either grazing or native pasture. Any more intensive land use or development would most likely require separate approval.

Decommissioning would take approximately 24 months to complete and would be followed by rehabilitation monitoring and management until such time as a safe and sustainable landform is confirmed.

Assuming currently modelled ash generation rates, the final landform would consist of a generally flat but free draining landform sloping from west to east. At its western extent the landform would have a maximum height of approximately RL of 186, to incorporate a 0.5 metre capping layer, and be graded down to a RL of 173 at the northern abutment of the main embankment and RL 172 at the southern abutment. The area would be vegetated with grass species. The concrete parapet along the main embankment would be removed and the ponded water allowed to evaporate, drained or otherwise managed in accordance with its water quality at the time. The landform would be regraded to provide free draining to the south. A new spillway would be provided around the main embankment wall to the south to allow surface flows to be returned to Pikes Gully post rehabilitation. The indicative final landform is provided in Figure 2-3.



Data sources
Jacobs 2019
AGL 2019
NSW Spatial Services 2019

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Figure 2 - 3 Indicative BWAD final landform

2.2.2 Additional Coal ash recycling and Fly ash harvesting upgrades

AGL currently recycles up to 170,000 tonnes of coal ash per annum from Bayswater including bottom ash from the BWAD. The ash is either extracted from the silos associated with the Ravensworth Fly ash system or extracted using mobile plant and equipment within the BWAD boundary. Fly and bottom ash can be used as fill in selected road projects and as a fine aggregate in cement and masonry blocks.

In order to meet the growing demand for coal ash and coal ash blended products, it is proposed to increase the scale of current coal ash recycling activities from Bayswater to enable the beneficial reuse of up to 1,000,000 tonnes per annum of ash during periods of peak demand. It is currently envisaged that average production values would reach around 600,000 tonnes per annum depending on activity within the construction industry and proximity to AGL. The existing ash recycling facilities would be incorporated into this process where feasible and scaled to suit requirements.

Ash recovery operations onsite would be powered by a generator or connected to the electricity mains. A mobile fuel cart would be used to store diesel products as required. Expanding the capacity of the operation to a peak rate of 1,000,000 tonnes per annum would require the following works:

- Provision of updated mobile plant and equipment used in the ash handling process
- Installation of up to two weighbridges (B-double)
- Construction of new internal access routes to improve safe truck movements onsite
- Installation of additional portable buildings (amenities and a laboratory)
- Connections with onsite utilities (e.g. potable water, sewerage, electrical)
- Associated ancillary equipment located within the disturbance footprint.

In addition, the existing approved fly ash harvesting plants at Bayswater would be upgraded as part of the Project. The proposed upgrades would include:

- Installation and operation of an additional silo
- Construction of new formalised internal access roads and water management structures
- Construction of associated ancillary equipment located within the disturbance footprint, including truck wash facilities, weighbridges, amenities and parking.

The indicative location of coal ash recycling infrastructure upgrades and fly ash infrastructure upgrades are shown in Figure 2-4. The final layout of the upgrades would be confirmed as part of detailed design, and would be maintained within the Project area, as shown on Figure 2-1.

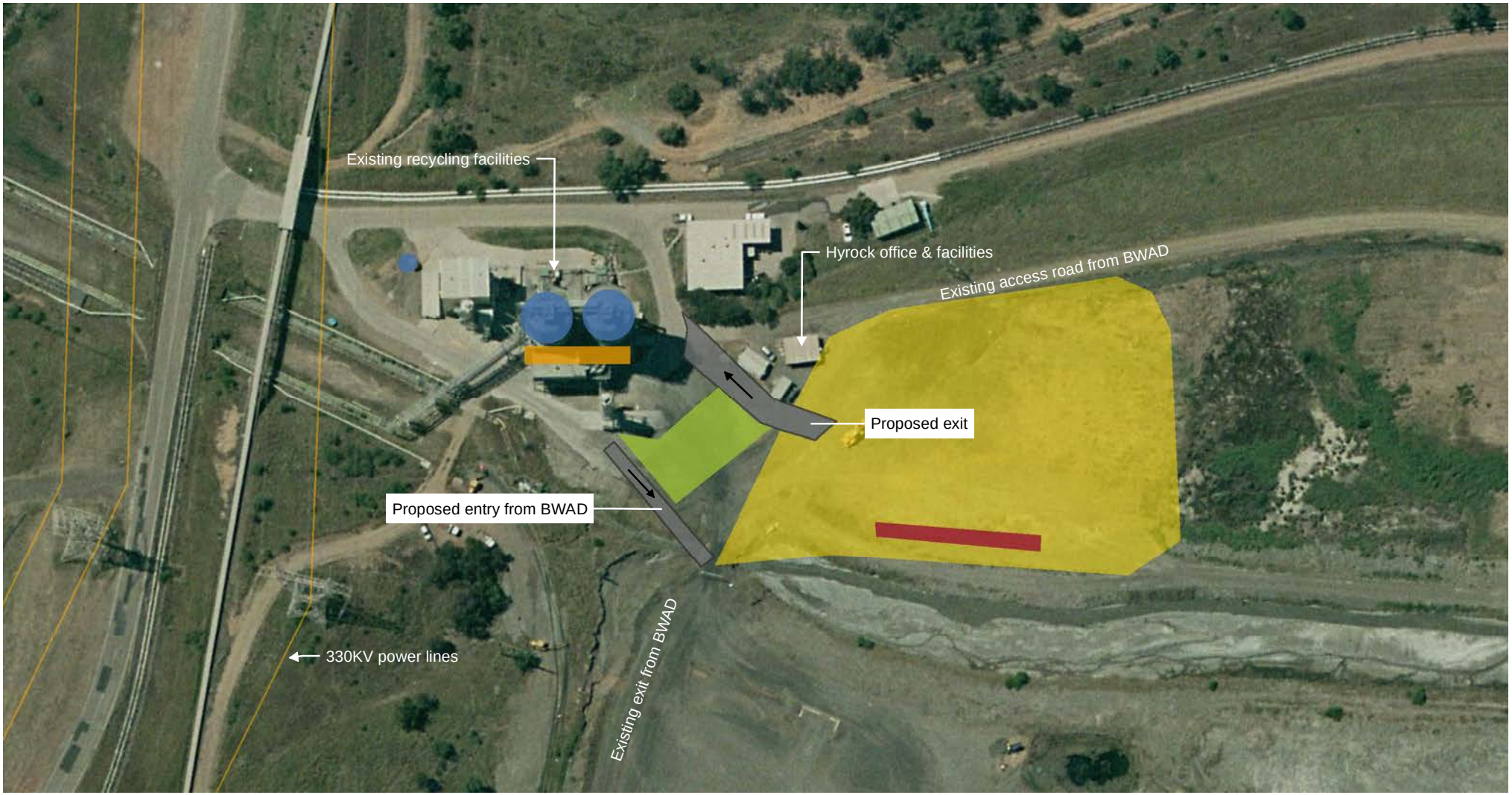

Figure 2 - 4 Indicative location and site layout of ash harvesting upgrades

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Construction

Construction of the new coal ash recycling and fly ash harvesting facilities would commence following Project approval. It is expected the majority of materials would be supplied to site as pre-fabricated materials with only minor assembly and installation works expected to be undertaken on site. Formalised gravel access roads would be provided to allow for additional vehicles entering and exiting the coal ash recycling and fly ash harvesting facilities. There would not be any additional vegetation clearance beyond what has been assessed in the maximum disturbance footprint as a result of these access roads.

Operation

Operation of the coal ash recycling facilities would occur over the remaining operational life of Bayswater. Additional workers would be employed, and expanded operations would generate a maximum of 360 (180 round trips) additional daily vehicle movements.

The operation of the fly ash harvesting infrastructure would continue to be managed in accordance with existing environmental management systems.

Decommissioning

Built infrastructure would be removed following closure of Bayswater and the site footprint graded and rehabilitated to a safe, stable and non-polluting landform.

2.2.3 Ash pipeline from Bayswater to Ravensworth Void No. 3

An additional pipeline is proposed for the transfer and disposal of ash from the Ravensworth Fly Ash Plant at Bayswater to Ravensworth Void No. 3 (**Ravensworth ash line**). The majority of this pipeline would be installed above ground, with sections of trenching or underboring proposed to be installed below ground at New England Highway and roadways, Pikes Creek, Liddell Station Road and various other existing infrastructure corridors. Where the pipeline crosses Bayswater Creek and Chilcotts Creek, the pipeline would be raised above ground. The new pipeline would connect to the existing recently extended ash pipeline which runs from Ravensworth Void 3 to Void 5.

The pipeline would be installed adjacent to the existing ash pipeline in previously disturbed areas where possible. Where construction activities are required within Chilcotts, Pikes and Bayswater Creeks, appropriate erosion and sediment controls would be installed to minimise impacts to these waterways as far as practicable.

Construction

The installation of the transfer pipelines would consist of the following activities:

- Vegetation clearance along the pipeline alignments. It has been assumed that all vegetation would be cleared, however opportunities to minimise clearance would be considered where feasible
- Laying above ground pipelines onto concrete plinths
- Trenching or underboring below ground sections of the pipelines. Depending on the trench depths, shoring or benching the trench may be required
- Removal of any disused pipelines as required.

Construction materials would be limited to pipe segments, concrete plinths and minor quantities of concrete and steel delivered as necessary.

Access to the alignment would be provided via Ravensworth, Pikes Gully Road, Hebden Road or via internal access roads from Bayswater. Existing internal roadways would be maintained as required.

Operation

The operation of the new pipes would be as per the existing pipeline with the disposal of ash at Ravensworth approved separately and not subject to this application.

Decommissioning

Above ground infrastructure would be removed following the retirement of Bayswater.

2.3 Salt cake landfill facility

The existing Bayswater water treatment plant removes naturally occurring salts and solids from the cooling water before the water is used in the power station. Salt is currently stored in the brine concentrator decant basin and Lake Liddell using the Hunter River Salinity Trading Scheme (**HRSTS**) to discharge to the Hunter River via Bayswater Creek. A salt caking plant will be constructed as part of the water treatment plant upgrade (Project approval 06_0047, as modified), which would produce a salt cake by-product.

The Project includes the construction and operation of a salt cake landfill facility on site to store the salt cake produced from the approved caking plant. The salt cake landfill facility is required to enable the approved caking plant to commence operation and complete the water treatment upgrades.

The Salt cake landfill facility has been designed to include 10 individual cells which would be constructed progressively. Each cell would be able to hold more than three years of salt cake, assuming that around 50,000 tonnes of salt cake is generated per year. The salt cake landfill would have capacity to hold approximately 600,000 tonnes of salt cake over its operational life.

In accordance with the *NSW EPA Environmental Guidelines for solid waste landfills* (Second Edition, 2016) a leachate barrier system would be required to contain leachate and prevent the contamination of surface water and groundwater over the life of the landfill. Each cell would be lined with at least one metre of clay, or other suitably impermeable material, as per the *EPA Environmental Guidelines* (EPA, 2016).

As most of the proposed cells would be of turkey's nest style construction, no natural stormwater runoff would enter these cells except for direct rainfall. Diversion structures would be constructed to prevent stormwater entering the cells.

The Salt cake landfill facility would be located on previously disturbed land, currently used as a contractor facility with plant parking, laydown, material stockpiles and gypsum drying.

Construction

The construction of the Salt cake landfill facility would be undertaken progressively and construction activities would include:

- Site clearing, including the removal of contractor facilities and materials. It is assumed that these materials would be relocated to other areas of AGL land, as required
- Establishment of clean water diversions
- Establishment of erosion and sediment controls in accordance with *Managing Urban Stormwater: Soils and construction - Volume 1* (the Blue Book) (Landcom, 2004)
- Excavation and minor earthworks to create landfill cells, including installation of appropriate lining, and surface water diversion structures, where required.

Clay materials for construction of cells, and capping, would be sourced from the proposed Borrow pits (see Section 2.4 for further information). Other materials needed would be brought to the site as required.

Excavated materials would be stockpiled within the proposed disturbance footprint and beneficially reused on AGL lands where possible. Stockpile management procedures for segregating spoil, dust suppression, erosion and sediment control would be implemented.

Operation

The salt cake would be delivered to the cells via existing internal access roads. Transfer and placement would occur as required. *EPA Environmental Guidelines* (EPA, 2016) would be adhered to throughout operation of the Salt cake landfill facility, which would include provision of appropriate coverage of each active landfill cell to minimise dust and rainwater infiltration.

Decommissioning

Final capping of each Salt cake landfill cell would be in accordance with the *EPA Environmental Guidelines* (EPA, 2016), and would comprise of a compacted clay layer (or other suitable material) at least 600 millimetres thick, and then a one metre thick revegetation layer comprising of clean soils, top soil and vegetation. Clay materials for decommissioning and rehabilitation would be sourced from the proposed Borrow Pits, and clean soils and topsoil would be utilised.

When constructing the final capping, consideration would be given to grading the final surface in such a direction so as not to impede on future landfill cells. As more cells are constructed, filled and then capped, this final landform may be amended to suit the topography where required.

Post closure, land use would be determined with the most suitable land use adopted. Any more intensive land use or development would most likely require separate approval.

Final decommissioning of the Salt cake landfill disposal area would be followed by rehabilitation monitoring and management until such time as a safe and sustainable landform is confirmed.

2.4 Borrow Pits

Four Borrow Pit sites are proposed to provide excavated material for use in construction of the Project and for other suitable projects such as subsequent land forming and rehabilitation at Bayswater and Liddell. It is expected that material from these Borrow Pit sites would be used for the BWAD augmentation works, use in the Salt cake landfill and other areas of AGL land as required.

The proposed locations of the Borrow Pits are shown in Figure 2-1.

The final landform would be designed to blend into surrounding landform to the extent possible and would be managed in accordance with existing guidelines to ensure a safe and sustainable landform remains upon Project completion. Drainage catchments would remain generally consistent with the existing situation.

2.4.1 Construction

It is expected the Borrow Pits would be accessed consecutively as the need for material arises. Construction is expected to commence from those locations closest to the BWAD and would proceed generally as follows:

- Site clearance, including vegetation removal where necessary
- Establishment of clean water diversions
- Establishment of erosion and sediment controls in accordance with *Managing Urban Stormwater: Soils and construction - Volume 1* (the Blue Book) (Landcom, 2004)
- Clearing vegetation and either mulching for onsite reuse or used to created habitat piles
- Stripping of topsoil for later use in rehabilitation.

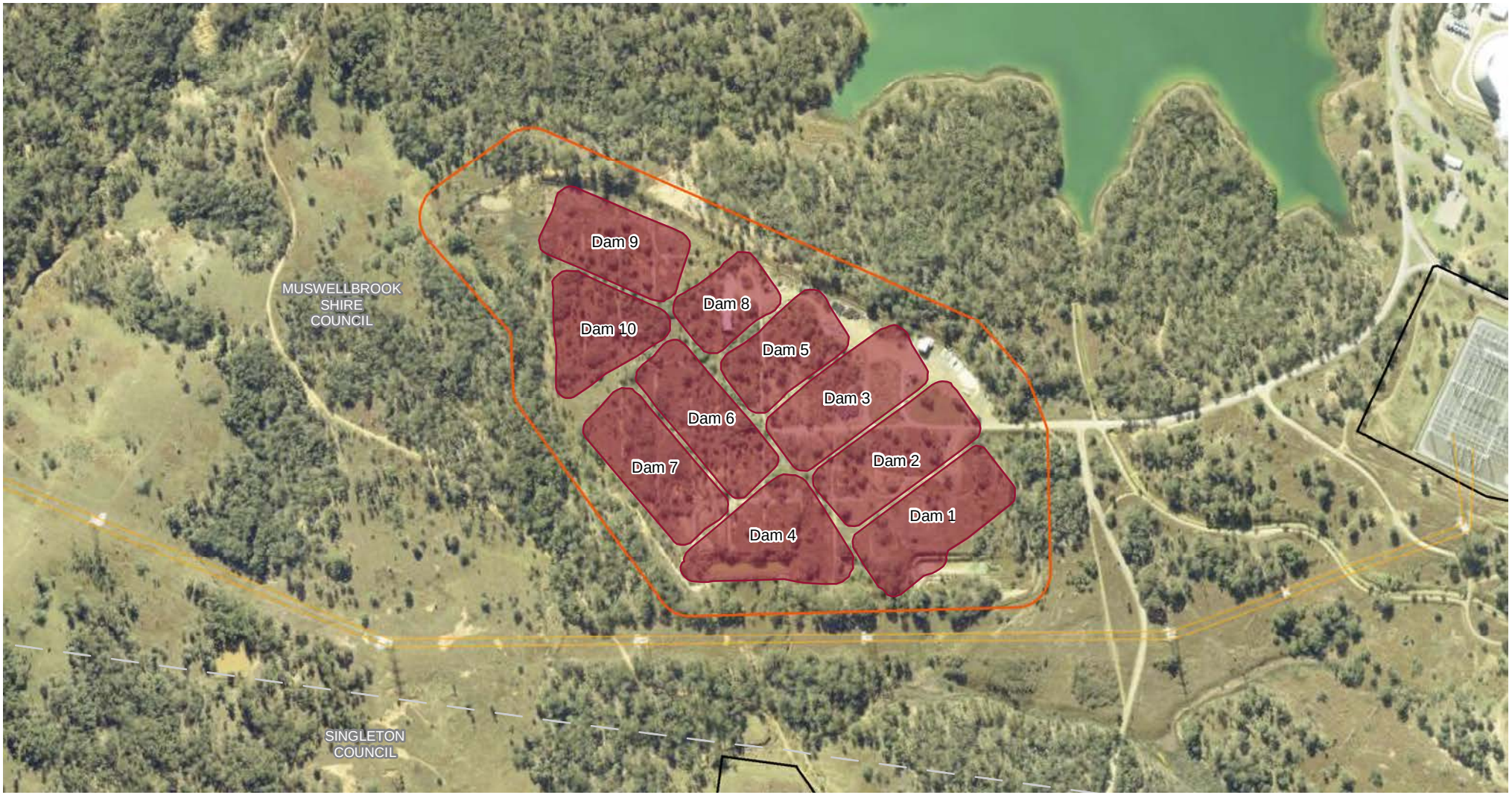

Figure 2-5 Proposed Salt cake landfill cell design

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2.4.2 Operation

The Borrow Pits operational stage would comprise:

- Excavation of clay material using benching techniques
- Transport of material to point of use using existing internal access tracks
- Progressive rehabilitation, or soil binding, of exposed areas to manage dust and sediment runoff.

The final design of the Borrow Pits would be self-draining in order to prevent surface water ponding within them. During operation, any surface water ponding within the Borrow Pits would be appropriately managed in accordance with the Blue Book, with suitable retention times and treatment provided before being discharged or re-used in operations. Excavation within the Borrow Pits would not intercept with groundwater table, and no dewatering works would be required except following rainfall events.

It is expected that existing internal access tracks would be maintained as required throughout operation, and in accordance with existing environmental management procedures.

2.4.3 Decommissioning

Once material within each Borrow Pit has been exhausted, the pits would be recontoured to form a safe and sustainable landform. Fencing may be required if necessary, to meet appropriate health and safety requirements. Disturbance areas would be covered with stockpiled topsoil and revegetated as required.

2.5 Coal handling plant water and wastewater infrastructure upgrades

Coal handling plant (**CHP**) water and wastewater infrastructure upgrades are proposed as part of an Environmental Improvement Program at Bayswater to improve the quality of discharges from the sediment basin and associated systems into Tinkers Creek (AECOM, 2017a).

Water from the following sources is currently collected and treated in the CHP sediment basin:

- Runoff from coal stockpiles as a result of direct rainfall on the CHP
- Wash down / process water from the CHP
- Catchment runoff from surrounding roads and batter slopes
- Discharge from the treated process water pond located to the south of the CHP
- Overflows / excess from water treatment processes i.e. oil water separator system and process water pond located to the south of the CHP.

The CHP sediment basin currently overflows daily to Tinkers Creek.

Additional water and wastewater management infrastructure works would include:

- Construction of clean water diversions to reduce stormwater inflows to the CHP sediment basin
- Reuse of water within the coal plant water system where possible for operational purposes which could include water treatment and
- Changes to the water management structures, including the enlargement/reconfiguration of the CHP sediment basin to allow for a larger volume of water to be stored with increased detention time and improved settlement of coal fines to better enable the treatment of water.

For the purposes of this assessment it is assumed that the volume and frequency of water discharged to Tinkers Creek would not change. The aim of the water management improvement works is to improve the water quality of discharges from the system. It is assumed that water quality in Tinkers Creek would be improved in accordance with the requirements of EPL 779.

2.5.1 Construction

Construction activities would include minor civil works and plant modifications related to the water management improvement works. Activities would be limited to the existing operational areas of the CHP and the disturbance footprint presented in Figure 2-1. Where earthworks are required, for example for the construction of the clean water diversions, appropriate erosion and sediment controls would be established to manage any potential impacts to the surrounding environment.

2.5.2 Operation

Following the construction of upgraded infrastructure, there would be minor changes to the operation of the CHP associated with improving water management and the water discharging from the system.

2.5.3 Decommissioning

The decommissioning of water management upgrades would be undertaken consistently with any future approvals to facilitate Bayswater's retirement.

2.6 Ancillary works

Routine clearing of vegetation along the alignments of the LSP Sludge Line and HP Pipeline would be undertaken to provide ongoing access for maintenance and management within the disturbance footprint. Ancillary infrastructure works would include repositioning of underground pipelines to above ground, replacement or upgrading of ageing pipelines, vegetation clearing associated with maintaining existing infrastructure, including along pipeline corridors.

2.7 Summary of operational changes

Beyond the BWAD, Salt cake landfill facility and additional Ash harvesting works, there are not expected to be any changes to the existing approved operation of Bayswater as part of the Project. This approval would not directly impact on the main generation activities carried out at Bayswater 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.

2.8 Consolidation and surrender of other approvals

AGL is committed to continual environmental improvement at Bayswater and has conducted a detailed review of its planning approvals for opportunities for consolidation and improvement. As part of the Project, AGL propose to consolidate seven existing water and wastewater development approvals (as listed in Table 2-2 below) into a single, contemporary planning approval. Following consolidation of these development consents as part of the Project, these approvals would be formally surrendered. The Project includes the continuation of the development authorised by these development consents and includes the ongoing maintenance of relevant works pertaining to these authorisations.

The Project will not impact on any other planning approvals pertaining to Bayswater or Liddell.

Table 2-2 Development consents to be consolidated

DA Reference	Description	Additional information
138/93 as modified Development consent DA 138/93 (as modified) granted on 16 December 1993 by Muswellbrook Shire Council for ash transfer and water return infrastructure components that occur within the MSC LGA	**Original Approval** The the approved works under DA 138/93 involves the removal of fly ash from the fabric filter hoppers at Bayswater Power Station and subsequent transport by pipeline to the Ravensworth No. 2 Site noting that this consent is only relevant to those aspects within the MSC LGA. The the approved works cover the construction, operation (24 hours per day, seven days a week) and maintenance of the following: • Pneumatic system to convey fly ash from the fabric filter hoppers to the Ravensworth Ash Plant at Bayswater Ash Dam • Surge bin • Storage silos (sealed truck access around silos, floor wash down facility, truck weigh bridge/s, extraction ports, access and truck) • Ash mixing plant • Return water tanks and associated pipelines • Vehicular and maintenance access tracks • Facilities for ash sales by truck • High pressure ash slurry pumps and pipelines • Return water pipeline system • Back up water supply system from Bayswater Power Station • Corrosion and scale inhibitor plant • Site offices and amenities, buildings to house control and electrical systems	Construction works have been completed. The operational and maintenance activities associated with this approval have been integrated into site operation environmental management plans. This would be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required. These will be carried over to the WOAOW Project.

DA Reference	Description	Additional information
	• Ancillary infrastructure i.e. power supply, water supply, sewer etc • Contaminated water drainage system from the Ravensworth Ash Plant to Bayswater Ash Dam • Drainage, settlement ponds and other soil erosion control works and • Access to the ash pipelines from New England Highway for construction, maintenance and operational purposes.	
	Modification Approval: Installation, operation and maintenance of additional capacity of the Return Water System at the Ravensworth Ash Disposal Site to cater for the increased return water recycling capacity requirements. The approved works included the following: • Upgrade to the Return Water System flow rate by 60 litres/sec to a new flow rate of 120 litres/sec • Retain and refurbish the existing 60 litres/sec pumping infrastructure • Installation, operation and maintenance of an additional 200mm diameter pipeline and pumps to cope with the required increase in capacity • The pipe will be a combination of Ductile Iron Cement Lined with a short length of High Density Poly ethylene at the Ravensworth end and match the existing pipeline • The existing controlled water discharge pump is to be removed and replaced by an additional return water pump with a capacity of 60l/s • An additional 60 l/s booster pump is to be installed parallel to the existing booster pumps	

DA Reference	Description	Additional information
	The new pumps will be interconnected into the existing pipeline. The existing pumps are to be left in place.	
2017-12 Development consent 2017-12 issued by Muswellbrook Shire Council on 7 April 2017 for pipeline replacement works on a section of the BWAD return water pipeline	**Approved works** Reliability issues associated with a 600 metre section of the BWAD return water pipeline necessitated its replacement to ensure the continued supply of water from the ash dam to the power station and the ongoing transportation and storage of ash created by power generating operations. The approved works consist of the construction, operation and maintenance of a High-Density Polyethylene pipe to replace an approximate 600 m section of the original return water line in order to avoid reliability and environmental issues associated with the existing pipeline. The works involved the removal and disposal of two sections of the existing asbestos cement pipeline, to provide for connection of the new high-density polyethylene pipeline with the existing pipeline and pump station.	Construction of the new section of pipeline has been completed. Continued operation and maintenance of this pipeline will be carried over to the new SSD consent. The operation and maintenance activities associated with the approved workshave been integrated with the site operation environmental management plans. These will be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required.
2017-89 Development consent 2017-89 issued by Muswellbrook Shire Council on 25 January 2018 for New Effluent Drain Sump	**Approved works** As part of the operations of the power station, cooling water is dosed with sulphuric acid and stored at two sites within the power station. The cooling water dosing area is a bunded area which drains into a sump (¾ effluent drain sump). The ¾ effluent drain sump is an intermediate storage tank for collecting waste cooling fluid from the cooling water dosing area. Once the level in the sump reaches a trigger level, the effluent sump pump transfers the content to a larger effluent sump through underground pipework. The original effluent sump was constructed using a 2.1 m diameter precast concrete pipe and in situ concrete lid and base slab. The concrete was protected from chemical attack with a fiberglass lining. The approved worksconsist of construction, operation and maintenance of the new ¾ effluent sump at an alternative	Construction of the approved worksis ongoing. The management measures outlined in the Statement of Environmental Effects (**SEE**) for this DA will be carried over to the WOAOW Project. These include: • Installation and maintenance of appropriate erosion and sediment control measures • The testing of excavated soil for contamination and to determine if it can be beneficially re-used in land uses appropriate to the outcome of the testing • AGL's existing Waste Minimisation and Management Plan • CEMP The operation and maintenance activities associated with the approved works will be integrated with the site operational environmental management plans. This will be

DA Reference	Description	Additional information
	location. The sump is to be located away from other buildings to allow standard bottom up construction in an open excavation with relocation of the pipe and pump infrastructure.	reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required.
12/2018 Development consent 12/2018 issued by Muswellbrook Shire Council on 15 June 2018 for new water transfer pipeline transferring water from Bayswater Ash Dam to the Ravensworth Ash Pipelines to enable water transfer to Ravensworth Void 4 for storage and reuse	**Approved works** The purpose of the approved worksis to manage and maintain storage capacity in the Bayswater Ash Dam by providing a pipeline from the BWAD to the Ravensworth Ash Pipelines for transfer of water to Void 4 for storage and reuse and to maintain freeboard within the Bayswater Ash Dam. The approved worksinvolve the construction, operation and maintenance of a new transfer pipeline, installation of a pump at the ash dam, a secondary pipeline containment in sections outside of the Bayswater Ash Dam catchment, and a basin at the connection of the new pipeline with the existing pipeline. The transfer pipeline consists of the following elements: • Installation of a new pump and pipeline from the Bayswater Ash Dam to an existing water transfer pipeline that connects to Ravensworth Void Number 4 • The new pipeline would be approximately 500 metres long from its commencement at the Bayswater Ash Dam to the connection point to the existing transfer pipeline • The pipeline material for the new pipeline is 280 mm diameter flexible Polyethylene • The pipeline is to be laid over cleared grassland and there would be no clearing or ground disturbance for the purposes of the pipeline • The pipeline would be laid directly above ground and directly on the ground surface. There would not be any restraint placed on the pipe in order to allow the pipe to thermally expand and contract	Construction approved under this consent is yet to commence. The management measures outlined in the SEE for this DA will be carried over to the WOAOW Project. These include: • Preliminary Erosion and Sediment Control Plan • CEMP development The operation and maintenance activities associated with the approved workswill be integrated with the operation environmental management plans for the site. This will be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required.

DA Reference	Description	Additional information
	• A manually operated pump would be installed at the Bayswater Ash Dam. The new pump would be provided with a small bund for the purpose of containing any hydrocarbon spills • A secondary containment bund would be constructed for the section of pipe outside of the ash dam catchment. This would be constructed in cleared areas using in situ soil material. The soil would be compacted and grassed to form a shallow slope allowing for maintenance slashing to protect the pipeline for fire risk • The basin would be located in a disturbed, cleared area at the connection of the new pipeline to the existing transfer pipeline. The basin would be constructed using in situ soil and have a volume capable of containing at least 200% of the full volume of the pipeline in the event of a leak at the bottom end of the pipeline	
06_0047 Part 3A project approval 06_0047 (as modified) granted on 6 April 2006 by the Minister for Planning and Public Spaces for upgrades to the Bayswater water treatment plant. Modification 1 was approved on 3 June 2006. Modification 2 was approved on 13 April 2018. This project approval was transitioned to a SSD consent via an order made on 28 August 2018	**Original Approval:** The approved works are to increase the salt removal capacity of the existing WTP from the current performance of around 13,000 tonnes per year and the current design capacity of 28,000 tonnes per year to an effective removal capacity of approximately 38,200 tonnes of salt removed per year to provide optimum plant performance. The approved worksinclude the construction, operation, maintenance, decommissioning and rehabilitation. The original approved works included the following elements: • Lime Softening Plant: Upgrades to the lime softening plant to treat Hunter River water which is then fed to Lake Liddell.	Construction approved under the original approval and in modification 1 has been completed. Continued operation and maintenance will be carried over to the new SSD consent. The operation and maintenance activities associated with the approved workshave been integrated with the site operational environmental management plans. These will be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required. Construction approved under modification 2 is ongoing.

DA Reference	Description	Additional information
	Refurbishment of the hydrated lime feed system, including installation of a new feeder. Installation of an acid dosing system, including a bunded 60,000 L bulk acid storage tank and acid dosing pumps. Minor changes to the lime dosing and storage equipment. • Circulating Water Treating Plant: Permeate directed to the existing reverse osmosis flush water tank and overflow to the circulating water basin. Alkalinity reduction plants returned to service, with a clarification step prior to the suspended solids filters. Processed water from the alkalinity reduction plant provides feed for the reverse osmosis plant. Excess process water is recirculated to the main cooling towers. Installation of new membranes within the existing reverse osmosis plant. Replacement of the reverse osmosis chemical dosing system. • Brine Concentrator Units Upgrade of the two brine concentrator units and installation of a third brine concentrator for optimal concentration capacity. Installation of a new flood box distribution system for each existing brine concentrator to eliminate blockages in the brine recirculation system. Installation of new pre-heaters and de-aerators. • Waste Brine Disposal System Installation of a mechanical vapour recompression brine crystalliser to concentrate waste brine from the	The management measures outlined in the EA for modification 2 will be carried over to the WOAOW Project. These include: • Construction Environmental Management Plan • Erosion and Sedimentation Control Plan

DA Reference	Description	Additional information
	BC plant. The resulting slurry waste is directed to the brine concentrator decant basin.	
	Modification 1: Modification of the the approved workswas obtained to change the hours of construction and post-construction commissioning and testing phases of the the approved works.	
	Modification 2: This modification includes upgrades to the existing water treatment plant to increase the capacity of the water treatment plant to remove salts from the cooling water and provide for a more efficient process to dispose of salt wastes generated. The key components of the upgrades include: • Construction of a brine return pipeline, storage tanks and associated infrastructure at the brine concentrator decant basin, connected to the existing waste brine transfer pipeline, including storage tanks, pumps and associated power supply. • Construction of two dewatering cells at the eastern end of the brine concentrator decant basin, with an overflow into the main brine concentrator decant basin cell. Construction of a salt caking plant and for conversion of concentrated brine from the brine concentrator into a solid waste cake for disposal.	
06_0259 Part 3A project approval 06_0259 (as modified) granted on 23 May 2007 by the Minister for Planning and Public Spaces for upgrades to the Bayswater water pumping	**Original Approval** The approved works consisted of the construction, operation and maintenance of a new low pressure pump station to work in conjunction with the existing pumping station. The following components are included: • New low-pressure pump station	Construction of the approved works has been completed.Continued operation and maintenance will be carried over to the new SSD consent. The operation and maintenance activities associated with the approved works are covered in specific management plans which have been integrated with the operation

DA Reference	Description	Additional information
station upgrade to increase water extraction capacity. Modification 1 approved 26 November 2007 This project approval was transitioned to be a SSD consent via an order made on 28 August 2018.	Pump station consisting of up to 10 submersible pump sets with a total extraction capacity of 800 ML/day. • Water Supply Pipeline(s) Above ground pipeline with a nominal diameter of 2,300 mm (or equivalent duel pipelines) to transfer water from the new Hunter River Pump Station to the discharge point above the Plashett storage. Pipeline(s) would have a nominal length of 3,500m between the pumping station and the flow discharge structure at Plashett Dam. Permanent gravel access track for the length of the majority of the pipeline for the construction and long-term maintenance use. Surge mitigation equipment installed at the pumping to control water hammer and water operating conditions. • Water discharge structure at Plashett Dam Energy dissipation structures at the discharge in to Plashett Dam to prevent scouring of the dam embankment over a range of dam levels. • Power supply works An additional substation and switchroom. Upgrade to the existing 33kV power supply. Oil filled transformer contained within in appropriately sized bunding or dry transformer.	environmental management plans for the site. This will be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required. Specific management plans that will be carried through to the WOAOW Project include: • Operational Environmental Management Plan • Ecology Management Plan • Vegetation Management Plan
	Modification: The modification to the approved works focused on the following: • Location of the pipeline below ground	

DA Reference	Description	Additional information
	• A new outlet position, leading to a reduced pipeline length and change in the location of the discharge point • Inclusion of a pair of additional surge mitigation tanks • Consolidate compliance reporting • Altered platypus management methods	
2019/37 Development consent 2019/37 issued by Muswellbrook Shire Council on 4 May 2020 for Lake Liddell Seepage Works	**Approved works** The works includes two pumping stations, Pumping Station 1 and Pumping Station 2 along with associated seepage capture and transfer infrastructure designed to return seepage from the Lake Liddell Dam Wall back to Lake Liddell..	Construction approved under this consent is yet to commence. The management measures outlined in the SEE for this DA will be carried over to the WOAOW Project. These include: • Erosion and Sediment Control Plan • CEMP development The operation and maintenance activities associated with this approved works will be integrated with the operation environmental management plans for the site. This will be reviewed and updated as required to ensure all environmental controls and mitigation measures have been identified and implemented as required.

3. Statutory context

This Chapter provides 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
- Any approvals that must be obtained before the proposed Project can commence and
- The likely interactions between the existing development consents and other environmental regulatory instruments for the Bayswater Power Station.

3.1 Summary of Statutory Context

3.1.1 Power to Grant approval

The Project is required to support the ongoing operation of Bayswater and so constitutes development for the purpose of "electricity generating works" and has a capital investment value of more than $30 million. The Project is accordingly SSD under the State Environmental Planning Policy (State and Regional Development) 2011 (**SEPP SRD**). On this basis, the Project is declared to be SSD and requires assessment in accordance with Division 4.7 of the EP&A Act.

In addition, the Project is also SSD under the 'waste management and resource facilities' provisions contained in SEPP SRD, as the Project will recycle more than 100,000 tonnes of fly ash waste per annum.

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 State Environmental Planning Policy (State and Regional Development) 2011, 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 Local Government Areas (**LGAs**).

The Muswellbrook Local Environmental Plan 2009 (**Muswellbrook LEP**) partially applies to land on which the Project is located. The subject land is zoned SP2 – Infrastructure: Power Station. The activities proposed as part of the Project are required to support the ongoing operation of Bayswater. Therefore, the Project is permissible under the provisions of the SP2 – Infrastructure: Power Station zone in the Muswellbrook LEP.

The subject land within the Singleton Local Environmental Plan 2013 (**Singleton LEP**) is zoned RU1 – Primary Production. 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 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 RU1 - Primary Production is a prescribed rural zone for the purposes of clause 34 of ISEPP. Accordingly, the Project is permissible.

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 Environmental Protection Licence under the *Protection of the Environment Operations Act 1997*(**POEO Act**) to accommodate additional scheduled activities
- Authorisation to remove or replace a permanent survey mark (TS Glendower) in accordance with clause 90 of the *Surveying and Spatial Information Regulation 2017* with application required at least 30 business days before the proposed removal or replacement

- Controlled activity approval under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 2000*
- Approval under Section 15 of the *Mine Subsidence Compensation Act 1961* for the erection or alteration of an improvement or subdivision of land within a mine subsidence district
- A lease, licence, permit, easement or right of way over a Crown Reserve under the *Crown Lands Management Act*
- A permit under Section 138 of the *Roads Act 1993.*

3.2 Consideration of Provisions and objectives of the EP&A Act and Regulation

The *Environmental Planning and Assessment Act 1979* (**EP&A Act**) and *Environmental Planning and Assessment Regulation 2000 (EP&A Regulation)* establish the planning and approvals process in NSW. It provides for the making of Environmental Planning Instruments (**EPIs**) including Local Environmental Plans (**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 Objectives of 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 objectives of the EP&A Act is provided in Section 21.2 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 State Environmental Planning Policy (State and Regional Development) being for the purpose of energy generation 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 development application.	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 development application 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 development application for SSD subject to Division 4.7. Consideration of how the requirements of Section 4.15 have been addressed is provided in Section 21.3 based on the findings of the EIS.	Refer to Table 21-2
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* • an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* • an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* • a bush fire safety authority under section 100B of the *Rural Fires Act 1997* • a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000.* 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 *Fisheries Management Act 1994* • 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 Chapter 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 1993* • a licence under the *Pipelines Act 1967* Consideration of the need for these approvals is provided below.	Chapter 3
4.63 Voluntary surrender of development consent	As identified in Section 2.8, AGL are proposing to voluntarily surrender certain development consents where the operation of the Project would supersede these approvals. As per Section 4.63: • 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.	Refer to Section 2.8

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 B.

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	EIS Certification Page
(c) the address of the land: (i) in respect of which the development application is to be made or (ii) on which the activity or infrastructure to which the statement relates is to be carried out	EIS Certification Page
(d) a description of the development, activity or infrastructure to which the statement relates	Refer to Chapter 2
(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	Refer to Chapters 7 to 19 and associated appendices.
(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	EIS Certification Page
An environmental impact statement must also include each of the following:	
(a) a summary of the environmental impact statement	Executive Summary
(b) a statement of the objectives of the development, activity or infrastructure	Section 4.1
(c) 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 4.3
(d) an analysis of the development, activity or infrastructure, including:	
(i) a full description of the development, activity or infrastructure	Chapter 2
(ii) 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	Section 1.4
(iii) the likely impact on the environment of the development, activity or infrastructure	Chapters 7 to 19
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment and	Chapter 20
(v) 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

EIS Requirement	Where addressed
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv)	Chapter 20
(f) 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 21

3.4 Applicable 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 and regionally significant development. Clause 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.

Clause 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 wholly ancillary to the ongoing operation of Bayswater and so constitutes development for the overall 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.

Clause 34 of ISEPP permits that 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.

The works are for the purpose of energy generation by coal, being wholly ancillary to the ongoing operation of Bayswater and located within land zoned SP2 Electricity Generation and RU1 - Primary Production zones both of which are prescribed for the purposes of clause 34 of ISEPP. Accordingly, the Project is permissible with consent.

Under Clause 101 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 will be provided via the existing dedicated access road which is not classified. Chapter 13 identifies that traffic volumes would not affect the operation of the New England Highway and Chapter 10 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 7 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 has been consulted in the preparation of the SEARs for the Project and development of the EIS and the Traffic Impact Assessment (see Appendix J) has addressed accessibility and traffic safety.

3.4.3 State Environmental Planning Policy No 33 – Hazardous and Offensive Development

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. Under SEPP 33 a consent authority must not consent to the carrying out of any development on land without considering:

- Current circulars or guidelines published by DPIE relating to hazardous or offensive development
- Whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply
- 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
- 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
- Any likely future use of the land surrounding the development.

The Project involves the expansion of existing operations on a site that is appropriately zoned and isolated from sensitive receptors. The Project does not involve the use of hazardous chemicals above screening levels that would trigger consideration as potentially hazardous development. The extensive buffer lands are owned by AGL and are appropriately zoned to prevent encroachment of development incompatible with the ongoing operations of Bayswater.

3.4.4 State Environmental Planning Policy No 55 – Remediation of Land

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. Clause 7 of SEPP 55 provides guidelines to be considered by the consent authority when determining development applications.

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

- It has considered whether the land is contaminated
- If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out and
- If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Chapter 11 and Appendix G considers the contamination status of the site and concludes that the site is suitable in its current state for the Project.

3.4.5 State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (**Koala SEPP**) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.

Where a Koala Plan of Management (**KPoM**) applies to the land, Clause 8 of the Koala SEPP applies to the development. The proposed development must be consistent with the approved KPoM that applies to the land. Where a KPoM does not apply to the land, and the land is identified on the Koala Development Application Map, and has an area of at least 1 ha, the provisions of Clause 9 of the Koala SEPP applies to the development. As such, the determining authority must take into account the requirements of the Guideline, or information prepared by a suitably qualified and experienced person in accordance with the guideline demonstrating that the land is not Highly Suitable Koala Habitat, or Core Koala Habitat.

Where no KPoM applies to the land, and it is not mapped on the Koala Development Application Map, Clause 10 of the Koala SEPP applies to the development. The determining authority is not prevented from granting consent to the development if they are satisfied that the land is not identified on the Koala Development Application Map, does not have an approved KPoM applying to it, and is not Core Koala Habitat.

The Biodiversity Development Assessment Report (**BDAR**) assesses the Project in relation to Koala habitat. Kleinfelder (2020) concludes that as no evidence of Koala activity was identified during surveys conducted across the larger study 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 Chapter 7 and Appendix C.

3.4.6 Muswellbrook Local Environmental Plan 2009

The Project area is located partially within 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
- Clause 5.10 - Heritage conservation
- Clause 7.1 - Terrestrial biodiversity and
- Clause 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 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 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 Appendix H and Appendix I).

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 proposed salt cake landfill 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* and Biodiversity Assessment Methods. Further details are provided in Chapter 7 and Appendix C.

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 Project area is located partially within 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
- Clause 5.10 - Heritage conservation
- Clause 7.1 - Earthworks
- Clause 7.2 - Flood planning
- Clause 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 and
- 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.

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 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 Appendix H and Appendix I).

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 site does not include land mapped as riparian land or watercourses and as such Clause 7.6 of the Singleton LEP does not apply. Consideration of sensitive receiving environments, including watercourses, is provided in Section 8.1.7.

3.5 Protection of the Environment Operations Act 1997

The principal legislation regulating pollution and waste management in NSW is the *Protection of the Environment Operations Act 1997* (**POEO Act)**. All scheduled activities as listed in Schedule 1 of the POEO Act require an Environment Protection License (**EPL**).

Bayswater is operated under EPL 779 which is held by AGL and issued by the EPA under the POEO Act for Bayswater. The existing EPL 779 for Bayswater would be modified to incorporate the additional scheduled activity of 'land based extractive activity'.

3.6 Waste Regulatory context

In NSW the POEO Act and the *Waste Avoidance and Resource Recovery Act 2001* (**WARR Act**) are the key legislation that govern the issues of waste generation, reuse, recycling, transport and disposal and establish a waste hierarchy as shown in Figure 3-1.

Figure 3-1 : The Waste Hierarchy in NSW

3.6.1 Protection of the Environment Operations Act 1997 (POEO Act)

The regulatory framework is centred around the POEO Act, which integrates EPA licensing with the development approval procedures under the EP&A Act. The POEO Act specifies the requirements for licences and the regulation of activities that have the potential to pollute or harm the environment.

Waste is defined under the POEO Act to include:

- Any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment
- Any discarded, rejected, unwanted, surplus or abandoned substance
- Any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance
- Any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations or
- Any substance prescribed by the regulations to be waste.

The following classes of waste are defined in clause 49 of Schedule 1 of the POEO Act:

- Special waste
- Liquid waste
- Hazardous waste
- Restricted solid waste
- General solid waste (putrescible) and
- General solid waste (non-putrescible).

The POEO Act makes it an offence to unlawfully transport waste material (Section 143); to use any premises as a waste facility without the authority to do so (Section 144); or provide misleading information regarding waste storage, transport and disposal (Section 145). The *Protection of the Environment Operations (Waste) Regulation 2014* includes strict thresholds for obtaining an EPL and outlines the waste levy system. The supply of coal ash for beneficial reuse is regulated by the Coal Ash Order 2014 made under the POEO Waste Regulation.

Bayswater operates under EPL 779 issued by the EPA. EPL779 authorises the carrying out of scheduled activities of:

- Coal works (>5,000,000 tonnes per annum)
- Chemical storage waste generation (>100 Tonnes annual volume of waste generated or stored) and
- Generation of electrical power from coal (>4000 GWh annual generating capacity).

The *Protection of the Environment Operations Amendment (Illegal Waste Disposal) Act 2013*, amends specific areas of the POEO Act to define and restrict illegal waste disposal activities. *The Environmentally Hazardous Chemicals Act 1985* provides the EPA with the authority to declare chemical substances as chemical wastes and to make chemical control orders relating to those substances that are declared as chemical wastes.

3.6.2 NSW Waste Avoidance and Resource Recovery Act 2001

The objects of the 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 EPA to develop a waste strategy for the State.

The WARR Act outlines the definition of extended producer responsibility schemes in which the producer's responsibility for a product is extended to the post-consumer stage of the products lifecycle.

Chapter 18 assesses the waste management components of the Project in relation to the WARR Act.

3.6.3 NSW Waste Avoidance and Resource Recovery Strategy 2014-2021

The NSW Government prepares a WARR Strategy every five years. It aims to reduce the generation of waste in NSW, and to keep materials circulating within the economy.

It has specific targets (for 2020–22) to:

- Avoid and reduce the amount of waste generated per person in NSW

- Increase recycling rates to:
  - 70% for municipal solid waste
  - 70% for commercial and industrial waste
  - 80% for construction and demolition waste
- Increase waste diverted from landfill to 75%
- Manage problem wastes better, through establishing 86 drop-off facilities and services across NSW
- Reduce litter, with 40% fewer items (compared to 2012) by 2017 and
- Combat illegal dumping, with 30% fewer incidents (compared to 2011) by 2017.

A significant part of the Project includes expanding facilities to recycle a greater proportion of fly ash and bottom ash. This directly meets the aims of the NSW government WARR strategy, and achievement of these aims would also assist AGL in prolonging the life of the BWAD. There are a range of local projects that could potentially beneficially reuse the waste materials generated on site, which are discussed in this Section 18.3.3.

3.6.4 The Coal Ash Order (2014) and The Coal Ash Exemption (2014)

The Coal Ash Order and Coal Ash Exemption (**CAOE**) specify the conditions under which "*coal ash or blended coal ash* [can be exempted] *from certain requirements under the Protection of the Environment Operations Act 1997 (POEO Act) and Waste Regulation in relation to the application of that waste to land, provided the consumer complies with the conditions of this exemption.*" Allowed uses of coal ash under this exemption include:

- As a soil amendment for the growing of vegetation
- In cementitious mixes such as concrete
- In non-cementitious mixes such as an engineered fill, stabiliser, filter or drainage material or as a sand substitute as follows:
  - Pipe bedding material
  - Selected backfill adjacent to structures
  - Road pavement, base and sub-base structures
  - Composite filler in asphalt pavements
  - Rigid and composite pavement structures
  - Select layers which act as working platforms at the top of earthworks
  - Fill for reinforced soil structures (including geo-grid applications).

This order applies to coal ash including fly ash and furnace bottom ash from burning Australian black coal, as well as blended coal ash but not brine conditioned or treated ash. The CAOE specify the maximum concentrations of chemicals and other attributes for the coal ash that need to be met for it to be lawfully supplied for the abovementioned applications.

Coal Ash generated by Bayswater and used off-site must comply with the conditions of the CAOE. The proponent has an established sampling plan for the testing of fly ash and are in the process of approving their sampling plan for bottom ash with the NSW EPA.

3.6.5 NSW EPA's Environmental Guidelines: Solid Waste Landfills (2016)

These guidelines provide general guidance and the minimum standards for landfills constructed in NSW. The new Salt cake landfill facility will be designed, constructed, operated and decommissioned in accordance with these guidelines.

3.6.6 NSW Circular Economy Policy Statement 2019

The *NSW Circular Economy Policy Statement 'Too Good to Waste'* sets the ambition and approach for a circular economy in NSW and provides principles to guide resource use and management. The NSW Government defines a circular economy as valuing resources by keeping products and materials in use for a long as possible.

A principle of circular economy is to regenerate natural resource systems. The proposed upgrade to the CHP aims to improve the quality of discharges from the site to the environment. Increasing the quantity of fly ash and bottom ash to be recycled will directly meet principles 1 and 2 of the Circular Economy Policy.

3.7 Contaminated Land Management Act 1997

The *Contaminated 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.

Chapter 11 and Appendix G consider the contamination status of the site and conclude that the site is suitable in its current state for the Project. There is a duty to notify any contamination under Section 60 of the CLM Act and this would be undertaken in the event that any previously unidentified contamination is encountered that exceeds notification thresholds.

3.8 Dams Safety Act 2015

The BWAD is currently prescribed under the NSW *Dam Safety Act 2015* (**DS Act**) and as a result has several conditions applied to it to ensure the safety of the structure and to minimise risk to the downstream population. The DS Act is administered through the Dams Safety NSW (**DSNSW**).

As part of the DSNSW's requirements, it is necessary to establish the Consequence Category for any prescribed dam. This is required by the DSNSW so that it can determine design requirements as well as set an appropriate level of ongoing surveillance.

The Consequence Category of the dam is reviewed at five-yearly intervals within comprehensive surveillance reports, which are submitted to the DSNSW. The last report concluded that BWAD remains within the Significant Consequence Category, under both sunny day and flood conditions.

The Consequence Category for the dam would be reviewed to consider the augmentation works proposed as part of the Project.

3.9 Heritage Act 1977

The *Heritage Act 1977* 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 1977* 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. Items listed under section 1 of the State Heritage Register may require a permit under section 139 of the Act.

An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* is not required for approved SSD.

There are no known relics located within the study area. Chapter 17 provides details of the heritage items in the vicinity of the Project and the required mitigation measures to avoid any significant impacts.

3.10 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (**BC Act**) commenced on 25 August 2017 and repeals the Threatened Species Conservation Act 1995, the Nature Conservation Trust Act 2001 and parts of the National Parks and Wildlife Act 1974. The BC Act introduces a Biodiversity Assessment Method (**BAM**) and Biodiversity Offsets Scheme.

Part 7 of the BC Act requires that an application for SSD approval under the EP&A Act be accompanied by a "*biodiversity development assessment report unless the Secretary of the Department of Planning and the Chief Executive of the Office of Environment and Heritage determine that the proposed development is not likely to have any significant impact on biodiversity values*".

The BDAR (Kleinfelder 2020) assesses the Project in relation to biodiversity and includes measures to avoid, mitigate and offset impacts to biodiversity in accordance with the BC Act and BAM. The findings of the BDAR are presented in Chapter 7.

Section 7.14 of the BC Act identifies that if the Minister for Planning and Public Spaces decides to grant consent or approval and the biodiversity offsets scheme applies to the proposed development, the conditions of the consent or approval may require the applicant to retire biodiversity credits to offset the residual impact on biodiversity values (whether of the number and class specified in the report or other number and class). The residual impact is the impact after the measures that are required to be carried out by the terms or conditions of the consent or approval to avoid or minimise the impact on biodiversity values of the proposed development. AGL would require biodiversity credits in accordance with any condition of approval.

3.11 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NSW) (**NPW Act**) protects Aboriginal heritage within NSW. Protection of Aboriginal heritage is outlined in Section 86 of the NPW Act, as follows:

- “a person must not harm or desecrate an object that the person knows is an Aboriginal object” (Section 86(1)),
- ”a person must not harm an Aboriginal object” (Section 86(2)),
- “a person must not harm or desecrate an Aboriginal place” (Section 86(4)).

Harm is defined under the NPW Act as ‘any act that destroys, defaces or damages the object including moving the object from the land on which it has been situated or causes or permits the object to be harmed’.

Section 87(1) of the NPW Act provides that it is a defence to these provisions if the harm or desecration is authorised by an Aboriginal Heritage Impact Permit. An Aboriginal Heritage Impact Permit is not required for development for which a SSD consent has been granted and the provisions of the NPW Act that prohibit an activity without such an authority do not apply (Section 4.41(d) of the EP&A Act).

Chapter 12 and Appendix H summarises the Aboriginal heritage impact assessment and consultation undertaken in accordance with relevant guidelines.

3.12 Native Title Act 1993

The main objective of the *Native Title Act 1993* is to recognise and protect native title. A successful native title claim results in the recognition of the particular rights, interests or uses claimed by the registered party. If a native title claim is recognised under the Act, 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 there are no native title claims registered with respect to the land within the project footprint.

Notification requirements under section 24KA of the *Native Title Act 1993* apply where construction work is required on Crown land. Notification in accordance with this section will occur concurrently with the public exhibition of the EIS.

3.13 Crown Land Management Act 2016

The *Crown Land Management Act 2016* 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 intersects with one area of Crown land, as shown on Figure 1-2.

3.14 Mine Subsidence Compensation Act 1961 (Repealed)

The *Mine Subsidence Compensation Act 1961* (**MSC Act**) provided for the regulation of development on land potentially affected by mine subsidence. The erection or alteration of an improvement or subdivision of land within a mine subsidence district required approval of the mine subsidence board under Section 15 of the MSC Act.

Part of Borrow Pit 1 and sections of the Ravensworth Ash pipeline within the Singleton LGA are within a mine subsidence district.

Subsidence Advisory NSW would be consulted during the assessment process and the Project would need to be designed to be structurally safe if mine subsidence is possible in the specific Project area.

3.15 Pipelines Act 1967

The *Pipelines Act 1967* (**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 Ravensworth ash pipeline is exempt under the Pipelines Act.

3.16 Rural Fires Act 1997

The *NSW Rural Fires Act 1997* (**Rural Fires Act**) facilitates the prevention, mitigation and suppression of bush and other fires in local government areas and parts of the State 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 Chapter 19.

3.17 Roads Act 1993

The *Roads Act 1993* (**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 requires works within road reserve areas associated with the Ravensworth ash pipeline. 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.

3.18 Water Act 1912 and Water Management Act 2000

The *Water Act 1912* (**Water Act**) identifies water management authorities and 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 *Water Management Act 2000* (**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. Chapter 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 metres 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).

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 AGL'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. 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. The design of the Borrow Pits would be developed to avoid aquifer interference.

3.19 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**) is the primary Commonwealth legislation relating to the environment. Under Part 3 of the EPBC Act, approval from the Australian Minister for the Environment and Energy 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 outside Commonwealth land and has, will have or is likely to have a significant impact on the environment of Commonwealth land and
- Is undertaken by the Commonwealth and has, will have or is likely to have a significant impact on the environment.

A significant impact under the EPBC Act is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. Matters of national environmental significance (**MNES**) include:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species

- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining) and
- A water resource, in relation to coal seam gas development and large coal mining development.

It is generally the responsibility of the proponent (or the land owner if owned by the Commonwealth) of a proposed action to determine whether the Project, or action, has the potential to impact upon a MNES and constitute the need for a referral to the Commonwealth for determination. An action that is referred for consideration by the Commonwealth Minister for the Environment cannot be undertaken until the outcome of the referral process is completed - either through the decision of the Minister for the Environment that the action is not a controlled action or that the assessment and approval process has been completed.

The EPBC Act Protected Matters Search Tool was searched on 4th June 2019 for the Project with a 10 km buffer. The Protected Matters Search Tool search results are summarised in Table 3-3.

Table 3-3: Protected Matters Search Tool results

EPBC Act Protected Matters Search Tool - 10 km buffer	
World Heritage Properties	1
National Heritage Places	1
Wetlands of International Importance	1
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	6
Listed Threatened Species	41
Listed Migratory Species	14
Other Matters Protected by the EPBC Act - 10 km buffer	
Commonwealth Land	2
Commonwealth Heritage Places	None
Listed Marine Species	21
Whales and Other Cetaceans	None
Critical Habitats	None
Commonwealth Reserves Tribunal	None
Commonwealth Reserves Marine	None

The search results indicate that MNES within the area of influence of the Project are limited to biodiversity. Consideration of MNES has been included in the BDAR (Refer to Appendix C) and is summarised in Chapter 7.

A referral was submitted under the EPBC Act and on 20 April 2020 and a delegate of the Commonwealth Minister for the Environment determined that the Project is a controlled action under the EPBC Act with the controlling provisions being listed threatened species and communities under sections 18 and 18A. The Project will be assessed under the Bilateral Agreement (*Amending Agreement No.1*, 2020) between the Commonwealth and NSW Governments.

The assessment requirements for the Commonwealth MNES relevant to the Project were provided on 28 April 2020. These requirements have been addressed within this EIS as identified in Appendix B.

3.20 Environmental Protection and Biodiversity Conservation Regulation

The Addendum SEARs issued for the Project require that the EIS must address the matters outlined in Schedule 4 of the EPBC Regulations in relation to the controlling provisions. Table 3-4 identifies how this EIS

addresses these form and content requirements. The addendum SEARs for the Project are provided in full in Appendix A and how they are addressed in the EIS is provided in Appendix B.

Table 3-4: Matters to be addressed by draft public environment report and environmental impact statement

EIS Requirement	Where addressed
1 General information – 1.01 The background of the action including:	
(a) the title of the action	Bayswater Power Station Water Infrastructure Upgrade Project also referred to as the Bayswater Water and Other Associated Operational Works Project.
(b) the full name and postal address of the designated proponent	AGL Macquarie Pty Limited Private Mail Bag 2, Muswellbrook, 2333, NSW, Australia
(c) a clear outline of the objective of the action	Objectives of the action are presented in Section 4. The Project's overall objective is to facilitate improved environmental outcomes and ongoing operation of Bayswater through: • Providing ash storage through to planned retirement • Improved ash recycling and management • Improved salt management through facilitating operation of saltcake facility and saltcake disposal • Rehabilitation of the ash dam, borrow-pit and saltcake disposal areas post retirement.
(d) the location of the action	The action is located within the Singleton and Muswellbrook Local Government Areas of NSW. The action is predominantly within the Bayswater Power Station operational area, with a component of works extending to the Ravensworth rehabilitation area. The majority of the works would be undertaken within the AGL Macquarie Landholding except for a small parcel of Crown land, Singleton Council owned land and TfNSW owned land.
(e) the background to the development of the action	The action responds to the ongoing operation of Bayswater and has arisen from the identified need to improve environmental performance of Bayswater Power Station over its remaining operational life. Refer to Section 1.1 for full project background.
(f) how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action.	While not a controlled action under the EPBC Act, the Bayswater Turbine Efficiency Upgrade and ongoing operation of Bayswater is being undertaken by AGL and affects the same Location. Based on review of EPBC Act public notices the following actions in the Hunter Valley have been deemed to need approval under the EPBC Act with controlling provisions reasonably expected to include impacts to threatened species and ecological communities: • Glendell Mine Continued Operations Project • Mangoola Coal Continued Operations Project • Bulga Coal Optimisation Project Modification, • Wambo Bates Extension Underground Mine • Hunter Valley Coal Mining Operations North • South Wambo underground coal mine extension • United and Wambo open cut coal mine project

EIS Requirement	Where addressed
	• Drayton Coal Mine Extension Project • Mt Arthur Coal open cut modification • Mt Owen continued coal mining operation • Extension of Liddell open cut coal mining operations • Extension of existing open cut coal mine at the Bulga Coal Complex • Warkworth Mine Extension • Continuation of Bengalla Mine • Extending Existing operations at Warkworth Coal Mine. The Project BDAR has considered impacts to threatened species and ecological communities having regard to habitat within 10 km of Bayswater and in accordance with the BAM.
(g) the current status of the action	The action is in the design stage. It is noted that the EIS addresses the voluntary surrender of existing approvals that relate to the ongoing operation of Bayswater but these approvals do not have associated approvals under the EPBC Act. The status of developments associated with approvals to be surrendered is provided in Table 2-2.
(h) the consequences of not proceeding with the action	The consequence of not replacing or upgrading the ageing water and wastewater infrastructure on site would result in disproportionately high maintenance costs and potential environmental costs associated with infrastructure failures. Furthermore, and most importantly, the 'Do Nothing' option could jeopardise the ongoing functionality and performance of Bayswater which is vital for supplying safe and efficient generation of electricity for the State of NSW. In particular, the failure to augment the ash dam would result in Bayswater not being able to continue to operate as no alternative option for ash management is currently available.
2 Description – 2.01 A description of the action, including:	
(a) all the components of the action	Refer to Section 2 for full project description. The action does not include the proposed surrender of existing approvals for which impacts have been previously assessed.
(b) the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	The location of the action is described in Figure 2-1 and Table 2-1.
(c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts	Refer to Section 2.
(d) relevant impacts of the action	Relevant impacts are identified as the extent of clearing and associated potential to increase fragmentation of remaining native vegetation. Relevant impacts are assessed in detail in Appendix C and summarised in 8.2.
(e) proposed safeguards and mitigation measures to deal with relevant impacts of the action	Safeguards and mitigation measures for relevant impacts to threatened species and ecological communities are detailed in Section 8.3. Overall project safeguards and mitigation measures are summarised in Section 20.

EIS Requirement	Where addressed
(f) any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action	A summary of statutory requirements that apply to the action is provided in Section 3.1.
(g) to the extent reasonably practicable, any feasible alternatives to the action, including: (i) if relevant, the alternative of taking no action; (ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action; (iii) sufficient detail to make clear why any alternative is preferred to another;	Consideration of feasible alternatives is provided in Section 4.3.
(h) any consultation about the action, including: (i) any consultation that has already taken place; (ii) proposed consultation about relevant impacts of the action; (iii) if there has been consultation about the proposed action—any documented response to, or result of, the consultation;	A summary of planned and completed consultation is provided in Section 5. DPIE will make the EIS publicly available for comment and any comments received will be responded to in a response to submissions report prior to the action being determined.
(i) identification of affected parties, including a statement mentioning any communities that may be affected and describing their views	Affected parties have been identified and consulted as described in Section 5.
3 Relevant impacts – 3.01 Information given under paragraph 2.01(d) must include:	
(a) a description of the relevant impacts of the action	Refer to Appendix C.
(b) a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	Refer to Appendix C.
(c) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Refer to Appendix C.
(d) analysis of the significance of the relevant impacts	Refer to Appendix C.
(e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts	Refer to Appendix C.
4 Proposed safeguards and mitigation measures - 4.01 Information given under paragraph 2.01(e) must include:	
(a) a description, and an assessment of the expected or predicted effectiveness of, the mitigation measures;	Nominated mitigation measures are expected to achieve their intended purpose of limiting impacts to the extent reasonable and feasible.
b) any statutory or policy basis for the mitigation measures;	Mitigation measures have been prepared in accordance with the NSW Biodiversity Assessment Method and Biodiversity Offset System requirements.

EIS Requirement	Where addressed
(c) the cost of the mitigation measures	The cost of mitigation measures has not yet been calculated. The retirement of biodiversity credits would constitute the vast majority of costs and would be subject to finalisation of offset strategy and extent of clearing ultimately required.
(d) an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing.	Overall project safeguards and mitigation measures are summarised in Section 20.
(e) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	The Department of Planning, Industry and Environment (**DPIE**) is responsible for the establishment of compliance requirements for the Project including assigning obligations to consult with other relevant agencies.
(f) a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent	Overall project safeguards and mitigation measures are summarised in Section 20.
5 Other approvals and conditions - 5.01 Information given under paragraph 2.01(f) must include:	
(a) details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including: (i) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy; (ii) how the scheme provides for the prevention, minimisation and management of any relevant impacts;	Refer to Section 3.1.
(b) a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action;	No approval has been obtained for the action to date.
(c) a statement identifying any additional approval that is required;	Refer to Section 3.1.
(d) a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	DPIE is responsible for the establishment of compliance requirements for the Project.
6 Environmental record of person proposing to take the action	
6.01 Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:	Nil

EIS Requirement	Where addressed
(a) the person proposing to take the action; and (b) for an action for which a person has applied for a permit, the person making the application.	
6.02 If the person proposing to take the action is a corporation—details of the corporation's environmental policy and planning framework.	Bayswater operates under the AGLE Health, Safety and Environment Management Systems (**HSEMS**) which would also apply to the Project (if approved). The HSEMS will be used to assure compliance with the conditions of all approvals granted at both a State and Commonwealth level, as well as existing regulatory requirements applicable to Bayswater that will extend to the Project including the Bayswater EPL. AGL is strongly committed to environmental management and operates under the AGLE Environment Policy which records AGL's commitment to: • Meet or exceed regulatory obligations • Analyse and improve the way it does business to reduce environmental risks and impacts • Continuously improve environmental performance through developing and reviewing effective management systems, measurement and targets • Share environmental objectives and commitments with employees and stakeholders • Minimize the risk of environmental incidents • Respond quickly and effectively to environmental incidents from its operations • Actively participate in the development of regulations, codes of practice, standards and policies to share scientific knowledge and support informed decision-making • Contribute to research and adaptation to new technologies that improve environmental outcomes • Use resources and energy efficiently, minimising emissions and waste.
7 Information sources - 7.01 For information given in a draft public environment report or environmental impact statement, the draft must state:	
(a) the source of the information	AGL has provided the action description, consultation summary and all information related to existing operations and environmental management. Kleinfelder has undertaken the preparation of the BDAR and land capability assessment. Jacobs has developed the EIS summarising the above inputs and all other technical assessments supporting the EIS.
(b) how recent the information is	All information has been prepared since November 2018 and where pre-existing information has been referenced it has been validated.
(c) how the reliability of the information was tested	The information presented here is the most recent available. The information has been prepared by specialist consultants

EIS Requirement	Where addressed
	with many years' of experience. Assessment of relevant impacts to controlling provisions has been undertaken in accordance with the NSW and Commonwealth endorsed BAM. The approach to assessment of relevant impacts has been discussed with DPIE and Department of Agriculture Water and Environment (**DAWE**). Both Jacobs and Kleinfelder have quality systems in place that involve internal review processes for all deliverables.
(d) what uncertainties (if any) are in the information	Due to the sub-optimal flowering conditions for the orchid species *Prasophyllum sp. Wybong* (C.Phelps ORG 5269) an expert report has been undertaken to determine the habitat suitability and any potential occurrence of this species in the study area. The expert report provides a conservative opinion that habitat exists on site for this species. It is intended that survey during optimal flowering conditions would be undertaken prior to the impact occurring such that actual extent of impact can be confirmed.

4. Strategic context and project need

This chapter provides a strategic justification of the development focusing on the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses.

4.1 Statement of Project objectives

The Project's overall purpose and objective is to facilitate improved environmental outcomes and ongoing operation of Bayswater through:

- Providing ash storage through to planned retirement
- Improved ash recycling and management
- Improved salt management through facilitating operation of saltcake facility and saltcake disposal
- Rehabilitation of the ash dam, borrow-pit and saltcake disposal areas post retirement.

While it facilitates the ongoing operation of Bayswater, no changes are proposed to the existing approved operation or any other component of Bayswater as part of the Project. Bayswater as a whole will continue to be operated and maintained in a manner which responds to market demand and complies with all applicable laws and existing authorisations.

4.2 Project need

Bayswater was commissioned in 1985 and has a current technical life up to 2035. AGL's asset management strategy has identified that the ageing water and wastewater infrastructure assets on site require upgrade and/or replacement to ensure the continued and efficient operation of Bayswater until its planned retirement. Further, since Bayswater was initially commissioned there have been advances in water and wastewater management. AGL have identified enhancement and upgrades to existing infrastructure that will result in improved environmental outcomes.

4.2.1 Bayswater Ash Dam

In addition, the existing BWAD is forecast, based on current emplacement and beneficial reuse of ash rates, to reach capacity within two years. To enable the ongoing operation of Bayswater it is critical to augment the existing BWAD to provide additional emplacement capacity for Fly ash and Bottom ash from Bayswater.

4.2.2 Ash Recycling

In addition to the need to minimise onsite disposal, there are currently limited and depleting natural resources that can be used for road construction projects within the Hunter, Central Coast and greater Sydney regional areas, for which coal ash products are suitable to be used. Furthermore, the 0.5 mm sand fraction grade of extracted material from the BWAD is suitable for use in applications where natural sands would otherwise be required, reducing the pressure on this naturally occurring resource (such as concrete).

The Sydney region is increasingly relying on resources originating in adjoining regions to supplement demand, currently importing about 13% of its fine aggregate (sand) needs and about 23% of its coarse aggregate needs (as calculated by AGL). Bottom ash is often a suitable alternative for both course and fine aggregates.

The main current sources of coarse aggregate for the Sydney region are; basalt in the Peats Ridge-Kulnura area (near Gosford); and latite in the Kiama–Shellharbour region.

The current major sources of fine aggregate (construction sand) for the Sydney market are Kurnell, Maroota, Somersby Plateau, Newnes Plateau, and Penrose (Southern Highlands). Kurnell is currently Sydney's main source of fine to medium-grained sand. The depletion and eventual closure of Kurnell has been predicted since the 1990's. A review of the resources undertaken in 2011 indicated that Kurnell may have resources for a further 10 years (ie up to 2021) (NSW Trade and Investment, 2016).

An increase in extracted material volumes from the proposed BWAD is therefore required to balance the depleting natural resources and to meet the growing demand for coal ash and coal ash blended products, particularly for use as fill in selected road projects and as a fine aggregate in cement and masonry blocks. In particular, the Project would facilitate the use of extracted materials for certain projects requiring materials that meet key TfNSW specifications for road construction materials (i.e. bridging material for poor soils, bridge abutments, pipe backfill, filter material and select fill). Specifically, bottom ash extracted from the site also has unique particle density, with structurally sound particles.

4.2.3 Ravensworth ash pipeline replacement

The Ravensworth ash pipeline is over 20 years old and requires replacement to reduce the risk of failure over the remaining operational life of Bayswater. The replacement of the pipeline is required under EPL 779.

4.2.4 Salt Cake Landfill

The Salt cake landfill would facilitate the commencement of operations of the separately approved salt caking plant which is a component of the upgraded water treatment plant. AGL received approval for the Bayswater Power Station Water Treatment Plant Modification 2 (06_0047 – MOD 2) in April 2018. As part of the application for that modification AGL initially proposed to store salt cake within the existing brine concentrator decanter basin. AGL subsequently amended its application to remove storage of salt cake in this manner due to concerns raised by Muswellbrook Shire Council and Singleton Council at the time. It was subsequently recognised within the assessment report for 06_0047 – MOD 2 that AGL would need to seek separate approval for the construction of a new purpose-built salt cake storage area prior to operating the proposed Salt caking plant.

4.2.5 Coal handling and Preparation Plant upgrades

Water from the CHP currently discharges daily into Tinkers Creek and AGL are reviewing options for water management relating to environmental improvement measures in consultation with the EPA. The purpose of the review is to determine practical and feasible option/s to reduce the risk of coal fines potentially discharging from the CHP to Tinkers Creek and causing the pollution of waters. The CHP upgrades proposed would achieve improved water management through increased retention and settling time for coal fines impacted run-off.

4.2.6 Borrow Pits

Onsite Borrow Pits are required to supply the materials needed to construct the BWAD augmentation works and Salt cake landfill and site rehabilitation. While the capping of the Liddell ash dams has been undertaken using mine spoil, AGL is not able to secure suitable material that achieves the necessary specifications for regulated dam augmentation or landfill construction from similar sources. Sourcing appropriate material from off site would have similar environmental impacts in other areas and additional transport impacts and as such on-site Borrow Pits are considered preferable.

4.2.7 Approvals consolidation

AGL acknowledges that Bayswater is regulated under a large number of planning approvals, resulting in a complex, duplicative and sometimes conflicting regulatory and environmental management regime for the site. AGL is committed to continual environmental improvement at Bayswater and has conducted a detailed review of its planning approvals for opportunities for consolidation and improvement.

4.3 Alternatives considered

AGL has reviewed options regarding various elements of the Project to ensure the continued safe, reliable and efficient operation of Bayswater until its planned closure to ensure they address the project objective of improved environmental outcomes and ongoing operation of Bayswater through:

- Providing ash storage through to planned retirement
- Improved ash recycling and management
- Improved salt management through facilitating operation of saltcake facility and saltcake disposal

- Rehabilitation of the ash dam, borrow-pit and saltcake disposal areas post retirement.

The 'Do Nothing' option was not considered to be a feasible alternative to the overall Project, as not replacing or upgrading the ageing water and wastewater infrastructure on site would result in disproportionately high maintenance costs and potential environmental costs associated with infrastructure failures. Furthermore, and most importantly, the 'Do Nothing' option could jeopardise the ongoing functionality and performance of Bayswater which is vital for supplying safe and efficient generation of electricity for the State of NSW.

The selection of Borrow Pit locations has focussed on avoiding vegetated areas to the extent possible whilst targeting areas with favourable material properties. For much of the remaining Project components, the location of works are dictated by the existing infrastructure requiring upgrade.

For each of the Project elements, opportunities to reduce the area of disturbance would be considered further during detailed design to minimise possible impacts associated with the Project. In particular, it is anticipated that this may result in a reduction in the extent of vegetation clearance, and thereby ecological impacts, and possible impacts to Aboriginal heritage.

Technical solutions that were considered for the following Project elements, are discussed below.

4.3.1 Ash dam augmentation

Before progressing assessment of options for the ash dam augmentation, AGL gave consideration to the use of the former Drayton Mine Void for ash disposal. The use of the void was found to be unfavourable due to the potential hydrogeological link between the void and aquifers nearby and the requirement to create additional disturbance to construct pipelines to convey the ash to the void from Bayswater.

In investigating the best solution to increase the capacity of the BWAD, four concept design options were developed and reviewed with a preferred option selected.

Based on current projections it is considered that storage of up to 12.5 million m^3 of ash would be required to satisfy Bayswater's future storage capacity requirements. Each of the options considered were located next to the existing BWAD in order to utilise the current infrastructure and site services. The following options were considered:

- Do Nothing - The existing BWAD is forecast, based on current emplacement and beneficial reuse of ash rates, to reach capacity within approximately two years. To enable the ongoing operation of Bayswater it is critical to augment the existing BWAD to provide additional emplacement capacity for Fly ash and Bottom ash from Bayswater. Without augmentation of the BWAD occurring, there would be inadequate storage capacity on site requiring consideration of other possible disposal options
- Option 1 - increasing the western levee and saddle dam heights until they provided enough storage capacity, up to the best-case estimates. This option was not selected as it did not have sufficient capacity to meet worst case storage requirements. It would result in one large and exposed ash beach, that has potential to emit dust and little opportunities to supress dust from commencement
- Option 2 - increasing the western levee and saddle dam heights until they provided enough storage capacity, up to the worst-case estimates. Ash discharges would be from the western levee wall. Similarly to Option 1, this option has the potential to emit dust
- Option 3 – using ash terracing to progressively stack the ash in approximate one metre increments using terraces. This option would also require the construction of ash terraces to a final height of RL 190 metres (under worst case ash generation estimates). This option was not selected as the continual raising of the ash would increase operational costs and impact existing services to the west of the BWAD. It would also present difficulties in accessing the ash surface to construct terraces
- Option 4 - dividing the ash storage into two cells using a central embankment and discharging the ash from the central embankment. The central embankment would be progressively raised by approximately one metre at a time.

The selected concept design was based on Option 2; however, a number of amendments were made, in part based on the alternative options considered to improve the environmental and operational performance of the

BWAD and address the Project objective. In order to minimise risks associated with dust emissions identified for Option 2, the preferred option would consist of five 'open ended cells'. This would allow for cycling of ash discharge between cells. The advantages to creating cells include:

- Cells would have opportunity to dry out and consolidate when discharge is cycled to alternate cells, achieving a higher final in-situ density and maximising the overall capacity available
- The divider walls would provide vehicular and/or plant access towards the centre of the storage to deploy dust suppression if required
- Individual cells can be flooded with water if dusting becomes an issue within a particular area
- Ash discharge could be completed from along the cell divider walls in the future to obtain a flatter final landform surface, if required
- Cell divider walls can provide access for capping operations during rehabilitation.

The opportunity to deliver the BWAD augmentation in stages was also considered. The staged augmentation of the BWAD would mean that construction could be limited, based on only what is required in the future (i.e. stage three may never be required should the ash generation end up being in the optimistic estimate range). For the purposes of the EIS, full augmentation has been assessed.

The proposed upgrades associated with Ash harvesting would enable the beneficial reuse of up to 1,000,000 tonnes per annum of ash during periods of peak demand. This in turn would provide opportunities to minimise the volume of ash requiring deposit in the augmented BWAD.

4.3.2 Salt cake landfill facility

A variety of alternative options were considered for the disposal of salt (brine) from the approved caking plant. These options included:

- Do Nothing – continue to store salt in the brine concentrator decant basin and Lake Liddell using the HRSTS to discharge. This is not a preferred option as the brine concentrator decant basin is almost at capacity and there is a risk that Lake Liddell would significantly increase in salinity if this option were to be implemented
- Ocean Disposal – transfer the salt cake to ocean either in liquid or solid form. Investigations to date have been unable to identify any existing ocean disposal process which could lawfully take the salt cake
- Offsite Landfill Disposal - transfer the salt cake to offsite landfill. This is not considered a viable option as it is unlikely offsite disposal locations would commit to taking the salt cake for the remaining life of Bayswater
- On Site Disposal (the preferred approach) - transfer the salt cake to onsite landfill, in solid form. This would cause the least environmental impact with waste being wholly contained and managed on site in an environmentally responsible manner.

Existing infrastructure, its proximity to the proposed Salt caking plant, and the extent of disturbance and known environmental constraints (such as contamination and presence of vegetation) were all considered when selecting the location of the Salt cake landfill. The proposed location is accessible by existing internal access roads and is located within an area that is already extensively disturbed, with favourable topography. As such the use of this site was considered the best opportunity to minimise environmental impacts, while also reducing the extent of ancillary works (ie regrading of the site).

4.4 Surrounding Land Use Compatibility

Existing development neighbouring Bayswater includes Liddell, the former Drayton Coal Mine, Liddell and Hunter Operations coal mines as well as the Main Northern Railway Line. The New England Highway runs parallel to Bayswater, with access from the highway provided by means of a dedicated road network designed to service the power stations. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGL landholding.

The village of Camberwell is located over seven km south east of the Ravensworth ash line. The village of Jerrys Plains is located approximately two km south of the nearest HP Pipe clearing and over five km from the southern extent of the Borrow Pits.

The closest residential area is the Antiene subdivision, which is located behind a ridge line approximately five kilometres north of the Project. The nearest residential receiver is located approximately 1.8 km south southwest of the southern HP pipe clearing works. The surrounding land-use context is illustrated in Figure 4-1.

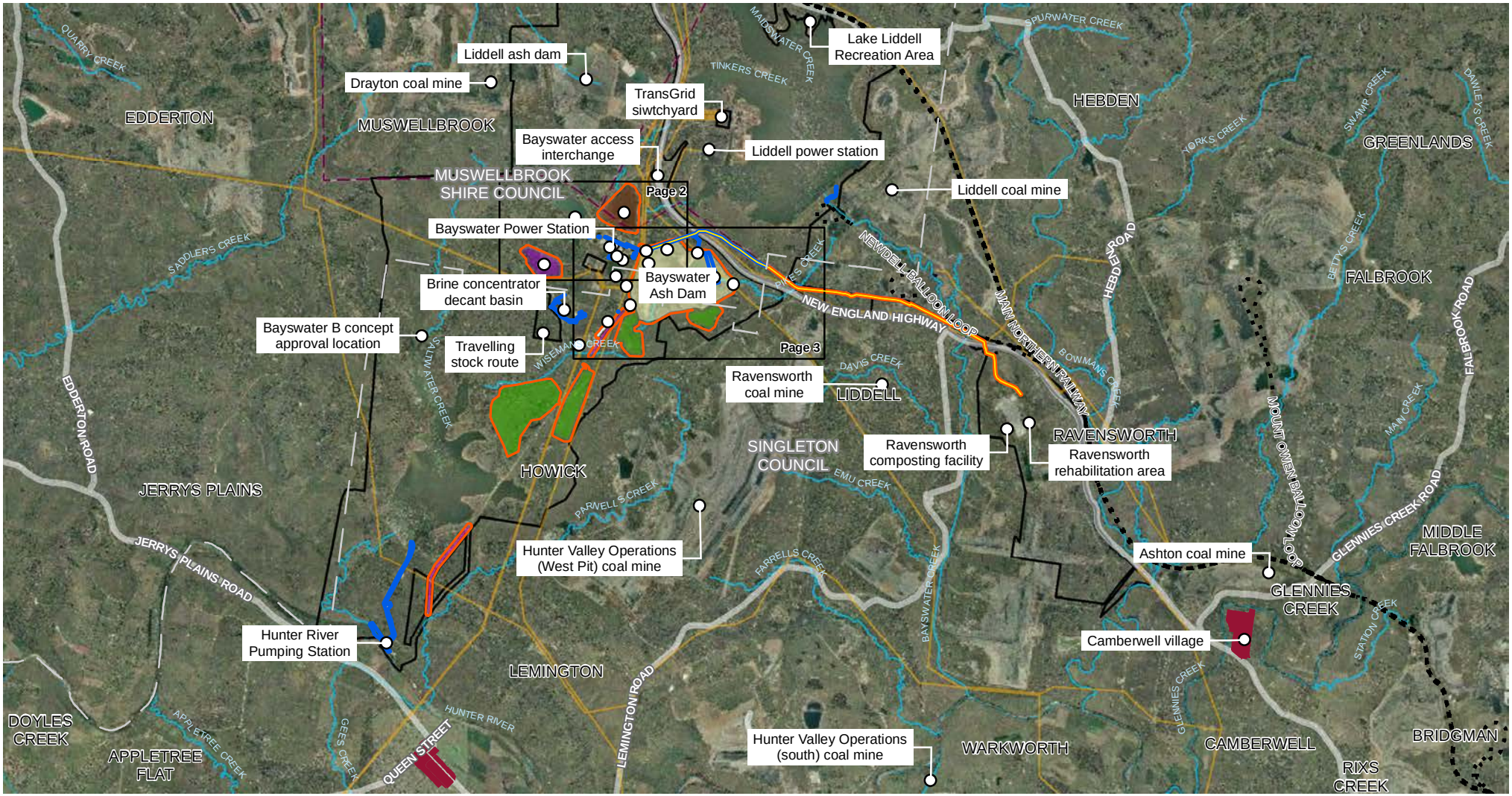
A summary of the nearby sensitive receiver locations which have been considered as part of this EIS is provided in Section 10.2.1.

The Project is located within the Hunter River catchment and predominately drains to Lake Liddell, an artificial operational water body constructed for the purposes of supplying cooling water to both Bayswater and Liddell.

The Project is not considered to conflict with any existing or proposed surrounding land uses. The Project is largely within the AGL owned lands established as a buffer to allow Bayswater to operate without significant impacts on surrounding land uses. This buffer is intended to be maintained under the control of AGL until Bayswater is retired and the site rehabilitated. While AGL may contemplate additional developments within this landholding, they will be assessed independently on their merits and be compatible with the ongoing operational status of Bayswater.

Land not owned by AGL is limited to small portions of the Ravensworth Ash Pipeline route. The design of the pipeline in these areas would be agreed with the relevant landowner so as not to conflict with any intended uses.

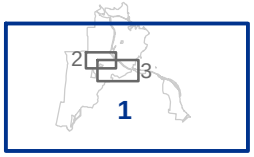
No conflicts are anticipated between the Project and any existing or proposed future land-uses.



- Study area
- Local Government Area boundary
- Footprints of approvals to be surrendered
- AGL owned land
- Residential
- Infrastructure location
- Railway
- Electricity transmission line
- Coal supply conveyor

Project elements:

- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Ravensworth Ash Line
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Salt Cake Landfill

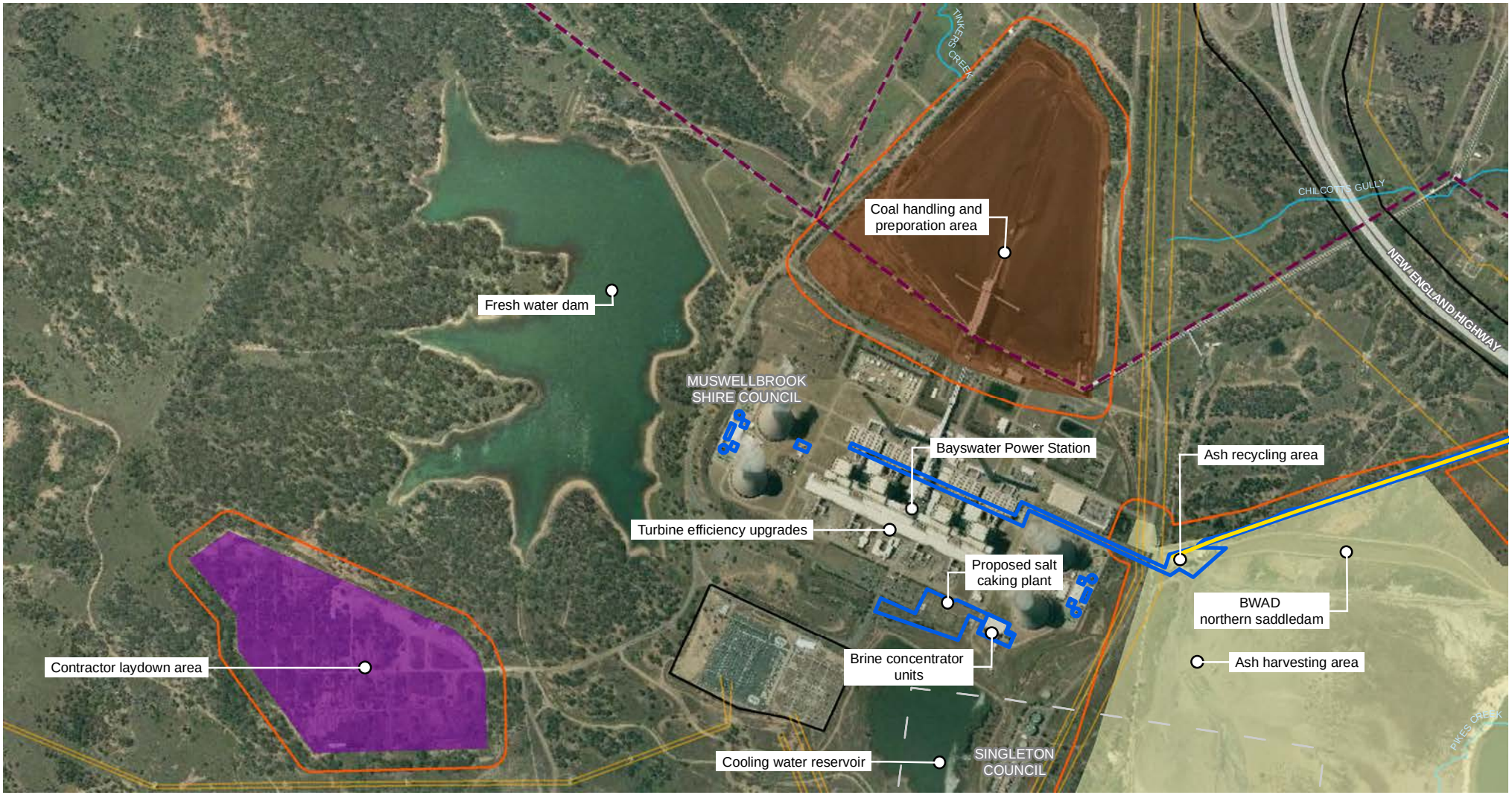


Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 4-1a Surrounding land use context and infrastructure



Study area
Local Government Area
Footprints of approvals to be surrendered
AGL owned land
Infrastructure locations
Electricity transmission line
Coal supply conveyor

Project elements:

Ash Dam Augmentation, Ash Harvesting and Water Management Works
Coal Handling Plant Water and Wastewater Infrastructure Upgrades
Ravensworth Ash
Salt Cake Landfill

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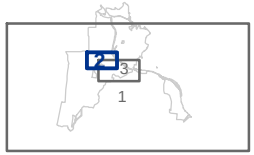

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 4-1b Infrastructure

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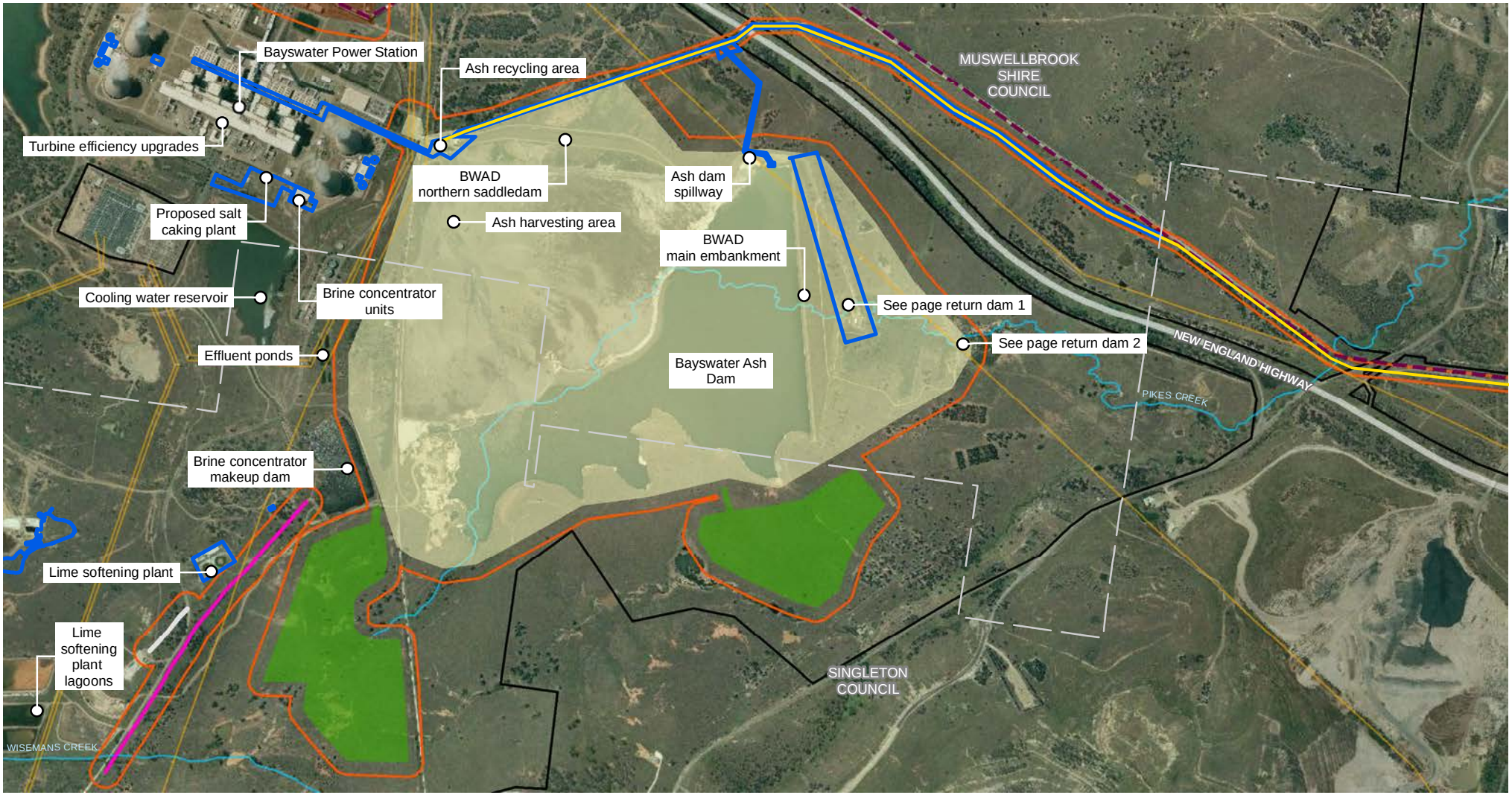

Study area
Local Government Area boundary
Footprints of approvals to be surrendered
AGL owned land
Infrastructure locations
Electricity transmission line
Coal supply conveyor

Project elements:

Ash Dam Augmentation, Ash Harvesting and Water Management Works
Coal Handling Plant Water and Wastewater Infrastructure Upgrades
Ravensworth Ash Line
HP Pipe Clearing
LSP Sludge Line Clearing
Clay Borrow Pits

0 250 500 m

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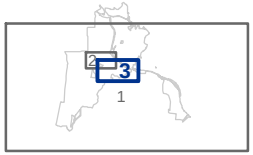


Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 4-1c Infrastructure

4.5 Strategic Policy Context

4.5.1 National Energy Market

Based on the above purpose, the strategic context for the Project is wholly related to the context of Bayswater within the NEM.

Bayswater is currently an important contributor of reliable, dispatchable power into the NEM. This importance has been highlighted in the recent approval of the Bayswater Turbine Efficiency Upgrade Project which was assessed as critical State significant infrastructure and recognised:

- Bayswater as being the second largest coal-fired power station 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.

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 2017 *Electricity Statement of Opportunities*. 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 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 Council of Australian Governments 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 support 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. Chief amongst these challenges is the need for ongoing investment to ensure reliable and affordable power during the transition to new generation. AGL will continue to engage on these challenges, working with the ESB and other stakeholders to ensure the future NEM meets the needs of customers, and the broader community.

The design of the various Project components has been progressed such that they can be constructed on an as needs basis up to the maximum impacts assessed in the EIS.

4.5.2 Paris Climate Conference COP21

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 5 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 2 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 Contribution s are not consistent with limiting warming to below 2 degrees above pre-industrial levels.

AGL's approach to climate change is grounded in their Greenhouse Gas Policy. Within this policy AGL has committed to the transparent disclosure of climate change risks to their business. AGL's Greenhouse Gas Policy underpins the range of activities AGL is undertaking to operate within a carbon constrained future and outlines their target to not extend the operating life of existing coal-fired power stations.

As Australia's largest greenhouse gas 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 greenhouse gas reduction activities will be structured, presenting a pathway for the gradual decarbonisation of AGL's generation portfolio by mid-century. The commitments of AGL within this policy are not inconsistent with the goal of the Paris Agreement to limit warming to below 2 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 operated 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. This will be released with FY20 full year results. 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 Integrated System Plan scenarios.

AGL will continue to disclose under the Task Force on Climate-related Financial Disclosures framework.

4.5.3 NSW Policy

The *NSW Climate Change Policy Framework* (Office of Environment and Heritage, 2016a)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 recently released *Department of Planning, Industry and Environment Net Zero Plan Stage 1: 2020-2030* (State of NSW, 2020) sets out how the NSW Government will deliver on the objectives to achieve net zero emissions by 2050 over the next decade.

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 ongoing operation of Bayswater 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.

4.5.4 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 and Muswellbrook LGA specifically 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.

4.5.5 Muswellbrook Shire Council

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 would support both direct and indirect job opportunities by the creation of jobs for approximately 90 additional workers during construction. Once operational, the Project would impact positively on employment through the creation of direct employment opportunities associated with the additional ash recycling. It is expected that operation of the Project would generate an additional 25 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.

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 close both of the major coal fired power generators –Liddell and Bayswater in 2022 and 2035 respectively. The Review culminates in recommendations of strategic directions and actions of which the following are of relevance to AGL lands.

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 pump hydro sources.	Council adopt a policy to proactively pursue energy production as a continuing industry of significance within the LGA.	The Project facilitates the improved environmental performance and rehabilitation outcomes for the continued operation of Bayswater and does not compromise future opportunities to re-purpose AGL lands for alternative purposes.
	Engage with all relevant stakeholders to explore the opportunities for alternative energy production and adaptive reuse of the existing generation and distribution infrastructure.	As a key player in the energy industry, AGL recognise their responsibility to be a part of the transition of Australia's energy system and to responsibly and respectfully work with our stakeholders to ensure the best possible outcomes. 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 and ultimately shift AGL's existing economic footprint, workforce, and community reliance on our operations through: • Repurposing existing assets and infrastructure • Activating and intensifying productive and complementing land uses • Innovating and diversifying agribusinesses and • 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	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 where it satisfies the NSW Government's Biodiversity Offset Policy.

Strategic Direction	Actions	Project relevance
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.	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 involves vegetation clearing. These impacts would be offset in accordance with the BC Act and EPBC Act in accordance with any approval conditions.
	Optimise the value of Hunter River water quality and public uses and accessibility to the foreshores.	The water management upgrades as part of the Project are anticipated to improve water quality as follows: • The Salt cake landfill facilitates an overall reduction of salt within the Hunter River system through reduced reliance on the HRSTS • The upgrades to the BWAD seepage collection system will reduce seepage loss to downstream environments and • The upgrades to the CHP water and wastewater infrastructure is expected to result in better water quality of Tinkers Creek and Lake Liddell during operation.

4.5.6 Singleton Council

The *Singleton Community Strategic Plan – Our Place: A Blueprint 2023* (Singleton Council, 2013) outlines the community's visions and aspirations for the Singleton LGA. The Strategic Plan outlines a number of outcomes relating to the four pillars of community, places, environment and community leadership.

The community identified improved air quality as being important during the development of the Strategic Plan and the community being conscious of its environmental footprint is an outcome for the environment pillar. The need to 'collaborate to protect, enhance and improve our environment' is outlined as a strategy to achieve this outcome. As the Project purpose is to facilitate improved environmental outcomes from Bayswater it is considered consistent with this strategy.

AGL has an agreement with Singleton Council covering drinking water supply to Jerrys Plains. The Project will improve AGL's ability to undertake maintenance on infrastructure associated with the supply of water and have no impact on this agreement or water supply.

4.5.7 AGL Policy

AGL has a range of Environment and sustainability policies available in full at https://www.agl.com.au/about-agl/sustainability. Of particular relevance to the Project and ongoing operation of Bayswater are the Greenhouse Gas Policy and Rehabilitation Policy.

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). This policy provides a public commitment that includes:

- Decarbonisation of generation by 2050
- Improve the Green House Gas efficiency of its operations and no investment in new coal fired generation in Australia without carbon capture and storage technology
- Establishment of end of life closure dates for their three operating coal plants including closure of the first unit at Liddell in April 2022 with the remaining three units scheduled for closure in April 2023 and Bayswater in 2035
- Renewable investment and
- Constructive engagement on energy and climate policy.

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, 2017). 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.

The Project is in keeping with AGLs current policies.

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.

AGL maintains a stakeholder consultation 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 and
- Provide regular updates to interested communities on the progress of projects.

5.1 NSW legislative requirements for consultation

SEARs for the Project were issued to AGL on 30 November 2018.

The SEARs require that the AGL consult with relevant local, State or Commonwealth Government authorities, exploration licence and mining lease title holders, service providers, community groups and affected landowners and describe the consultation that was carried out, identify the issues raised, and identify where the design of the infrastructure has been amended in response to these issues or a short explanation where amendments have not been made.

The summary of consultation undertaken, issues raise and where or how addressed is provided in Table 5.1.

5.2 Community consultation

Bayswater has been established within the local community since it was built in the 1980's and has developed strong community relationships during this time. AGL maintains a community reference group known as the AGL Macquarie Community Dialogue Group 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 discussed at a Community Dialogue Group meeting on 19 November 2019 and no stakeholder issues were raised. In December 2019 a meeting was held with Hunter Business Chamber to provide them with a Project update. They were supportive of the Project. In January 2020 letters were sent to the adjoining residents to provide an update on the proposed Project. No correspondence has been received.

5.3 Exploration licence and mining lease title holder consultation

AGL wrote to the following relevant title holders regarding the Project interaction with mining titles in January 2020:

- Glendell Tenements Pty Limited for EL 6594
- Bloomfield Collieries Pty Ltd for EL 6705
- Cumnock No.1 Colliery Pty Ltd for AUTH0385 and ML 1669
- Dellworth Pty Ltd for EL 6812
- Resource Pacific Pty Ltd for ML 1477, ML 1591, ML 1595, ML 1398
- Glencore Newpac Pty Ltd for ML 1349
- Coal & Allied Operations Pty Ltd for ML 1359.

Acknowledgment has been received from all title holders with the exception of Glencore Newpac Pty Ltd. No issues have been raised.

5.4 Government authority consultation

AGL 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:

- Department of Planning & Environment – Division of Resources & Geoscience, now known as Department of Planning, Industry and Environment (**DRG**)
- Environment Protection Authority (**EPA**)
- Office of Environment and Heritage, now known as the Biodiversity Conservation Division (**BCD**)
- The Department of Primary Industries - NSW Department of Industry Crown Lands and Water Division), now known as Department of Planning, Industry and Environment (Crown Lands in NSW);
- NSW Rural Fire Service (**RFS**)
- Department of Transport - Roads and Maritime Services (**Roads and Maritime**), now known as Transport for NSW (**TfNSW)**;
- Singleton Council
- Muswellbrook Shire Council
- Dams Safety NSW.

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.

Table 5-1 Summary of Government authority consultation

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
Department of Planning, Industry, and Environment	31 July 2018	A meeting was held with the DPIE Staff to outline the Project including timing and proposed consolidation of consents	This meeting was held to announce the Project.	Not applicable.
	4 November 2019	A meeting was held with DPIE to discuss approval pathways and EPBC Referral timings.	DPIE confirmed support of the Project and requested AGL to carry out consultation with the affected landowners.	AGL are seeking the required permissions from the relevant landowners.
Singleton Council (SC)	10 July 2018	A meeting was held with the SC Manager Development and Environmental Services to outline the Project.	This meeting was held to announce the Project.	Not applicable.
	2018	SC provided input into the environmental assessment requirements.	SC requested the EIS include consideration of water supply (current and future) specifically to Jerry Plains. The assessment should take into consideration the existing agreement between AGL and Singleton Council for water supply to Jerrys Plains.	Project approves clearing of Bayswater water supply assets providing the ability to undertake maintenance and repairs to water infrastructure in a timely manner. This in turn reduces risks of supply interruptions in the event a water supply pipeline failure.
			SC noted that the consultation with Water NSW should be undertaken	Correspondence between AGL & WaterNSW regarding the Project has been undertaken as described below.
	7 April 2020	AGL provided an email to SC regarding interaction with Pikes Gully Road.	SC replied 22 April and confirmed that AGL would need to submit a Section 138 application for approval prior to commencing construction works within the Pikes Gully Road corridor.	AGL to seek a Section 138 approval from SC prior to commencing works within Pikes Gully Road.
	9 April 2020	AGL provided SC with an email update on the Project and a response to the items raised by SC in relation to the SEARs.	No additional issues raised.	
Environment Protection Authority (EPA)	2018	EPA have provided input into the environmental assessment requirements.	EPA have requested consideration of the cause of any seepage or infiltration issues resulting from existing ash disposal activities within the	AGL submitted an assessment report on the seepage associated with the Ravensworth Voids at the end of 2018. Any

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
			Ravensworth Voids and proposed or initiated mitigation actions to address these issues and how these will be applied to any new ash disposal.	required mitigation measures will be subject to a separate development application as no new ash disposal at Ravensworth is proposed as part of the Project.
	2019	AGL have been in regular contact with the EPA during 2019 regarding reuse of coal ash.	EPA requested information on procedures/practices put in place to ensure that any recovered ash for reuse offsite meets the requirements of the Coal Ash Order and Exemption and an assessment of available markets for recovered ash and cenospheres.	An outline of the ash recycling process is provided in Chapter 18. AGL has an established sampling plan for the testing of fly ash and are in the process seeking approval for the sampling plan for bottom ash with the EPA. The recycled ash product is expected to be supplied to large infrastructure projects such as road upgrades on an 'as required' basis. Expansion of ash recycling at Bayswater is market driven.
Office of Environment and Heritage (OEH) – Now being 'Biodiversity and Conservation Division' (BCD)	2018	BCD have provided input into the environmental assessment requirements.	BCD provided standard SEARs inputs for Biodiversity and Cultural Heritage. They noted that any Aboriginal cultural heritage assessment undertaken prior to 2010 is unlikely to meet current OEH Aboriginal cultural heritage guidelines for the assessment of Aboriginal cultural heritage in NSW. The OEH 2011 Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW should be referenced in this instance.	An ACHAR for the Project has been prepared in accordance with the necessary guidelines (provided in Chapter 12 and Appendix H)
	2019	BCD was consulted to confirm survey requirements for threatened orchids and engagement of and orchid expert.	BCD provided written confirmation on how to adequately assess for orchids that had not been flowering due to the drought and confirmed the process of preparing an expert report.	Refer to Appendix C.
DPIE -Water	2018	The former Department of Industry – Water provided input into the environmental assessment requirements.	DPI have requested: • Identification of an adequate and secure water supply for the life of the project	A site water balance was undertaken for the Project. This is provided in Appendix E. The Project is predominately located on land owned by AGL, although some Project

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
			• A detailed site water balance • Assessment of impacts to surface and groundwater sources, and consideration of relevant legislation • Consideration of impacts to Crown land, native title rights and consent requirements.	infrastructure also crosses road reserves owned by TfNSW, Singleton Council, and a small area of Crown land. Notification requirements under section 24KA of the Native Title Act 1993 apply where construction work is required on Crown land. Notification in accordance with this section will occur concurrent with the public display of the EIS.
NSW Fire and Rescue	2018	Fire and Rescue have provided input into the environmental assessment requirements.	RFS had no specific recommendations in relation to bush fire protection and noted that at the time of review, there was no requirement for a fire safety study. It was noted that power stations often pose unique challenges to firefighting when responding to an incident, and consultation with organisations such as NSW RFS through the design development process enables the design and implementation of effective fire safety solutions.	Consideration of hazards associated with work within bushfire prone land, is provided in Chapter 19.
Division of Industry (Crown Land)	1 October 2019 & 11 February 2020	A phone conversation followed by an email was carried to provide a Project briefing as well as to discuss land ownership at Bayswater Creek.	Crown Land Division confirmed the status of the land indicted that a long-term license would be required for the Ravensworth Ash Line component of the Project.	AGL to seek a Crown Lands License.
Commonwealth Department of Agriculture, Water and Environment (DAWE)	2019	A meeting was held with DAWE officers to outline the Project and discuss its likelihood to trigger the EPBC Act (12 June 2019). Email correspondence on 26 November 2019 sought advice regarding approach to assess the Orchid	DAWE advised that the Project would be considered to be a Controlled Activity. DAWE confirmed AGLs approach to engage an Orchid expert was acceptable.	Orchid expert engaged and orchid report included in Appendix C.
	2020	Meeting held with DAWE to discuss referral assessment	DAWE confirmed referral assessment timing.	Project referred. Addendum SEARs have been addressed in Section 3.5.

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
		timing and issuing of addendum SEARs.		
Department of Planning, Industry and Environment – Division of Resources & Geoscience (DRG)	5 September 2018	Letter sent by AGL to DRG introducing the Project and offering to meet DRG to discuss.	No issues raised. DRG suggested consultation be carried out during the assessment phase of the project.	
	2018	DRG have provided input into the environmental assessment requirements.	Recommended consideration of current mining and exploration titles and applications and consultation with exploration licence holders and mining lease title holders be undertaken. Required that the proponent should undertake a dated and referenced search of current mining and exploration titles and applications. Evidence of the search should be provided in the form of a date referenced map.	Letters were posted to affected Title Holders advising them of the Project in January 2020. Dated referenced search result maps are provided in Appendix L.
	9 April 2020	Email to DRG regarding letters to mining title holders and in relation to Biodiversity Offset Requirements.	Email from DRG received 6 May 2020 acknowledging AGL's email. No issues raised. DRG indicated they would consult further regarding the proposed Biodiversity Offsets when available.	AGL to consult further with DRG regarding the Biodiversity Offsets strategy.
Department of Transport - Roads and Maritime Services – Now Transport for NSW (TfNSW).	2018	TfNSW have provided input into the environmental assessment requirements.	TfNSW described their primary interests as the road network, traffic and broader transport issues. In particular, TfNSW raised the efficiency and safety of the classified road network, the security of property assets and the integration of land use and transport.	A Traffic Impact Assessment addressing the SEARs and TfNSW comments is provided in Chapter 13 and Appendix J.
	19 February 2020	Meeting held between TfNSW and AGL to discuss amending the existing Deed.	TfNSW agreed that the Deed should be amended to include the "new" assets. TfNSW request a copy of the Traffic Impact Assessment for the Project.	Traffic impact assessment provided to TfNSW.
Muswellbrook Shire Council (MSC)	7 August 2018	A meeting was held with Councils Executive Manager Planning and Environment to outline the Project.	This meeting was held to announce the Project.	

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
	2018	MSC have provided input into the environmental assessment requirements.	MSC requested the EIS include a Traffic Impact Assessment and Air Quality Assessment, particularly noting concerns about PM2.5, and PM10 particulate generation. It was noted that Council is likely to seek conditions which bind the Project traffic and air quality to its predictions. Council also requested that the EIS include consideration of workforce requirements, impacts to social infrastructure and service, biodiversity, biosecurity and salinity.	The Project Traffic Impact Assessment is provided in Appendix J. The Project Air Quality Assessment is provided in Appendix F. Socio-economic impacts are discussed in Section 15. Biodiversity impact assessment is summarized in Section 7 with a BDAR in accordance with the BC Act provided in Appendix C. Salinity is discussed in Section 11.
	10 March 2020	Meeting held between MSC and AGL	Items raised by MSC in their response to SEARs letter dated 30 November 2018. MSC requested a letter detailing how AGL have addressed MSC's concerns around the Project.	AGL presented an update on the Project and detailed how the issues raised in their response to SEARs have been considered and addressed.
	14 April 2020	Letter to MSC	Concerns raised in MSC's response to SEARs letter dated 30 November 2018.	Letter provided to MSC.
Subsidence Advisory NSW (SANSW)	6 April 2020	AGL provided a letter to SANSW outlining the WOAOW Project and the components that interact with the mine subsidence district.	SANSW replied on 23 April 2020 and confirmed that AGL requires approval from them for those aspects of the Project within a mine subsidence district. SANSW also recommended that AGL conduct a desktop geotechnical study on the recorded mine workings to determine the risk of subsidence to the development and incorporate the risk and consequences incorporated into the structural design.	AGL to seek approval from SA NSW for the components of the Project that fall within the mine subsidence district where required. AGL to incorporate the geotechnical considerations related to the mine subsidence areas into the design of the new Ravensworth Ash Pipeline. The risks and consequences are to be incorporated into the structural design where deemed appropriate.
Water NSW	9 April 2020	AGL provided an email to Water NSW introducing the Project and offering to discuss in greater detail.	Water NSW replied raising concern around Pikes Gully Road access as they have a water monitoring station in Bayswater Creek. Water NSW requested that Pikes Gully road not be impacted by the development.	AGL responded to Water NSW on 16 April 2020 and confirmed that the construction method for the Ravensworth new Ash Pipeline at Pikes Gully would be

Stakeholder	Date	Details	Purpose / Issues raised by the stakeholder	How Addressed
				underboring and should not require road closure.
NSW Rural Fire Service	14 April 2020	AGL provided an email to NSW RFS introducing the Project and offering to discuss in greater detail.	NSW RFS responded on 4 May 2020 and recommended that the EIS include: • Identification of mapped bush fire prone land (BFPL) • Identification of existing and proposed structures associated with the proposal • Existing bush fire conditions of consent • Where structures are located on mapped BFPL, identify the Bush Fire Risk and proposed risk mitigation measures (hazard management, construction, access, water and emergency management) • Draft consolidated Bush Fire conditions of consent (incorporating current and proposed bush fire prevention measures).	Consideration of hazards associated with work within bushfire prone land, is provided in Chapter 19. The site Bushfire Management Plan would be updated to incorporate new structures in BFPL.
Dams Safety NSW	14 April 2020	AGL provided an email to Dam Safety NSW introducing the Project and offering to discuss in greater detail.	Dam Safety NSW responded on 15 April 2020 and requested a meeting with AGL. Meeting held on 22 April 2020. AGL gave a brief presentation on the proposal, in particular the Bayswater Ash Dam Augmentation. Dam Safety NSW confirmed the new requirements and that formal approval from Dam Safety NSW is no longer required. Dam Safety NSW requested a formal letter from AGL with regards to the Bayswater Ash Dam Augmentation and how the requirements would be met for their records.	AGL to send a letter to Dam Safety NSW when the design of the Bayswater Ash Dam Augmentation has been completed.

5.5 Indigenous stakeholder engagement

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

Aboriginal community consultation was undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010), which establishes the requirements for consultation with Aboriginal stakeholders as part of the heritage assessment process to determine potential impacts of proposed activities on Aboriginal objects and places. These requirements include four stages with associated timeframes which must be adhered to. Consultation in accordance with these requirements is summarised below:

5.5.1 Stage 1 - Notification of the proposed project and registration of interest

Stage 1 of the consultation process is to identify, notify and register any Aboriginal people or groups who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and / or places in the study area.

Notification was initiated on 10 May 2019 to all relevant organisations listed under section 4.1.2 in DECCW (2010). The following organisations were contacted on 10th May 2019 to identify stakeholder groups or people with a potential interest in the Project:

- Wanaruah Local Aboriginal Land Council
- NTS Corp
- Office of Environment and Heritage – Hunter office
- Office of the Registrar, Aboriginal Land Rights Act 1983
- Muswellbrook Shire Council
- Singleton Council
- Singleton Local Land Services.

In addition, a notice was placed in the Koori Mail and Singleton Argus local newspapers, with information explaining the Project and its exact location. These advertisements provided additional opportunity for Aboriginal people who are interested in the Project to register. A copy of the advertisement is included in Appendix H.

Project notifications were sent to all groups and individuals identified as a result of the above consultation process. A total of 26 groups and individuals registered their interest. A list of Registered Aboriginal Parties (**RAPs**) for the Project and copies of the notifications were submitted to DPIE and Wonnarua Local Aboriginal Land Council on 11 July 2019.

Full details of the notification of the Project and registration of interest process is provided in Appendix H.

5.5.2 Stage 2 – Presentation of information about the proposed project

Stage 2 of the consultation process provides RAPs with information about the scope of the Project and the proposed cultural heritage assessment process.

The RAPs were provided with a letter outlining the Project and a copy of the document *AGL Bayswater Project Information and Methodology* (please refer to Appendix H). Comments on this document were invited from RAPs and they were invited to contact Jacobs at any time throughout the assessment process to discuss the Project.

Site Officers were selected for the archaeological survey and were issued a checklist to ensure safety and preparedness for work.

5.5.3 Stage 3 – Gathering information about cultural significance

Stage 3 of the consultation process is to facilitate a process whereby RAPs can contribute to culturally appropriate information gathering and the research methodology, provide information that will enable the cultural significance of Aboriginal objects and/or places on the study area to be determined, and have input into the development of any cultural heritage management options.

RAPs were invited to submit information relevant to the cultural significance of the study area and any areas and objects within it, at all stages of the consultation process.

5.5.4 Stage 4 – Review of draft ACHAR

Stage 4 of the consultation process involves the RAPs review and feedback on the draft ACHAR. The ACHAR was drafted to document the assessment process.

The draft ACHAR was sent to all RAPs for comments and feedback on 24th October 2019 (by email) and 25th October 2019 (by post) and a 28 day review period was provided. Copies of written submissions received from RAPs is included in Appendix A of the ACHAR (see Appendix H).

One written submission was received by Jacobs in support of the findings and recommendations of the draft ACHAR. The RAP indicated a wish to be included in any future fieldwork and meetings associated with the Project. The submission did not recommend any changes be made to the ACHAR.

Further details of consultation including meeting minutes, examples of letters sent to RAPs and knowledge holders, conversations undertaken during archaeological survey, native title search results, records of cultural heritage values interviews and a detailed consultation log are included in Appendix H.

This section summarises the consultation process throughout the archaeological assessment (Table 5-2) and outlines the stages of consultation.

Table 5-2 Summary of consultation process

Task Name	Start	Finish
Stage 1- Agency Letters	May 10, 2019	May 10, 2019
Stage 1- Newspaper advertisements	May 15, 2019	May 29, 2019
Stage 1- Project Notification and invitation to register supplied to potential Aboriginal stakeholders	June 20, 2019	July 5, 2019
Stage 1- Supply of the list of RAPs to DPIE and Wanaruah LALC	July 11, 2019	July 11, 2019
Stage 2- RAP review of project information and methodology	Aug 7, 2019	Sep 4, 2019
Stage 2- Engage Aboriginal stakeholders to undertake a site survey	Aug 7, 2019	Sep 4, 2019
Stage 3- Seek the names of Aboriginal people with cultural knowledge by letter or notify native title holders	May 10, 2019	July 5, 2019
Stage 3- Notify Aboriginal people with cultural knowledge by letter, and invite input on cultural significance	June 20, 2019	Nov 25, 2019
Stage 4- Carry out archaeological survey and prepare a draft ACHAR	Sep 9, 2019	Oct 2, 2019
Stage 4- Present the draft ACHAR to RAPs for review and comment	Oct 23, 2019	Nov 25, 2019

6. Environmental impacts

This chapter provides a summary of how the likely environmental impacts were identified as part of Project scoping.

A Preliminary Environmental Assessment was undertaken to support the application for the SEARs (GHD, 2018). Table 6-1 provides a summary of the risks identified associated with the Project.

Table 6-1 Summary of Preliminary Environmental Risk Assessment

Category	Issues
High	Water (surface water and groundwater), ecology, Aboriginal cultural heritage
Medium	Soils and contamination, Non-Aboriginal heritage, traffic and access
Low	Socio-economic, noise and vibration, air quality, greenhouse gas, visual amenity, land use and safety.

In accordance with the SEARs, the following specialist assessments have been undertaken:

- Biodiversity Development Assessment Report (Kleinfelder, 2020a), presented in Appendix C and summarised in Chapter 7
- Surface water, groundwater and Flooding Technical Report (Jacobs, 2020a), presented in Appendix D and summarised in Chapters 8 and 9
- Borrow Pit Drilling and Groundwater Monitoring Well Installation Report (Jacobs, 2019a) summarised in Chapter 9
- Water Balance Modelling Report (Jacobs, 2019b) presented in Appendix E and summarised in Chapters 8 and 9
- Air Quality Impact Assessment (Jacobs, 2019c), presented in Appendix F and summarised in Chapter 10
- Land Capability Assessment (Kleinfelder, 2020b), presented in Appendix G and summarised in Chapter 11
- Aboriginal Cultural Heritage Assessment Report (Jacobs, 2019d), presented in Appendix H and summarised in Chapter 12
- Traffic and Transport Assessment (Jacobs, 2019e) presented in Appendix J and summarised in Chapter 13
- Visual Impact Assessment (Jacobs, 2019f) presented in Appendix K and summarised in Chapter 16
- Heritage Assessment (Jacobs, 2019g) presented in Appendix I and summarised in Chapter 17.

Hazards (Chapter 19), Noise and Vibration (Chapter 14), Socio-economic (Chapter 15) and Waste (Chapter 18) impacts are considered in less detail and are presented in single chapters.

7. Biodiversity

This chapter summarises the findings of the BDAR prepared by Kleinfelder Australia Pty Ltd (see Appendix C). The BDAR provides the following in response to the SEARs requirements:

- *an assessment of the likely biodiversity impacts of the development, in accordance with the Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values;*
- *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*
- *an assessment of the likely impacts on any listed aquatic threatened species, populations or ecological communities, scheduled under the Fisheries Management Act 1994, and a description of the measures to minimise and rehabilitate impacts.*

7.1 Assessment methodology

The BDAR has been undertaken in accordance with the BAM (Office of Environment and Heritage, 2017) to support this EIS.

The following areas were adopted as part of the BDAR to describe particular geographical areas:

- Development Site: the area to be directly impacted by the Project, and corresponds to the Project area shown in Figure 2-1**;**
- Study area: the Development Site plus a 25-50 metres buffer; and
- Locality: land within a 10 kilometre radius of the study area.

A number of assessment guidelines were used to inform the BDAR, namely:

- *Biodiversity Assessment Method* (Office of Environment and Heritage, 2017)
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of the Environment, 2013)
- Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft) (DEC, 2004)

A list of the assessment guidelines that were used to inform the biodiversity assessment is provided in Appendix C.

7.2 Existing environment

The total Development Site is 561 ha, and includes all land required for construction and operation. The existing BWAD footprint and other existing pieces of infrastructure are within this area but have been excluded from the study as they are existing approved pieces of infrastructure.

7.2.1 Landscape context

The study area occurs within the northern portion of the Sydney Basin Interim Biogeographic Regionalisation for Australia (**IBRA**) Region and the northern portion of the Hunter IBRA sub-region (Department of the Environment and Energy, 2012).

This landscape is described as undulating lowlands, rounded to steep hills with rock outcrop on ridges on Permian lithic sandstone, conglomerate, shale and coal, general elevation 40 to 300 metres with a few higher peaks, local relief 30 to 120 metres. Red-brown to yellow brown harsh texture-contrast soils on slopes, dark coloured clays in valleys and limited accumulations of sand and gravel in streams.

Land surrounding the Project area contains a mixture of infrastructure, cleared lands, plantation crops and intact vegetation. Existing infrastructure and open cleared areas dominate the Project area however, some areas of

intact vegetation occur across the site, particularly in the western portions where it connects to patchy vegetation in the broader landscape. Much of the vegetation within the Project area and surrounds is fragmented by roads, infrastructure (e.g. pipelines), and areas cleared for agriculture

There are no important wetlands within or adjacent to Bayswater. The closest SEPP (Coastal Management) Coastal Wetland (Hunter River - Estuarine) is located over 65 km to the south-east of the Project.

There are no areas of geological significance within the Project area. There are no significant soil hazard features within the study area; with no steep slopes or significant drainage features. As discussed in Section 11.2.2, no Acid Sulfate Soils (**ASS**) are anticipated within the Project area.

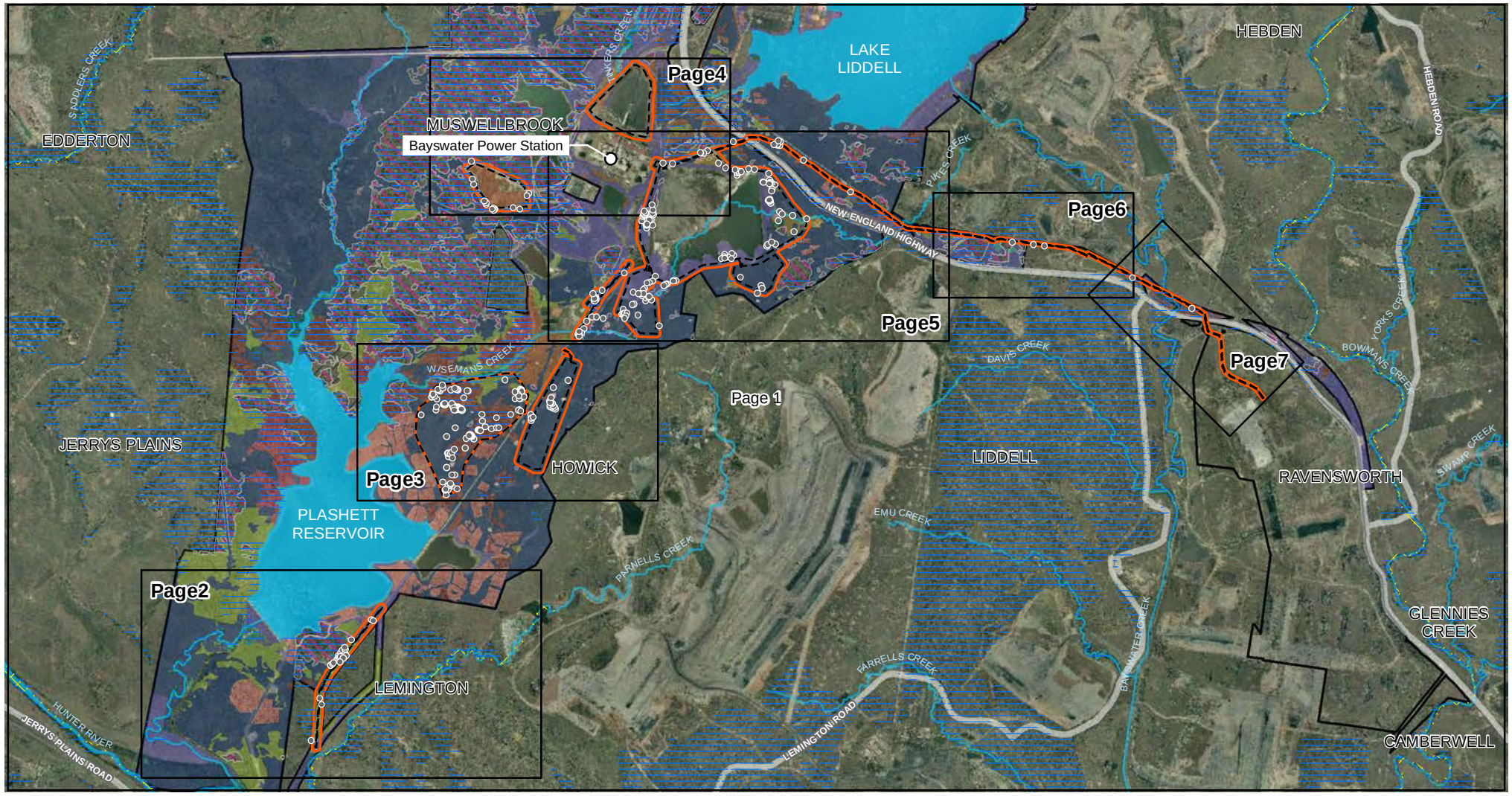
There are no areas of outstanding biodiversity value mapped within the Project area.

7.2.2 Vegetation communities

Three plant community types (**PCTs**), as defined in the BioNet Vegetation Classification database, were identified within the Project area:

- 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; and
- PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.

Additionally, the site contains areas of Non-Native vegetation; exotic grasslands, dams, and cleared land (existing tracks, roads and infrastructure). The PCTs within the Study Area are shown in the Figure 7-1 map series.



Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial
Habitat feature

Vegetation communities within AGL Macquarie lands (Kleinfelder)

- Acacia Regrowth
- Central Hunter Box - Ironbark Woodland
- Central Hunter Box - Ironbark Woodland Regeneration
- Central Hunter Bulloak Forest
- Central Hunter Swamp Oak Forest
- Dam
- Derived Native Grasslands
- Derived/Modified Native Grasslands
- Exotic Grasslands
- Hunter Floodplain Red Gum Woodland Complex
- Hunter Valley River Oak Forest
- Hunter Valley Weeping Myall Woodland
- Plantation
- Rehabilitation
- Slaty Gum Woodland
- Wetland/Dam (with wetland vegetation)

0 1 2 km

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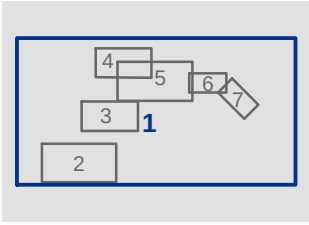

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1a Plant community types and vegetation zones

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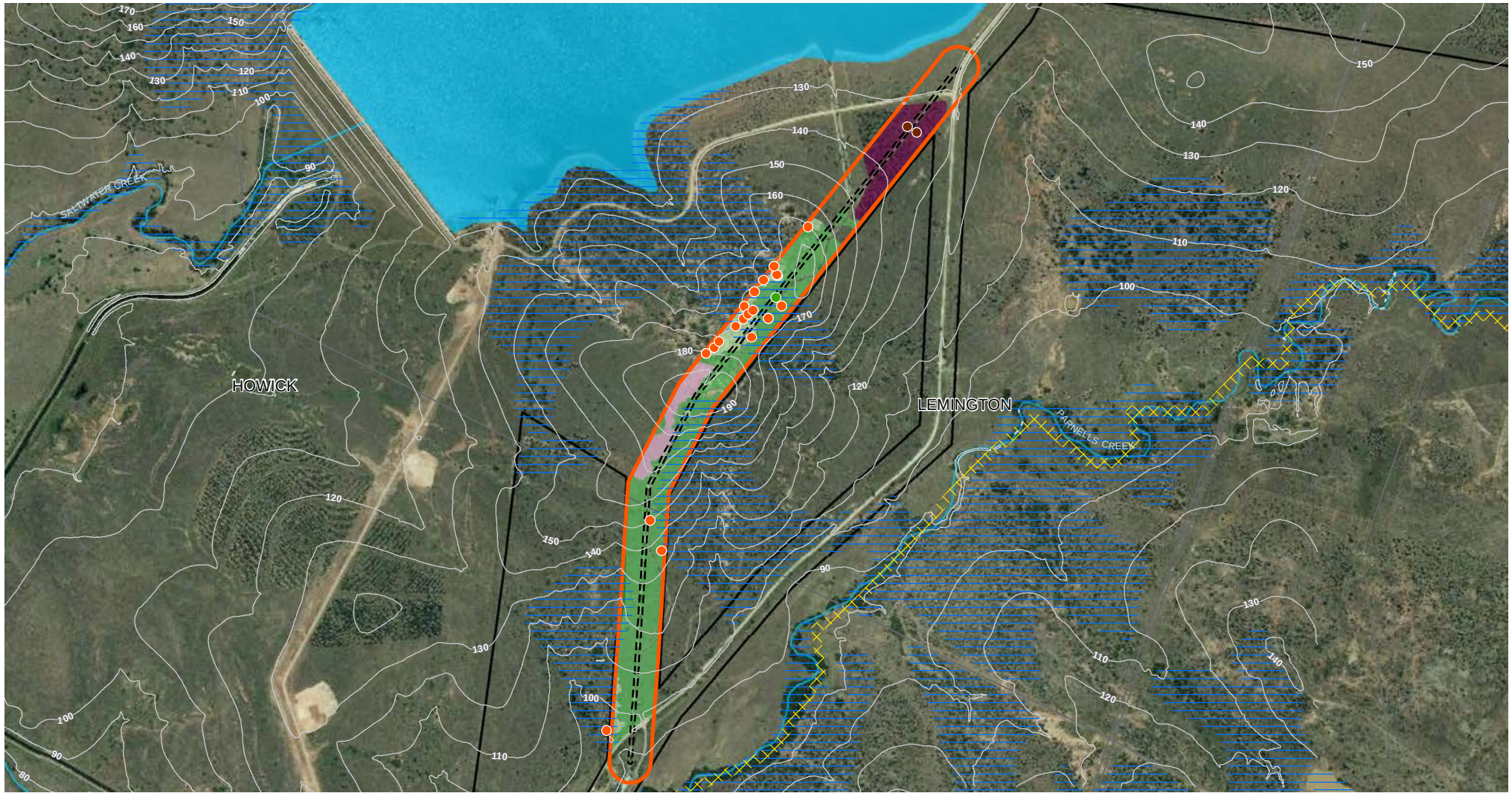


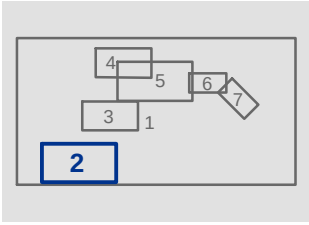
Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Aquatic
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
Dead Stag
Hollow-bearing Tree
Nest

PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
Zone 1 - Moderate / Good / CEEC
Zone 3 - Regrowth
Zone 4 - Grassland
Zone 6 - Plantation

0 250 500 m

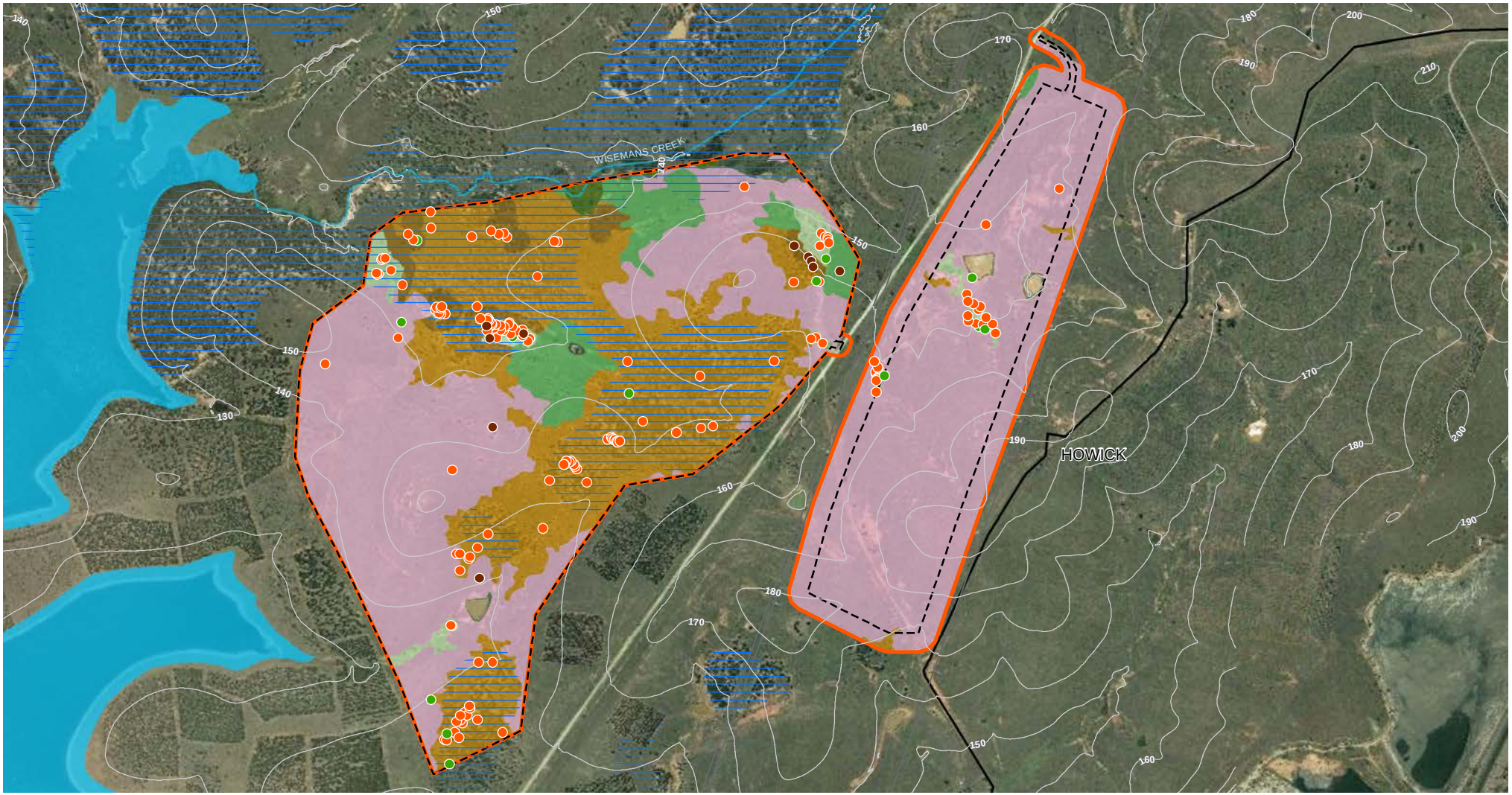
1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1b Plant community types and vegetation zones



Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

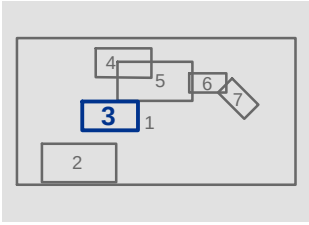
PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- Zone 1 - Moderate / Good / CEEC
- Zone 2 - Moderate / Good
- Zone 3 - Regrowth
- Zone 4 - Grassland

PCT 1692: Bull Oak grassy woodland of the central Hunter Valley
- Zone 7 -Moderate / Good
- Zone 8 - Moderate / Good / CEEC

PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
- Zone 9 - Moderate / Good

0 250 500 m

1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1c Plant community types and vegetation zones

Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Terrestrial

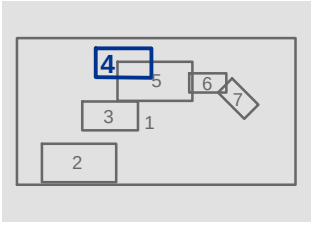
Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest

PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- Zone 1 - Moderate / Good / CEEC
- Zone 2 - Moderate / Good
- Zone 3 - Regrowth
- Zone 4 - Grassland
- Zone 5 - Rehabilitation

PCT 1692: Bull Oak grassy woodland of the central Hunter Valley
- Zone 7 -Moderate / Good

0 250 500 m

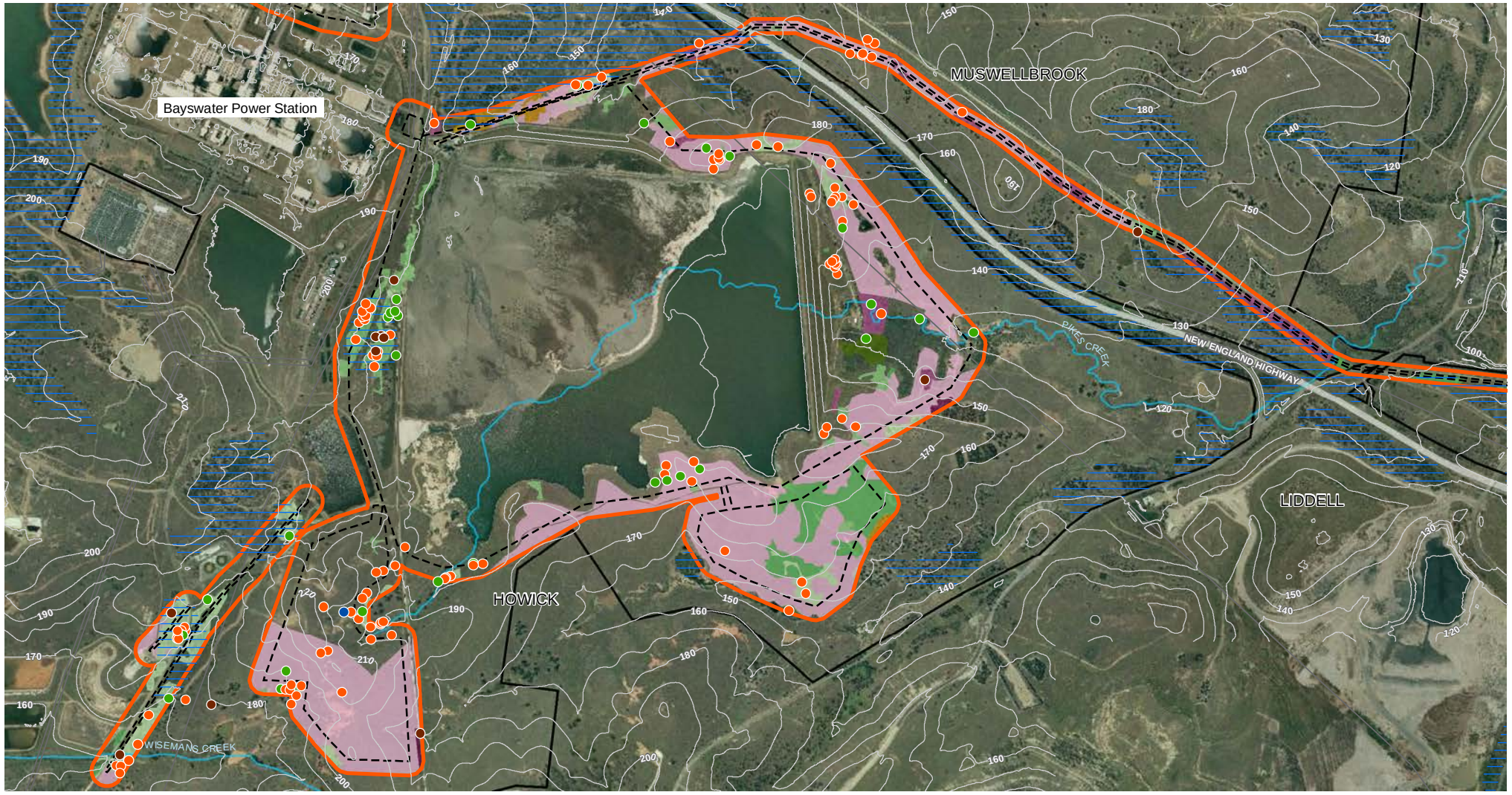
1:15,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1d Plant community types and vegetation zones



Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
- Dead Stag
- Hollow-bearing Tree
- Nest
- Water feature

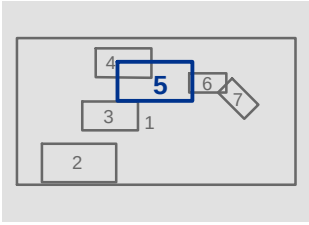
PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- Zone 1 - Moderate / Good / CEEC
- Zone 2 - Moderate / Good
- Zone 3 - Regrowth
- Zone 4 - Grassland
- Zone 5 - Rehabilitation
- Zone 6 - Plantation

PCT 1692: Bull Oak grassy woodland of the central Hunter Valley
- Zone 7 -Moderate / Good

PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
- Zone 9 - Moderate / Good

0 250 500 m

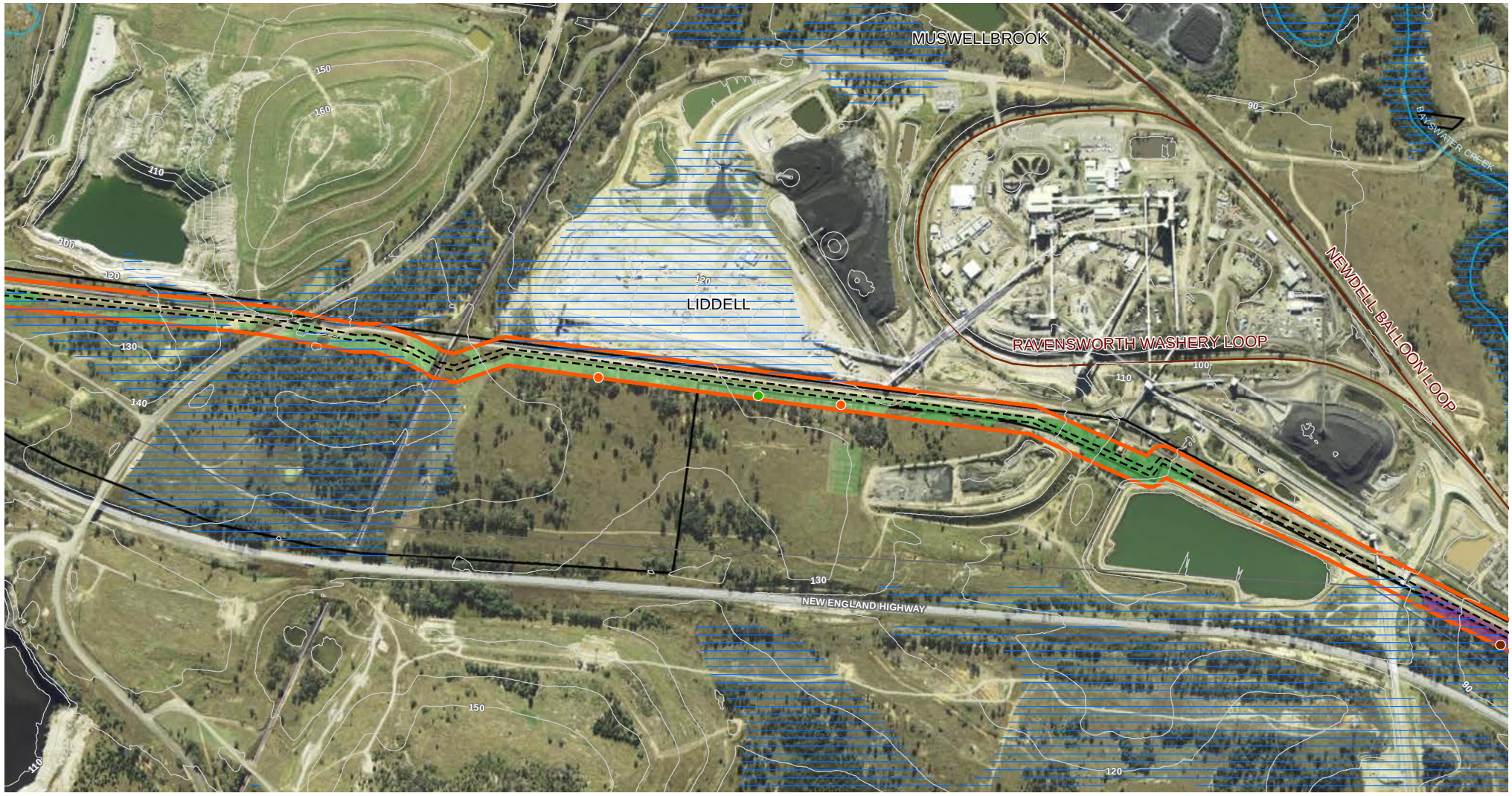
1:20,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1e Plant community types and vegetation zones



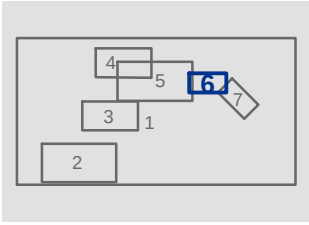
Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Terrestrial

Habitat type
Dead Stag
Hollow-bearing Tree
Nest

PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
Zone 2 - Moderate / Good
Zone 3 - Regrowth
Zone 5 - Rehabilitation

0 250 500 m

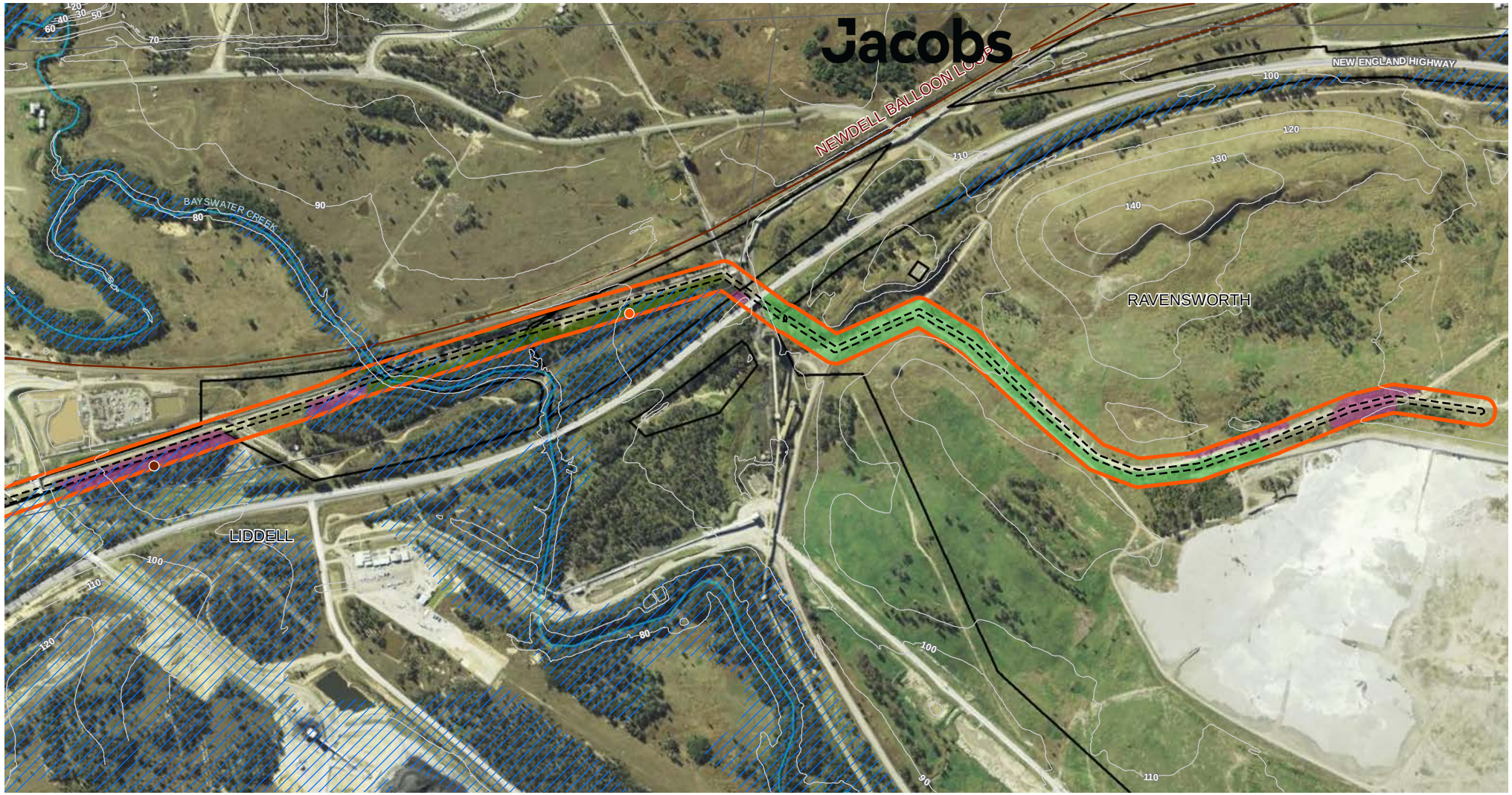
1:10,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1f Plant community types and vegetation zones



Study area
Proposal area
AGL owned land
Groundwater Dependent Ecosystem - Terrestrial

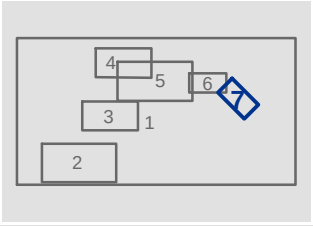
Habitat type
Hollow-bearing Tree
Nest

PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
Zone 2 - Moderate / Good
Zone 3 - Regrowth
Zone 5 - Rehabilitation

PCT 1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley
Zone 9 - Moderate / Good

0 250 500 m

1:10,000 at A4



Data sources
Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019
Kleinfelder 2019

GDA94 MGA56

Figure 7-1g Plant community types and vegetation zones

PCT 1691 was divided into six zones based on condition, this includes areas of Rehabilitation and Plantations, which were both assigned to PCT 1691 as the closest equivalent (discussed further in descriptions below). PCT 1692 was divided into two zones and areas of PCT 1731 constituted one zone. Details are provided in Table 7-1 below.

Table 7-1 Plant Community Types and other areas within the Project area

Zone	PCT	Condition Class	Vegetation Formation	Vegetation Class	Area (ha)
1	1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the central and Upper Hunter	Mod-Good-CEEC	Grassy Woodlands	Coastal Valley Grassy Woodlands	8.09
2		Mod-Good			6.70
3		Regrowth			40.36
4		Grassland			147.77
5		Rehabilitation			3.75
6		Plantation			0.14
				Sub-total of PCT	***206.71***
7	1692: Bull Oak grassy woodland of the central Hunter Valley	Mod-Good	Grassy Woodlands	Coastal Valley Grassy Woodlands	56.11
8		Mod-Good-CEEC			5.53
				Sub-total of PCT	***61.64***
9	1731: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.	Mod-Good	Forested Wetlands	Coastal Swamp Forests	2.40
-	Non-Native: Exotic Grasslands	-	-	-	55.82
-	Non-Native: Wetland/Dam (with Wetland Vegetation)	-	-	-	11.30
-	Dams (no Wetland Vegetation)	-	-	-	1.47
-	Excluded	-	-	-	221.77
				Total Area	**561.21**

7.2.3 Threatened Ecological Communities

A total of 20.32 ha of the Development site across three vegetation zones were identified as constituting Threatened Ecological Communities (TECs) under the BC Act and/or the EPBC Act as summarised in Table 7-2.

Table 7-2 Threatened Ecological Communities within the Project area

Zone	PCT	Area (ha)	Status	
			BC Act	EPBC Act
1	1691: Narrow-leaved Ironbark – Grey Box grassy woodland of the central and Upper Hunter	8.09	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
2		6.70		-
7	1692: Bull Oak grassy woodland of the central Hunter Valley	5.53	-	Central Hunter Valley eucalypt forest and woodland CEEC

Within the Project area there is a total of 14.79 ha of the *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* Endangered Ecological Community (**EEC**) listed under the BC Act, and a total of 13.62 ha of the *Central Hunter Valley eucalypt forest and woodland* Critically Endangered Ecological Community (**CEEC**) listed under the EPBC Act.

7.2.4 Flora Habitat

The habitat for threatened flora species within the study area is of varying quality due to historical and current disturbances including clearing and cattle grazing. Additionally, at the time of assessment the study area was subject to drought conditions with very little rainfall occurring in the region in preceding months. Rainfall in the Muswellbrook and Singleton LGAs had been below average since 2017.

Habitat for tree and shrub species is present, where canopy and shrub layers are persistent. The *Acacia pendula* Endangered Population within the Hunter Catchment has been identified at Liddell, approximately 1 km to the north of the current study area. Habitat for the *Cymbidium canaliculatum* Endangered Population within the Hunter Catchment is limited, with only a few areas of *Eucalyptus crebra* (Narrow-leaved Ironbark) occurring within the study area, and few large *E. crebra* individuals occur.

Habitat for ground dwelling threatened flora species has been impacted within the study area due to the drought and grazing impacts. This is particularly relevant to potential orchid habitat within open grassland areas which are substantially degraded by the dry conditions.

Plate 1: Degraded Grassland Habitat within the Study Area (Borrow Pit 4).

7.2.5 Threatened Flora

The desktop assessment identified the following threatened fauna species may occur within the study area:

- Acacia pendula – Endangered Population in the Hunter Catchment

- *Asperula asthenes* (Trailing Woodruff)
- Cymbidium canaliculatum Endangered Population in the Hunter Catchment
- *Diuris tricolor* (Pine Donkey Orchid)
- Eucalyptus glaucina (Slaty Red Gum)
- *Eucalyptus nicholii* (Narrow-leaved Black Peppermint)
- Persicaria elatior (Tall Knotweed)
- Prasophyllum sp. Wybong (A Leek Orchid)
- Pterostylis chaetophora
- *Pterostylis gibbosa* (Illawarra Greenhood).

Further details, including an assessment of the likelihood of occurrence of threatened flora is provided in Appendix C.

The targeted surveys for these threatened flora species were undertaken in accordance with the *NSW Guide to Surveying Threatened Plants* (Office of ENvironment and Heritage, 2016b) between July 2019 and January 2020.

One threatened population, *Acacia pendula Endangered Population in the Hunter Catchment,* listed under the BC Act was identified during field surveys. One planted *Acacia pendula* was identified within the Study Area, outside the Disturbance Area footprint.

Targeted threatened Flora surveys identified one planted *Acacia pendula.* This individual is within the threatened population, *Acacia pendula Endangered Population in the Hunter Catchment*, listed under the BC Act. The location of the individual plant is within the Study Area but outside the Development Site and would not be impacted.

Due to sub-optimal conditions for the flowering season of *Diuris tricolor* (Pine Donkey Orchid) and *Prasophyllum* sp. Wybong (A Leek Orchid; EPBC Act), and the lack of flowering of these two species at a local reference population (being the Mangoola Mine Site, located approximately 25 km north-west of the Study Area), an expert report (Bell, 2020) was prepared to assess the habitat suitability of the Study Area for these species in accordance with Section 6.5.2.3. of the BAM.

Bell (2020) considered that approximately 166 ha (30%) of the proposed 561 ha disturbance area may provide habitat for *Diuris tricolor* (Pine Donkey Orchid) and *Prasophyllum petilum* (Synonymous with *Prasophyllum* sp. Wybong listed under the EPBC Act). In accordance with the findings of Bell (2020), both *Diuris tricolor* and *Prasophyllum petilum* have been assumed to be present within the Development Site.

Bell (2020) notes that the assessment of 166 ha of potential orchid habitat is conservative and that the Development Site is "unlikely to support large populations of *Diuris* and probably no *Prasophyllum".*

Further details, including an assessment of the likelihood of occurrence of threatened flora and the expert report (Bell, 2020) is provided in Appendix C.

7.2.6 Fauna Habitat

A total of 367 hollow-bearing trees and dead stags containing large hollows were identified during the surveys within the Study Area. Of these, 219 occur within the Project area. Hollows were assessed as either potentially suitable for Large Forest Owls, including the Powerful Owl, Masked Owl and Barking Owl, or not suitable due to size, position or orientation. Potentially suitable hollows were stag-watched as part of nocturnal surveys.

Habitat for Large Forest Owls has been assessed as occurring within all vegetation zones, except within the mapped Grassland areas which constitute Vegetation Zone 4 (PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and Upper Hunter (Grassland)). Grassland areas were not considered suitable habitat for the Striped Legless Lizard due to the lack of fallen timber and/or dense tussock grasses (low biomass).

Two koala feed tree species, *Eucalyptus tereticornis* and *Eucalyptus punctata*, occur within the Study Area. Within the Study Area these two tree species only constitute >15% of the canopy cover within small portions of the site (within Vegetation Zone 1 – PCT 1691: Moderate-Good-CEEC, and Vegetation Zone 6 – PCT 1691: Plantation).

No evidence of Koala activity was identified during surveys conducted within the Study Area. Due to the limited extent of habitat and the patchy occurrence of feed trees within the Study Area, it is unlikely that the Study Area represents Core Koala Habitat.

7.2.7 Aquatic Habitat

Waterbodies containing habitat suitable for Amphibians (permanent water and standing vegetation), were identified across the Study area.

Suitable amphibian habitat is present within the Development Site and consists of constructed Dams which contain permanent water and suitable wetland vegetation (primarily *Thypha* and *Juncus acutus*). A total of eight Dams were identified within the Study Area (total of 4.99 ha). While these Dams did contain suitable abiotic features, three of the eight Dams were identified as containing Plague Minnow (*Gambusia holbrooki*). While the presence of this species does not exclude the potential for presence of Green and Golden Bell Frogs (**GGBF**), they do have the potential to impact on population numbers.

The GGBF has previously been recorded within the Sewage Treatment Plant Polishing Ponds within the Bayswater Site (directly to the west of the Study Area), approximately 20 years ago. Surveys conducted within the Study Area for the proposed Action did not identify the species.

No other amphibious species were considered likely to occur within the study area.

Lake Liddell, Plashett Reservoir and Bayswater Creek have been mapped as Key Fish Habitat (**KFH**) (Department of Primary Industries, 2019) (see Figure 8-2). As discussed in Section 8.1.7, each of these watercourses have been classified as Type 3 minimal KFH.

7.2.8 Threatened Fauna

The desktop assessment identified 18 threatened fauna species that may occur within the study area, including:

- *Litoria aurea* (Green and Golden Bell Frog)
- *Burhinus grallarius*; (Bush Stone-curlew)
- Callocephalon fimbriatum (Gang-gang Cockatoo)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle)
- Hieraaetus morphnoides (Little Eagle)
- *Lophoictinia isura* (Square-tailed Kite)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- Tyto novaehollandiae (Masked Owl)
- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Dasyurus maculatus* (Spotted-tailed Quoll)
- *Myotis Macropus* (Southern Myotis)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)
- *Planigale maculate* (Common Planigale)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Delma impar* (Striped Legless Lizard)
- Hoplocephalus bitorquatus (Pale-headed Snake).

Further details, including the assessment of the likelihood of occurrence of threatened and migratory species is provided in Appendix C.

Targeted surveys for threatened fauna were conducted in accordance with the appropriate guidelines. As a result of the targeted surveys, three mammals, four bird and one reptile species were detected within the Study Area consisting of:

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) was identified near the dam in Borrow Pit 3
- Southern Myotis (*Myotis macropus*) was identified near the large dam on the eastern side of the BWAD
- Squirrel Glider (*Petaurus norfolcensis*) was identified within Borrow Pit 4 and has been added as a candidate species, as it is not associated with any of the PCTs within the Development Site
- Little Lorikeet (*Glossopsitta pusilla*) was identified flying over the Salt cake landfill area
- Hooded Robin (*Melanodryas cucullata*) was identified in Borrow Pit 4
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) was identified at multiple locations within the Development Site and Study Area including multiple nesting locations
- Speckled Warbler (*Chthonicola sagittata*) was identified in Borrow Pit 4
- Striped Legless Lizard (*Delma Impar*) was identified on two occasions in the same area in Borrow Pit 4.

Each of the identified threatened fauna are listed as vulnerable under the BC Act. The Striped Legless Lizard *(Delma impar),* is also listed as Vulnerable under the EPBC Act.

7.3 Assessment of impacts

7.3.1 Construction

Removal of vegetation

Direct impacts of the Project will occur during the construction phase during clearing works. Within the Project area, construction would require complete removal of all native vegetation (totalling 270.85 ha of native vegetation).

Opportunities to limit the extent of vegetation clearance required would be considered as part of detailed design.

Removal of fauna habitat, including hollow bearing trees

A total of 367 hollow-bearing trees and dead stags containing large hollows were identified during the surveys within the study area. Of these 219 occur within the Project area, including:

- 187 potential hollow-bearing trees containing:
  - 400 small hollows
  - 295 medium hollows
  - 58 large hollows
- 32 dead stags containing:
  - 50 small hollows
  - 64 medium hollows
  - 12 large hollows.

The removal of hollow-bearing trees would result in the loss of nesting, roosting and/or sheltering habitat for locally occurring hollow-dependent fauna species. The removal of these trees and stags is considered unlikely to impact any threatened fauna species. Opportunities to limit the number requiring removal would however be considered.

Habitat connectivity

Vegetation within and surrounding the BWAD, Borrow Pits 1, 2 and 3, the HP Pipe and LSP Sludge Line, and the Ravensworth Ash line are isolated with limited connectivity. As such, removal of vegetation in these areas is unlikely to impact on the movement of fauna in the local area.

The vegetation within the proposed salt cake landfill area consists of acacia regrowth and does not provide a canopy link for fauna movement. The site does provide covered movement for ground dwelling fauna species. This portion of the Project area is surrounding by patches of woody vegetation, and local connectivity and movement corridors would be maintained if this vegetation was removed, particularly to the west of the salt cake landfill.

The majority of the woodland vegetation removal will occur from within Borrow Pit 4. This vegetation is connected to the south-east (patchy) and to the north and north-west (more continuous patches) of the Borrow Pit. The removal of the vegetation within Borrow Pit 4 would not limit movement on a broader scale, however there would be the potential loss of movement to small patches of Rehabilitation Vegetation directly adjacent to the east/south-east of the Borrow Pit.

Fauna injury

Vehicle and machinery activity would be increased during the construction of the Project. The Project area does not have any major access tracks/roads which intersect with large areas of woodland/forest vegetation. As such impacts from vehicle strikes is not anticipated to be a significant impact of the Project. Limited construction speeds within work areas would be enforced which would limit the potential for impacts from vehicle strikes.

Noise vibration, dust and light spill

Increased human activity (from workers and traffic levels) directly adjacent to sensitive habitat areas may cause disturbance to flora and fauna species in adjoining habitat.

Weeds and pathogens

The fungal pathogens *Phytophora cinnamomi* and Myrtle Rust (*Puccinia psidii*) are known to occur in the surrounding LGAs however it is unknown if they occur at Bayswater. These pathogens can have devastating impacts on native plant communities and inhabiting fauna if not managed.

Species which require control to ensure they are not spread due to works prior to and post construction of the Development Site include species identified as priority weeds in the Hunter; *Senecio madagascariensis* (Fireweed), *Opuntia stricta* (Prickly Pear), *Olea europaea* subsp., *cuspidata* (African Olive), *Hyparrhenia hirta* (Coolatai Grass) and *Lycium ferocissimum* (African Box Thorn). Additionally, Fireweed, Prickly Pear and African Box Thorn are listed as Weeds of National Significance.

7.3.2 Operation

The majority of impacts to biodiversity would occur as a result of vegetation clearance and construction activities. As such, once operational, the Project is unlikely to have a significant impact to the surrounding ecological environment. The Project may however result in positive impacts discussed below in each Project component:

BWAD Augmentation

The alignment of Pikes Creek downstream (east and north-east) of the BWAD is largely devoid of remnant native vegetation and is dominated by Exotic Grasslands (potentially areas of Native Grasslands). Along the alignment of Pikes Creek there are small patches of Remnant Central Hunter Box – Ironbark Woodland EEC and some areas of Rehabilitation. The Project is unlikely to lead to significant impact on the downstream occurrence of the EEC in this area due to the already degraded nature of the patches of the community. As discussed further in Section 8.2.2, the proposed augmentation works would include improvements to the BWAD seepage collection system, which in turn is likely to have a positive impact on the water quality of Pikes Creek and other downstream receiving water bodies.

CHP Water and Wastewater infrastructure upgrades

Discharges (overflows) to Tinkers Creek currently occur on a daily basis from the CHP sediment basin. CHP water and wastewater infrastructure upgrades are proposed as part of an environmental improvement program

at Bayswater to reduce the quantity of discharges to Tinkers Creek from the sediment basin and associated drainage systems.

Works within the CHP, which releases water into Tinkers Creek would reduce the quantity of water being discharged to the creek. The CHP occurs at the upper reaches of the catchment of Tinkers Creek, and a reduction in the amount of water discharged is unlikely to have a significant downstream effect.

Salt cake landfill

Salt migration modelling was undertaken to consider potential downstream impacts to sensitive receptors surrounding the landfill in the event of landfill lining failure, leading to a discharge of saline water into the environment.

High priority Groundwater Dependent Ecosystems (GDEs) are not mapped near the salt cake landfill site and are therefore not relevant. However, the following sensitive ecological communities are located downstream:

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC.

Groundwater bores in the vicinity of the mapped EEC/CEEC indicate that existing groundwater is saline (with existing mean, median and maximum total dissolved solids (salt) concentration of 7,277 mg/L, 7,783 mg/L and 13,760 mg/L) (see Section 9.1.2 and Appendix D for further details).

Should the proposed lining of the salt cake landfill fail, it is expected that increasing salinity in the groundwater (exceeding the existing background levels), could be encountered at a depth below about four metres below ground level (**mBGL**) (Jacobs, 2019a). The vegetation immediately surrounding the salt cake landfill is unlikely to be a GDE. At most, this vegetation would be facultative phreatophyte (opportunistically groundwater dependant). Due to the location of the vegetation (higher in the landscape), and dominant soil type (clay) it is unlikely that the roots of the vegetation would be able to penetrate to the groundwater. However, where depth to the groundwater is reduced, and more penetrable soils (sandy) are present, there is the potential for this vegetation to be facultative phreatophyte (opportunistically groundwater dependent) and could potentially be impacted by increased salinity levels.

However, based on the salt migration modelling, it is unlikely that the salt concentrations at the top of the groundwater table would increase above existing background levels, as such it is unlikely there would be a significant impact on the vegetation in the vicinity of the salt cake landfill due to salinity. Nevertheless, mitigations are proposed to monitor possible impacts.

7.3.3 Impacts to Matters of National Environmental Significance

Assessments of significance in accordance with the *Significant Impact Guidelines 1.1 –Matters of National Environmental Significance* (DoE, 2013) have been undertaken for all listed TECs and threatened species considered relevant to the assessment. Table 7-3 Summarises the outcomes of these assessments and Appendix C provides the details supporting the Assessment of Significance Findings.

Table 7-3 Summary of Assessment of Significance for MNES

Species	Listing status	Likelihood of occurrence	Impacts to habitat	Assessment of significance
Flora				
Prasophyllum sp. Wybong *(C.Phelps ORG 5269)* (EPBC)	CE	Low-Moderate	166 ha	Unknown, as extent of presence within Development Site has not been able to be confirmed due to drought conditions.

Species	Listing status	Likelihood of occurrence	Impacts to habitat	Assessment of significance
Ozothamnus tesselatus – Vulnerable	V	Low	14.68 ha	Surveys conducted within the Study Area for the proposed Action did not identify the species. As such, no location population of the species was detected, and the proposed Action is unlikely to have a significant impact on the species.
Threatened Ecological Communities				
Central Hunter Valley eucalypt forest and woodland	CE	Known	13.62 ha	It is unlikely that this removal will cause a significant impact on this community.
White-Box Yellow-Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	Nil	Nil	No areas of White-Box Yellow-Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland were identified within the study area. It is unlikely that the Action will cause a significant impact on this community.
Amphibians				
Litoria aurea Green and Golden Bell Frog	V	Low	4.99 ha within the Study Area. Impact: 3.90 ha; within the approved disturbance area of the Ash Dam), 0.35 ha no impact, and 0.74 ha impacted.	Surveys conducted within the Study Area for the proposed Action did not identify the species. As such, no location population of the species was detected, and the proposed Action is unlikely to have a significant impact on the species.
Birds				
Anthochaera phrygia Regent Honeyeater	CE	Moderate – Low	14.68 ha – foraging only.	The Action is unlikely to result in a significant impact to this species.
Lathamus discolor Swift Parrot	CE	Moderate - Low	14.68 ha	The Action is unlikely to result in a significant impact to this species.
Mammals				
Chalinolobus dwyeri Large-eared Pied Bat	V	Moderate	82.60 ha	Surveys detected no suitable roost sites. The Action is unlikely to have a significant impact on this species.

Species	Listing status	Likelihood of occurrence	Impacts to habitat	Assessment of significance
Dasyurus maculatus Spotted-tailed Quoll	E	Moderate - Low	82.60 ha	Targeted surveys conducted within the Study Area for the proposed Action did not identify the species. The Action is unlikely to have a significant impact on any potentially occurring local population of the species.
Nyctophilus corbeni Corben's Long-eared Bat	V	Moderate - Low	82.60 ha	Targeted surveys for this species were conducted in December. These surveys detected no individuals or breeding habitat. The Action is unlikely to have a significant impact on this species.
Petrogale penicillata Brush-tailed Rock Wallaby	V	Low	Nil	This species was not detected within the study area and the Development Site lacks suitable habitat. The Action is unlikely to have a significant impact on any potentially occurring local population of the species.
Phascolarctos cinereus Koala	V	Low	8.23 ha	Targeted surveys for this species did not identify the species. The study area was assessed as providing mainly dispersal habitat of the Koala and as not providing breeding habitat for the species. The removal of the habitat within the Impact Area is unlikely to have a significant impact on any potentially occurring local population of the species.
Pteropus poliocephalus Grey-headed Flying-fox	V	Moderate - High	18.57 ha	The Grey-headed Flying-fox was not detected within the study area and no breeding habitat was present. The Action is unlikely to have a significant impact on this species.
Reptiles				
Delma impar Striped Legless Lizard	V	Known	122.97 ha	Targeted surveys for this species within the study area identified one to two individuals at the same location (on different days) within Borrow Pit 4. Due to the uncertainty around the status of the population within the study area (size, importance, breeding potential), the potential for the proposal to have a significant impact on the species is uncertain. As such, the Action has the potential to significantly impact on the species in the locality.

Species	Listing status	Likelihood of occurrence	Impacts to habitat	Assessment of significance
Aprasia parapulchella Pink-tailed Worm-lizard	V	Low	N/A	No records of the Pink-tailed Worm-lizard (Aprasia parapulchella) occur within the locality. Targeted surveys for this species within the study area identified no individuals. As such, the Action is unlikely to significantly impact the species in the locality.
Migratory Species				
Hirundapus caudacutus White-throated Needletail	M	Moderate-low	122.97 ha	This species was not identified during the assessment; however, the species has a moderate to low likelihood of occurrence within the study areas areal habitat. The Action is unlikely to have a significant impact on this species.

It was concluded that for the majority of the threatened species, the ecological communities and migratory species identified within the Development Site or identified as having suitable habitat within the disturbance footprint, the Project is unlikely to have a significant impact. There were two species; Striped Legless Lizard and *Prasophyllum* sp. Wybong, for which the significance of potential impacts remain unknown.

Due to the study area occurring at the northern extent of the known distribution of the Striped Legless Lizard (*Delma impar*) there is the potential for the Project to significantly impact on this species. However, surveys conducted within the study area have not identified a large population of the species, as such, the population within the Development Site may not be extensive and occupying all potential habitat.

Due to sub-optimal conditions for the flowering of *Prasophyllum* sp. Wybong (A Leek Orchid), the species was not recorded as flowering at a local reference population during the 2019 season, and as such surveys within the Study Area could not be conducted. The expert report that has been prepared for the species determined that approximately 166 ha of habitat for *Prasophyllum* sp. Wybong occurs within the impact area; however, this area is unlikely to contain a population of the species. Due to the lack of certainty regarding the occurrence of the species within the Development Site, potential impacts to this species are currently uncertain.

7.4 Environmental management measures

Environmental management measures relating to biodiversity impacts are outlined in Table 7-4.

Table 7-4 Environmental management measures – biodiversity impacts

Ref	Environmental management measure	Timing
BD01	Opportunities to limit the extent of vegetation (including hollow-bearing trees and stags) clearance required would be considered as part of detailed design and construction planning.	Pre-construction
BD02	A Biodiversity Management Plan would be prepared as part of the CEMS and include the following requirements: • Clearly delineate the boundaries of the Project area to prevent any unnecessary clearing beyond its extent • 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’	Construction

Ref	Environmental management measure	Timing
	• 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 Biodiversity 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.	
BD03	Prior to the removal of hollow-bearing trees / habitat trees, a pre-clearing protocol would be implemented which would include the following requirements: • Pre-clearance surveys would be undertaken to determine if any inhabiting fauna are present • A suitably qualified and trained fauna handler would be present during hollow-bearing tree clearing to rescue and relocate displaced fauna Appropriate exclusion fencing around trees and woodland that are to be retained within the Project area would be erected, considering allowance for Tree Protection Zones in accordance with the Standards Australia (2009).	Construction
BD04	Clearing would be avoided, where practicable, during breeding and through egg hatching periods for the Striped Legless Lizard, November to February. If clearing is to occur during this period (November to February): • Pre-clearing surveys within areas of Striped Legless Lizard habitat will be conducted Any individuals captured during these pre-clearing surveys will be relocated into similar habitat outside the Development Site.	Construction
BD05	Weeds and pathogens would be managed in accordance with applicable legislative requirements including and not limited to the *Biosecurity Act 2015* (NSW). The following measures would be implemented to prevent the transfer of weeds and pathogens: • Plant and equipment would be required to arrive at site clean • Soil and seed material transfers would consider the risks of weeds and pathogens being present and the sensitivity of the receiving area. No transfers are to occur to relatively less disturbed areas of site unless material can be determined to be from a non-weed infested area and not contain pathogens • Weed infestations within the construction footprint are to be identified and mapped prior to construction. Methods to be implemented for the control of noxious weeds would be included in the CEMS and adopted as necessary in each CEMP. This is to include weed control works to be conducted throughout the construction phase of the Project, and follow-up weed control within the Development Site post construction.	Construction
BD06	If it is identified there is a Salt cake landfill lining failure and an associated increase in salinity in the groundwater, above background levels, then monitoring of vegetation within the predicted impact area would occur. If during the monitoring of vegetation there is an identified impact on the vegetation due to the increased salinity from the Salt cake landfill, additional offsetting measures would be implemented where required. Credits retirement would be calculated based on the area of impact and the ratio of credits generated within the closest equivalent vegetation zone within the impact area.	Operation

Ref	Environmental management measure	Timing
BD07	Upon the completion of extraction works within each Borrow Pit location, these areas would be rehabilitated. A rehabilitation plan for each Borrow Pit would be prepared prior to completion. Where the areas are to be returned to native vegetation, locally endemic species will be used for rehabilitation of appropriate vegetation communities, using locally sourced seeds/plants where possible.	Decommissioning
BD08	Biodiversity offset credits would be retired in accordance with BC Act and EPBC Act requirements. The number and type of credits would be refined as part of further survey and detailed design. A clearing staging plan would be prepared prior to the commencement of works. From this plan the required biodiversity credits for each stage would be determined based on areas of impacts to each vegetation zone, and the retirement of biodiversity credits would occur prior to the commencement of each stage. This plan will be set out in a separate document to the BDAR and would be approved by DPIE prior to commencement of disturbance works.	Prior to clearing for each Project component.

7.5 Biodiversity offsets

Ecosystem and species credits would be required as part of the biodiversity offsets for the Project, as outlined below and in accordance with Section 10.3 of the BAM (Office of Environment and Heritage, 2017). A species credit is a class of biodiversity credit created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. A summary of the impacts on native vegetation and the required ecosystem credit is provided in Table 7-5.

Table 7-5: Summary of ecosystem credit requirements

Zone	PCT & Class	Area (ha)	Current Vegetation Integrity Score	Future Vegetation Integrity Score	Credits Required
1	1691: Mod-Good-CEEC	8.09	64.7	0	272
2	1691: Mod_Good	6.70	51.7	0	173
3	1691: Regrowth	40.36	44.7	0	899
4	1691: Grassland	147.77	33.4	0	2,471
5	1691: Rehab	3.75	45.2	0	85
6	1691: Plantation	0.14	57.7	0	4
Sub-total for PCT 1691		***206.71***			***3,904***
7	1692: Mod-Good	56.11	48.2	0	1,175
8	1692: Mod-Good-CEEC	5.53	37.5	0	100
Sub-total for PCT 1692		***61.64***			***1,275***
9	1731: Mod_Good	2.40	28.3	0	31
Total Native Vegetation Zones		**270.85**			**5,209**
	PCT 1691: Paddock Trees	-	-	-	31
Total					***5,240***

A summary of the impacts on threatened species and the required species credit is provided in Table 7-6.

Table 7-6: Summary of species credit requirements

Species	Impact - Area (ha) / Count	Credits Required
Diuris tricolor (Pine Donkey Orchid)	166 ha	2158
Prasophyllum petilum	166 ha	2877
Squirrel Glider (*Petaurus norfolcensis*)	59.05 ha	1,433
Southern Myotis (*Myotis macropus*)	8.11 ha	233
Striped Legless Lizard (*Delma impar*)	120.68 ha	2,169

Biodiversity offset credits would be retired in accordance with BC Act and EPBC Act requirements. The number and type of credits would be refined as part of further survey and detailed design.

8. Surface water and hydrology

This chapter summarises the findings, where relevant of the Surface Water, Groundwater and Flooding Technical Paper (Jacobs, 2020a)*, and Water Balance Modelling Report* (Jacobs, 2019b) *which were undertaken to consider potential impacts on surface water and hydrology as a result of the Project, and to address the following SEARs for the Project:*

- 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;
- details of water requirements and supply arrangements for construction and operation;
- 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 in accordance with Managing Urban Stormwater: Soils & Construction (Landcom, 2004).

8.1 Existing environment

8.1.1 Regional water catchments

Bayswater is situated in the central region of the Hunter River catchment area which spans approximately 22,000 km^2. The Hunter River rises in the Mount Royal Range north east of Scone and travels approximately 450 kilometres to the sea at Newcastle. The Hunter region supports a range of agricultural activities including wineries, dairying, vegetables, fodder, beef and horse breeding as well as over 20 of the largest coal mines in Australia and two large coal-fired power stations. The river is regulated from Glenbawn Dam to Maitland, spanning a distance of approximately 250 kilometres.

A significant management issue in the Hunter River catchment area is high salinity. In response to this, in 1994, the NSW government implemented the HRSTS which enabled the regulation of salty water discharge into the Hunter River (DEC, 2006).

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 and has been substantially disturbed by mining activities. A dam wall was constructed across Bayswater Creek in the 1960s to create Lake Liddell, a large cooling water pond for Liddell. Below Lake Liddell, the waterway has been heavily modified to accommodate discharges from the lake where it flows in a south-easterly direction into the Hunter River approximately 15 kilometres downstream. While discharges from Lake Liddell are the primary source of flow into Bayswater Creek, a number of other tributaries flow into Bayswater Creek below the BWAD 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.

8.1.2 Climate

Daily rainfall data was collected from AGLs rain gauge at Bayswater, and BOM's (2019c) Doyles Creek (Wood Park, Station Number 061130) rainfall station, located approximately 10 km to the south west of the site. The average annual rainfall was 699 mm at Bayswater. Rainfall is generally greater in the late spring/summer months from November to February. Within the winter months, rainfall is relatively high, peaking in June.

Areal actual evapotranspiration (**AAET**) data was used to estimate evaporation rates and showed there is a rainfall surplus in February and from April to September. The remaining months have a rainfall deficit, indicating that evaporation exceeds rainfall.

8.1.3 Topography

The local topography is shown in Figure 8-1. The Project area is generally characterised by low hills with elevations ranging from 100 m Australian Height Datum (**mAHD**) to 220 mAHD. The majority of the Project elements are situated between Lake Liddell in the north east and Plashett Reservoir to the south west, both with an elevation of approximately 125 to 130 mAHD. Maximum slopes of natural land are approximately 25% to 30%.

8.1.4 Watercourses

Within the vicinity of the Project are a number of watercourses and artificial water bodies, as shown in Figure 8-2. These include:

- Tinkers Creek, Bayswater Creek, Pikes Creek, Saltwater Creek, Chilcott Creek and Wisemans Creek; and
- Bayswater Ash Dam, Plashetts Reservoir, Lake Liddell and Freshwater Dam.

These features and their relationship to the Project are described as follows:

Bayswater Ash Dam is located at the top of the Pikes Creek catchment. The BWAD is designed as a slurry water system operated as a closed loop system, meaning that it is effectively a zero discharge 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 under and within the main embankment is also collected via a system of drains and the water is returned to the dam using a series of pumps. Discharge under flooding conditions would occur to Chilcotts Creek and flow to Lake Liddell. The Bayswater augmentation, ash harvesting and construction and operation of Borrow Pits one, two and three would occur within the catchment of the BWAD.

Plashett Reservoir is located in the south-western portion of the study area, in proximity to Borrow Pits 3 and 4. This waterbody has a capacity of approximately 67 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. Works associated with Borrow Pits 3 and 4 and the clearing of the HP and LSP pipelines would occur within the catchment of the 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 licensed 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 discharge point at the main dam wall. Water discharges released from Lake Liddell to Bayswater Creek are monitored at licensed discharge point “LDP08”. The quality of water released into Bayswater Creek is subject to regulation by the HRSTS and water quality parameter limits implemented under AGL’s EPL 779. The coal handling plant upgrades, Ravensworth Pipeline, BWAD augmentation and ash harvesting operations would occur within the catchment of Lake Liddell.

Freshwater Dam is located north of the Salt cake landfill but would not receive surface water inflows from any Project component.

Tinkers Creek is located north-west of Bayswater CHP and receives discharge from Bayswater at two discharge points. The CHP sediment basin currently overflows daily to Tinkers Creek. Tinkers Creek additionally receives flow from a modified drainage line that links the Freshwater Dam (located to the south-west) to Tinkers Creek. In order to manage salinity in the cooling towers, water is periodically blown down into Lake Liddell (Aurecon, 2013). Water is discharged from Bayswater from two licenced discharge points that drain to Tinkers Creek which subsequently flows downstream into Lake Liddell.

Bayswater Creek is a fifth order waterway which, within the study area, 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. Bayswater Creek intersects with the Project area along the proposed Ravensworth ash line.

Pikes Creek is located to the north of the study area and flows in a north-easterly direction through the BWAD and under the New England Highway. Pikes Creek intersects with the Project area along the proposed Ravensworth ash line. Seepage from the BWAD is collected in one of two Seepage Collection Ponds (**SCP**) to manage discharge to Pikes Creek. Pikes Creek receives flow from a number of small tributaries downstream of the BWAD.

Saltwater Creek flows in a southerly direction toward Plashett Reservoir. A major unnamed tributary of Saltwater Creek (known as Noname Creek) joins the waterway approximately 1 km upstream of the confluence of Saltwater Creek and Plashett Reservoir. Saltwater Creek also receives flow from a number of smaller tributaries located along the length of the waterway. Noname Creek is situated within proximity of the proposed salt cake landfill site.

Chilcotts Creek is an ephemeral, first order stream located on the north-eastern side of Bayswater CHP and north of the BWAD. The creek flows approximately 1 km in a north-easterly direction toward Lake Liddell and crosses under the New England Highway and intersects with the Project area along the proposed Ravensworth ash line. Two small drainage lines flow into the creek however the creek receives the majority of its flow from direct seepage from the BWAD saddle dam wall and from runoff during wet periods.

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. Wisemans Creek is situated directly adjacent to the proposed Borrow Pit 1 site and within proximity of Borrow Pit 2 and Borrow Pit 3 sites.

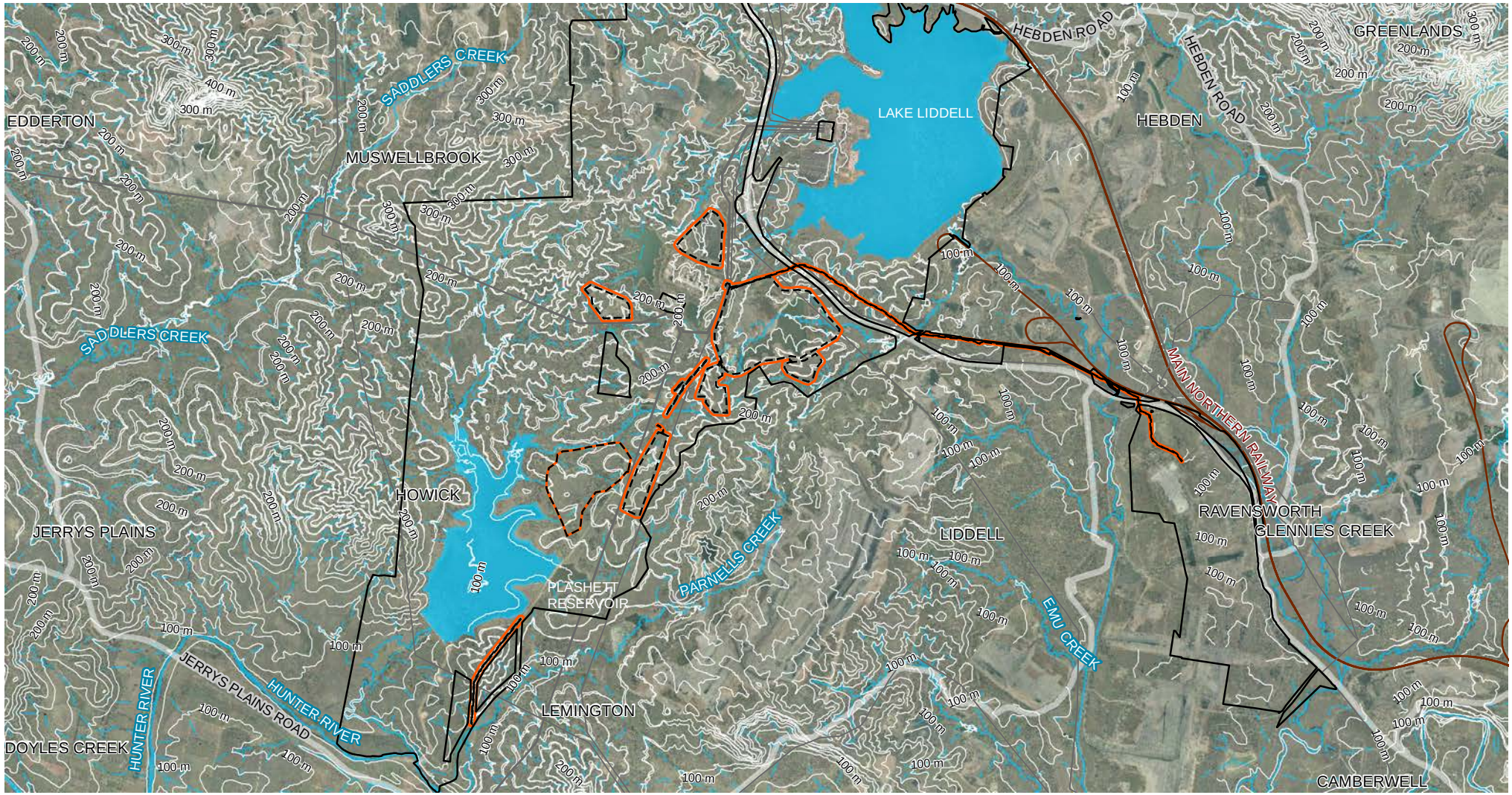
8.1.5 Flooding

The Project is not located on land that is mapped under the *Singleton Local Environment Plan 2013* as being susceptible to flooding. No mapping for flood prone land is available under the Muswellbrook *Local Environment Plan 2009.* It is noted that a Floodplain Risk Management Plan, which is typically prepared for urban floodplains, has not been prepared by Singleton Council and/or Muswellbrook Shire Council covering the Project area. The probable maximum flood level for the BWAD is estimated at RL 173.3 metres which is 0.7 metres below the main embankment crest (Aurecon, 2019) located across Pikes Gully. This means that flood behaviour in Pikes Gully downstream of the BWAD is not influenced by the BWAD.

The Project elements are generally located within the catchment areas of Lake Liddell and Plashett Reservoir. A drainage line runs along the south western boundary of the proposed salt cake landfill. The drainage line drains a catchment area of approximately 50 hectares and discharges into Noname Creek, which in turn drains a relatively small catchment area of approximately 160 hectares before discharging into Saltwater Creek.

Despite its proximity to a minor watercourse, the proposed Salt cake landfill is located on high ground (between RL 197 metres and RL 175 metres), and at least 8 metres above the bed of Noname Creek and is not expected to be subject to flooding from Noname Creek during major flood events.

A number of gullies and drainage lines cross the proposed Borrow Pits, which drain to either Bayswater Creek (Borrow Pits 1 and 2) or Wisemans Creek and Plashett Reservoir (Borrow Pits 3 and 4).



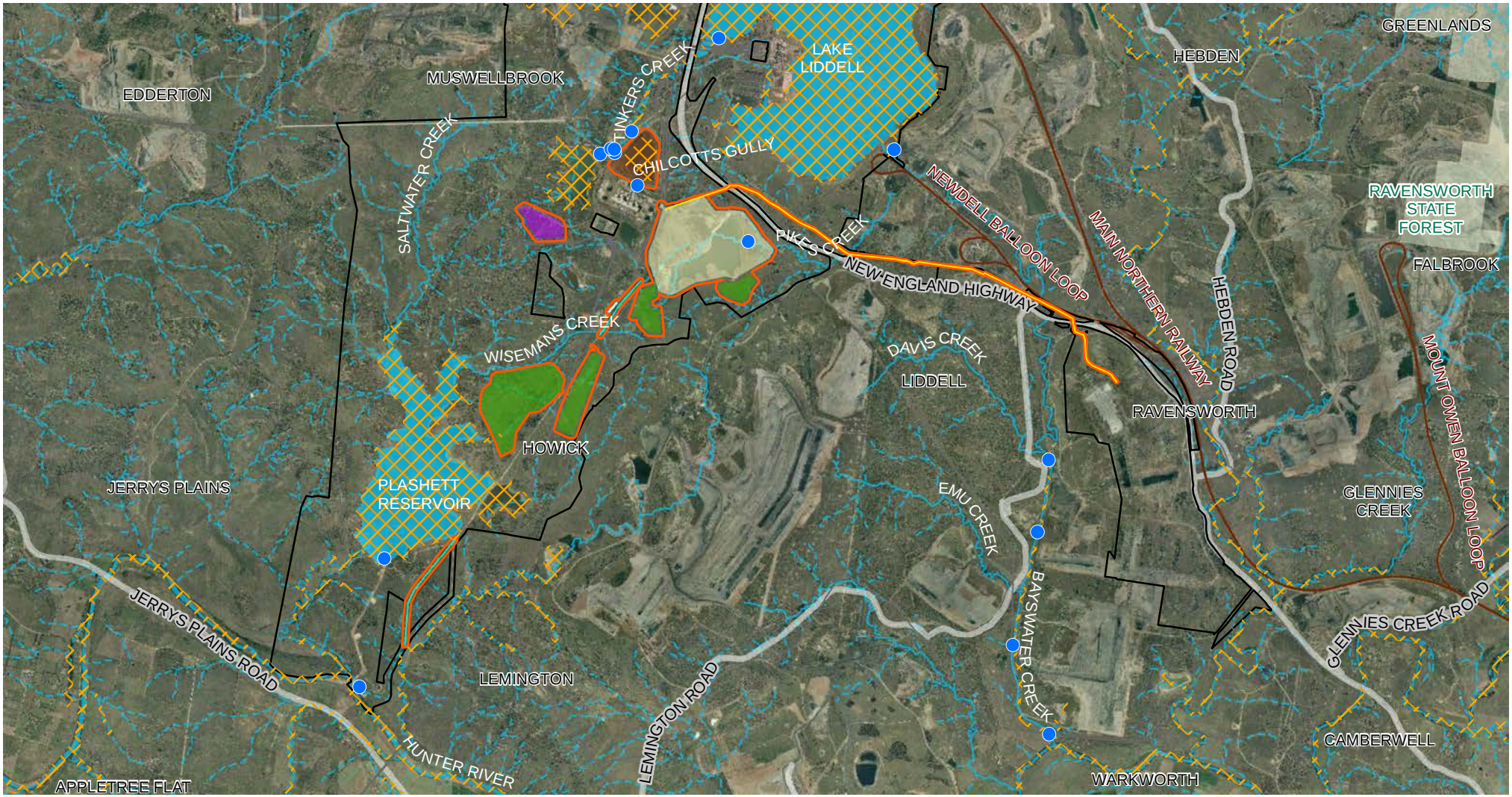
Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 8-1 Topography

Date: 27/11/2019 Path: J:\IE\Projects\04_Eastern\IA215400\22_Spatial\GIS\Directory\Templates\Figures\WOAOW_EIS\IA215400_GIS_EIS_F003_r1v1_Topography.mxd
Created by : XX | QA by : XX



Study area
AGL owned land

Project elements:

- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Salt Cake Landfill
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Ravensworth Ash Line

Water monitoring
Key Fish Habitat

0 1 2 km

1:100,000 at A4

N

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 8-2 Surface water existing environment

Date: 22/10/2019 Path: J:\IE\Projects\04_Eastern\IA215400\22_Spatial\GIS\Directory\Templates\Figures\Surface_Water\IA215400_GIS_SW_F001_r1v2_Site_boundary.mxd
Created by : XX | QA by : XX

8.1.6 Water quality

Waterways within the wider Hunter River catchment area are affected by high salinity. Sources of salt within waterways in the catchment include rainfall and weathering products which enter streams via surface runoff pathways and groundwater sources, particularly from the underground geology of the Permian coal measures. Coal mining and power generation are also expected to contribute to sources of salinity in streams however lack of long-term monitoring data and a highly variable climate make this difficult to confirm. Of the surface water salinity observations from across the Hunter region, median electrical conductivities exceed 5500 µS/cm in water sources for Singleton, Jerrys Plains, Muswellbrook and Wybong. Streams with identified groundwater interactions are also often found to have high salinities (Australian Government – Bioregional Assessments, 2019).

Within the study area, monitoring records for Lake Liddell, Plashett Reservoir, Bayswater Creek, Tinkers Creek, Pikes Gully and Hunter River have been collected from various sources and analysed for the purposes of this assessment.

Sampling data from the following sources has been used for the purposes of this assessment, noting that some data presented has been derived from grab samples only and therefore is solely reflective of water quality at the time of collection and should not be interpreted as long-term water quality trends. *Ravensworth Void 4 Discharge Investigation* (Aurecon, 2013);

- Monitoring data acquired from AGL (2019); and
- Bayswater Coal Handling Plant Sediment Basin – Assessment of Water Quality and Water Management (AECOM, 2017a)

The location of water monitoring points is shown on Figure 8-2. Generally, the water sampling data analysed indicated that discharge water quality was within the range specified in EPL 779.

When considering water quality in relation to the recommended ANZECC/ARMCANZ (2000) guidelines for protection of aquatic ecosystems, or 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) (ANZG, 2018) there were instances of some toxicants exceeding the recommended guidelines. In particular, electrical conductivity was found to be outside either the ANZECC/ARMCANZ (2000) recommended range of 125 – 2250µS/cm within Tinkers Creek, Lake Liddell, Plashett Reservoir and Pikes Creek. However, median electrical conductivities are suggested to exceed 5500µS/cm in water sources within the Hunter River Catchment. Therefore, the values recorded are considered consistent with regional water quality issues, and in some instances (for example within Tinkers Creek) low in comparison.

In addition, other toxicants were either below detection limits or below recommended upper limits stated in the appropriate guidelines. Further details are provided in Appendix D.

8.1.7 Sensitive receiving environments

Lake Liddell, Plashett Reservoir and Bayswater Creek have been mapped as KFH (Department of Primary Industries, 2019) (see Figure 8-2). 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. Further details are provided in Chapter 7.

Considering this, all three waterways have been classified as Type 3 minimal KFH (Department of Primary Industries, 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 area have been mapped as KFH.

Commercial fishing is prohibited in waterways within the Project area, and no waterways are classified as aquaculture areas. No waterways within the footprint area are part of the drinking water catchments for any of the surrounding townships.

Singleton Council supplies drinking water to the surrounding LGA through two water supply schemes; one scheme draws raw from Glennies Creek Dam (Lake St Clair) before treatment at Obanvale Water Treatment Plant, and the other scheme is the Jerry Plains Scheme, which operates as an agreement whereby AGL collect, treat and supply drinking water to Singleton Council for the town of Jerry Plains. Glennies Creek catchment is beyond the study area for the Project and would not be affected. Raw water for the Jerry Plains Scheme is stored within Plashett Reservoir prior to treatment. The Project would not affect the ongoing operation and treatment of water under the Jerry Plains Scheme.

Overall, no waterways within the Project area are considered as sensitive receiving environments.

8.2 Assessment of impacts

8.2.1 Construction

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 licences. 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. These risks are applicable to the construction of each Project element:

- Removal of vegetation, general earthworks, including stripping of topsoil and excavation could result in the mobilisation of exposed soils, increased erosion and sedimentation (Section 11.2 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 Bayswater, result in discharge to the environment and
- 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.

In addition, there are potential surface water and hydrology impacts associated with the following Project elements:

Ravensworth Ash line

Instream works required for the Ravensworth Ash line would lead to direct disturbance of Chilcotts Creek and Bayswater Creek and potential soil and bank erosion. If not appropriately managed these works could result in impacts to these watercourses.

There are sections of the Ravensworth Ash line that would be installed below ground through trenching or underboring. Pikes Creek would be underbored. While this would avoid direct impacts to Pikes Creek, the potential loss of drilling fluids during underboring could result in increased sedimentation and turbidity in watercourses and potential ecosystem impacts.

Borrow Pits

During construction, surface water diversions would be installed, and the Borrow Pits would be designed so that runoff is diverted away from the site, thereby enabling the extracted materials to be suitable for use as part of the Project. Once the Borrow Pits are stabilised, the final landform would be designed to be free draining so that they do not form permanent water bodies. Further details on the proposed water management and drainage structures would be developed as part of the detailed design.

It is assumed that the design of the Borrow Pits would have appropriate retention time or treatment such that any discharge meets the water quality objectives of the receiving water body during operation. Any ponding water (ie rainwater) that is collected in the Borrow Pits would be managed in accordance with *Managing Urban Stormwater: Soils and construction - Volume 1* (the Blue Book).

Details of water management during construction will be provided in the Water Management Plan/CEMP that will be developed for the Project.

Overall, and in consideration of the proposed environmental management measures outlined in Section 8.3, the Borrow Pits would not result in any impact to regional surface water quality or quantities.

8.2.2 Operation

During operation, possible effects on surface water and flooding have been identified for the operation of the augmented BWAD, the proposed Borrow Pits, Ravensworth ash line and the CHP upgrades. All other Project elements would predominantly be located above or below ground with minimal features that would affect regional surface water or flooding.

BWAD Augmentation

Currently seepage water from the BWAD discharges through the existing ash dam wall. Augmentation of BWAD and increasing the ash dam wall level could lead to increased seepage flows through the dam wall into one of the two SCP (SCP1 and SCP2).

The water balance modelling results indicate that currently there are daily seepage flows from the BWAD, which are bypassing the BWAD seepage collection system (SCP1 and SCP 2) (see Appendix E for further details). These flows are currently reaching Pikes Creek and other downstream water bodies.

The Project includes upgrading the BWAD seepage collection system to maximise the volume of BWAD seepage loss flows that are captured by the SCPs and pumped back to BWAD. The proposed upgrades would include:

- Installing a seepage collection system below the saddle dam wall
- Enlargement and deepening of the existing SCPs
- Installation of larger capacity pumps to increase the maximum volume of seepage water that can be pumped back to the BWAD following large storm events
- Increasing the duration of pumping from the seepage collection ponds to the BWAD.

In addition, seepage flow rates would continue to be monitored and reported as part of the dam monitoring and surveillance reporting required by the DSC approvals. Therefore, the proposed upgrades to the seepage collection are expected to result in a reduction of the volume of the potentially impacted BWAD seepage that is discharged to the receiving environment. This is likely to have a positive impact on the water quality of Pikes Creek and other downstream receiving water bodies.

As noted in Section 8.1.5, the flood behaviour of Pikes Creek is not affected by the operation of BWAD. As such, the proposed augmentation works would also not affect flood behaviour of Pikes Creek.

Should a large-scale breach of the BWAD occur from either the main embankment, or the saddle dam wall it is possible that inundation of flood water and slurry from the main embankment could reach downstream along Pikes Creek. Depending on the volumes of overflow, inundation could overtop the bridge where the New England Highway crosses Pikes Creek approximately 1.75 kilometres downstream. It is also possible that the Liddell Station Road could be subject to inundation further downstream. Should overflow from the saddle dam wall occur, the inundation area could follow the natural creek line to the north, reaching the culvert at the New England Highway approximately 550 metres downstream.

However, the existing process for the management of water from within the BWAD would be continued. Water levels within BWAD would be maintained at an appropriate level to ensure an adequate environmental freeboard is maintained and to avoid discharge over the spillway.

Borrow Pits

Poor design of excavations from the proposed Borrow Pits could lead to ponding of water, scouring and bank erosion which could impact on downstream water quality. The key risks to surface water and hydrology from the operation of the Borrow Pits relates to the excavation and transport of the materials, and erosion and sedimentation from exposed areas being transported to downstream waterways from wind and rain.

The final design of the Borrow Pits would include surface water diversions so that surface water runoff is diverted away from each Borrow Pit. However rain water that is collected in the Borrow Pits would need to be managed appropriately.

Potential impacts on flooding for the operational phase include re-distribution of flood flows due to diversion which can impact on scouring and bank erosion.

Once the Borrow Pits are stabilised, the final landform would be designed to be free draining so that they do not form permanent water bodies.

Ravensworth ash line

The alignment of the Ravensworth ash line crosses Chilcotts Creek, Pikes Creek and Bayswater Creek. Without mitigation or controls, should failures occur within the pipeline during operation, discharges of contaminated slurry water may result in impacts to the surrounding waterways. However, as the majority of the ash line length is above-ground, if leaks occur, they will be able to be detected through routine inspections and fixed. The pipeline will be designed and constructed in a manner that reduces the likelihood of leaks, this approach has been endorsed by the EPA. Additionally, operation of the pipeline will follow a maintenance regime to further reduce the likelihood of leaks. If underground sections of the ash line were to leak, potential sensitive receptors in the areas of underground pipe lengths are limited to low potential GDEs at creek crossings. Construction in accordance with industry standards would limit the likelihood of leaks and potential leakage is only applicable during the life of ash transport. After ash transport stops, there would be no leakage.

CHP Water and Wastewater infrastructure upgrades

Discharges (overflows) to Tinkers Creek currently occur on a daily basis from the CHP sediment basin. CHP water and wastewater infrastructure upgrades are proposed as part of the Project and in response to Condition U2 of EPL 779, which requires an environmental improvement program at Bayswater to, amongst other things, reduce the quantity and improve the quality of discharges to Tinkers Creek from the sediment basin and associated systems.

Upgrades as part of the Project may include implementing operational reuse of the coal plant water system through alterations/upgrades to the CHP such as belt cleaners, scrapers, trays and controls systems, and the construction of clean water diversions to reduce stormwater inflows to the CHP sediment basin. Existing water management systems, including the monitoring of the volume and quality of discharges to Tinkers Creek, would continue to operate.

The proposed upgrade works are being undertaken in response to Condition U2 of EPL 779 (AECOM, 2017a). Discharges would be regulated in accordance with existing licence requirements and would be regulated by EPA.

Overall the Project is expected to have a positive impact on the volumes of water being discharged to Tinkers Creek and Lake Liddell.

8.3 Environmental management measures

Environmental management measures relating to surface water and hydrology impacts are outlined in Table 8-1.

Table 8-1 Environmental management measures – surface water and hydrology impacts

Ref	Environmental management measure	Timing
SW01	An overarching Construction Environmental Management Strategy (CEMS) would be prepared for the Project and would require the preparation of a Construction Environmental Management Plan (CEMP) for each Project component. The CEMS would outline measures to manage soil and water impacts associated with the construction works. The CEMS would require that each CEMP would provide: • Measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans for all progressive stages of construction • Measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation • Measures to manage groundwater dewatering and impacts • Processes for dewatering of water that has accumulated on site and from sediment basins, including relevant discharge criteria • Measures to manage accidental spills including the requirement to maintain materials such as spill kits • Measures to manage potential saline soils • Details of surface water and groundwater quality monitoring to be undertaken prior to, throughout, and following construction • Controls for receiving environments including: Designation of 'no go' zones for construction plant and equipment Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to ensure containment of sediment-laden runoff and diversion toward sediment sump treatment areas (not sediment basins) to prevent flow of runoff to nearby waterways.	Pre-construction Construction
SW02	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 (Department of Environment, Climate Change and Water, 2008), commonly referred to as the "Blue Book". Additionally, any water collected from worksites would be treated and discharged (where able) to avoid any potential contamination or local storm water impacts. Measures would be designed in accordance with the relevant guideline where appropriate.	Construction
SW03	Alternative water supply options to potable water would be investigated, with the aim of using recycled water where feasible. Measures would be implemented to reduce reliance on potable water use for both construction and operational phases of the Project where possible noting that AGL obtains the majority of its water from the Hunter River under AGL's existing Macquarie Generation Water Licensing Package dated April 2011. No additional water is required for the Project outside of this Water Licensing Package. Water use requirements and sources would be reviewed during the detailed design and construction planning, documented in each CEMP and implemented throughout the Project. Any existing Water Management Plans would be updated to incorporate any altered water use requirements during operational stages of the Project.	Construction Operation

Ref	Environmental management measure	Timing
SW04	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 Operation
SW05	A construction water quality monitoring program would be developed where appropriate and included in each CEMP for the Project to, observe any changes in surface water and groundwater during construction, and inform appropriate management responses. The program would be based on the water quality monitoring methodology, water quality indicators and the monitoring locations outlined in the CEMS. Sampling locations and monitoring methodology to be undertaken during construction would be further developed in detailed design in accordance with the *ANZECC water quality guidelines* (ANZECC/ARMCANZ (2000). It may include collection of samples for analysis from key locations, visual monitoring of other points of release of construction waters and monitoring of downstream waterways where appropriate. The monitoring frequency during construction would be confirmed during detailed design however would include at least monthly construction monitoring at all monitoring sites which would be preferentially monitored following wet weather events. Should the results of monitoring identify that the water quality management measures are not effective in adequately mitigating water quality impacts, additional mitigation measures would be identified and implemented as required.	Prior to construction, and during construction and operation
SW06	The Bayswater site operational water quality monitoring program would be updated and implemented as required.	Prior to operation and during operation
SW07	The specific requirements for water quality controls would be confirmed as the detailed design develops and prior to commencement of construction of each Project element to ensure the objectives of the Project are achieved.	Prior to Construction
SW08	The following measures would be undertaken to manage activities in proximity to waterways: • Works within waterfront land would be managed in accordance with the relevant guideline as deemed appropriate; • Implementing practices to minimise disturbance of banks and undertaken bank stabilization; and • Appropriate drainage features would be incorporated into the design of the Project elements by a suitably qualified and experienced professional. All Project elements would be designed and constructed in accordance with relevant guidelines.	Prior to construction and during construction
SW09	Borrow Pits would be designed to comply with design specifications to minimise interference and disruption of natural surface water flows and water quality, particularly impacts on turbidity.	All

Ref	Environmental management measure	Timing
SW10	Routine inspections and monitoring of the Ravensworth Ash line would be undertaken to ensure any leakages are promptly identified and fixed.	Operation
F01	Temporary works would consider flood risks during construction. Should construction staging require a temporary departure from the design (e.g. higher embankments for preloading, temporary diversions or temporary crossings of waterways), flood impacts would be assessed before finalising the approach.	Construction
F02	Where stockpiles are to be located in the floodplain, they would be located and sized to ensure no adverse impacts on flood behaviour.	Construction Operation
F03	Flood management controls would be included as part of each CEMP. The controls would consider likelihood of flooding, flood evacuation routes, warning times and potential impacts from flooding from the Project. It would include, but not be limited to: • Any monitoring requirements to provide advance notice of a flood event • Procedures (e.g. dam safety emergency plan) to be implemented in the event of a flood • Required training and staff inductions.	Prior to Construction Construction
F04	Temporary crossings on water courses would be designed with consideration of flooding during construction and removal and rehabilitation following completion of construction.	Prior to Construction Construction
F05	Dam break inundation maps would be prepared based on two-dimensional hydraulic modelling software based on the current relevant guidelines presented in Australian Rainfall and Runoff (Ball J et al, 2019), ANCOLD and guidelines acceptable to Dams Safety NSW. The inundation maps would be utilised to confirm the consequence category for the dam.	Prior to Construction
F06	A detailed assessment of the flood handling capacity for the BWAD would be undertaken for each of the augmentation stages based on the current guidelines presented in Australian Rainfall and Runoff (Ball J et al, 2019). The consequence categories for each of the augmentation stages would be reassessed and inundation maps prepared to inform the Dam Safety Emergency Plan.	Prior to Construction
F07	A flooding assessment based on current guidelines from the Australian Rainfall and Runoff and using a two-dimensional hydraulic modelling software would be undertaken for: • The proposed Borrow Pits, to consider possible re-distribution of flood flows due to diversion and which may impact on scouring and bank erosion. • The Salt cake landfill, to demonstrate that the salt cake landfill facility would have no adverse impacts on flood behaviour up to and including the 1% AEP event.	Prior to Construction
F08	The design of the Ravensworth Ash line would confirm that the pipeline would have no adverse impacts on flood behaviour and the pipeline would be unlikely to be damaged or destroyed up to the designed storm event.	Prior to Construction

9. Groundwater

This chapter summarises the findings of the Surface Water, Groundwater and Flooding Technical Paper' (Jacobs, 2020a) (Appendix D)*, which was undertaken to consider impacts to groundwater as a result of the Project.*

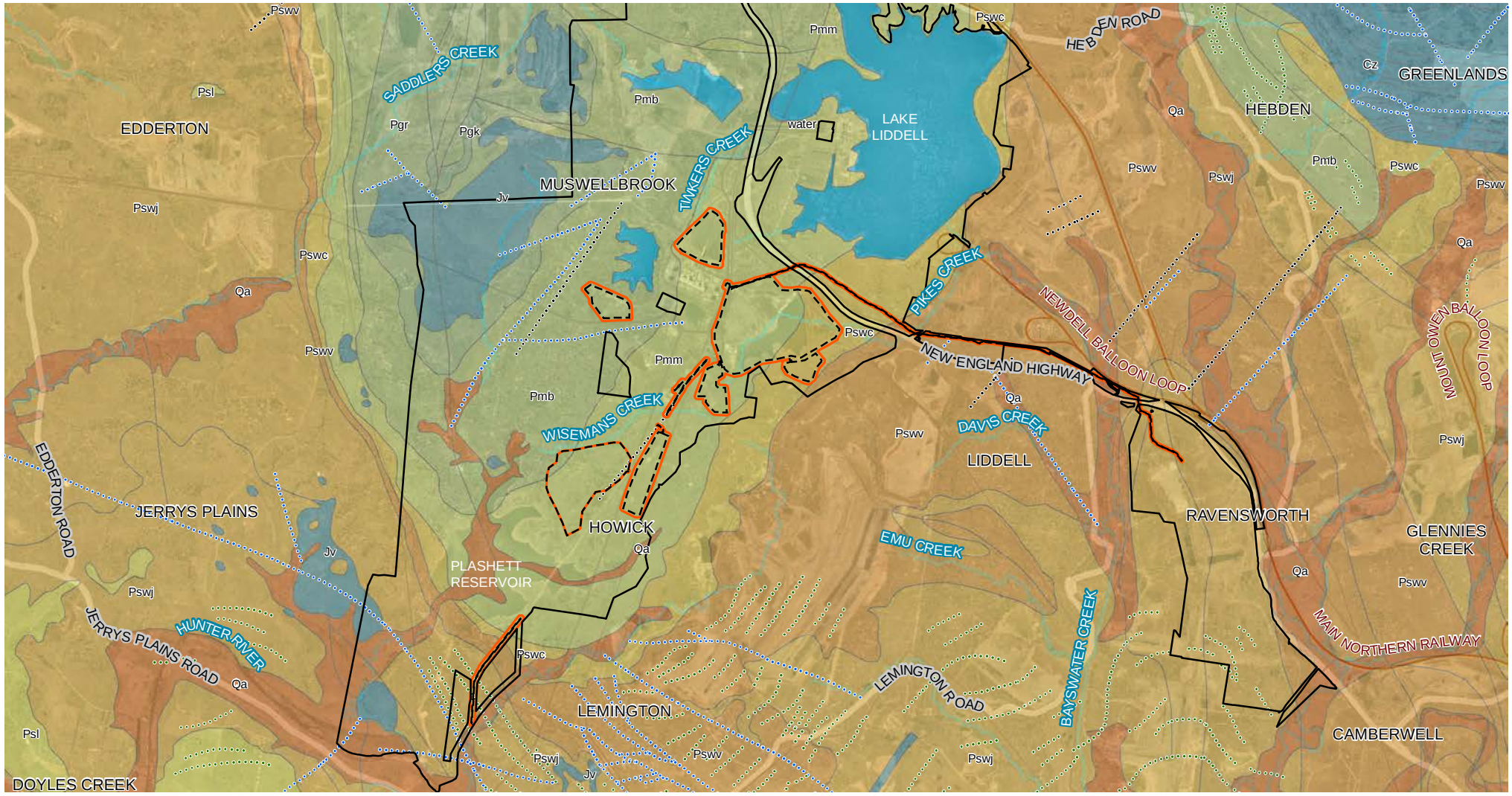
- *an assessment of the likely impacts of the development (including flooding) on the quantity and quality of the region's surface and groundwater resources, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;*
- *details of water requirements and supply arrangements for construction and operation;*
- *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 in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).*

In accordance with Department of Industries requirements, detailed site water balance modelling has also been undertaken, the findings of which are summarised where relevant in this Chapter. The full assessment is provided in Appendix E.

9.1 Existing environment

9.1.1 Geology

The *1:100,000 Hunter Coalfield Regional Geology map* (Department of Mineral Resources, 1993) indicates that surface geology in the vicinity of the Project comprises sedimentary rock, with some limited areas mapped as Quaternary Alluvium as illustrated in Figure 9-1.



Study area
Proposal area
AGL owned land
Structure
Fault
Dyke
Cz
Jv
Pgk
Pgr
Pmb
Pmm
Psl
Pswc
Pswj
Pswv
Qa
water

0 1 2 km

1:100,000 at A4

Data sources

Jacobs 2019, AGL 2019, NSW Spatial Services 2019, DIRE

GDA94 MGA56

Figure 9-1 Geology

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9.1.2 Hydrogeology

Registered groundwater bores

Bore data provided by WaterNSW (WaterNSW, 2019) was reviewed to investigate registered groundwater bores and associated groundwater level records in the locality. The review identified 35 registered groundwater bores within the surrounding lands. Licensed groundwater bore locations are shown in Figure 9-2 and summarised in Table 9-1.

The purpose of the 35 bores is summarised as follows:

- Water supply for manufacturing and industry (i.e. Commercial/industrial) – 2 bores
- Dewatering – 2 bores
- Monitoring – 29 bores
- Unknown – 2 bores

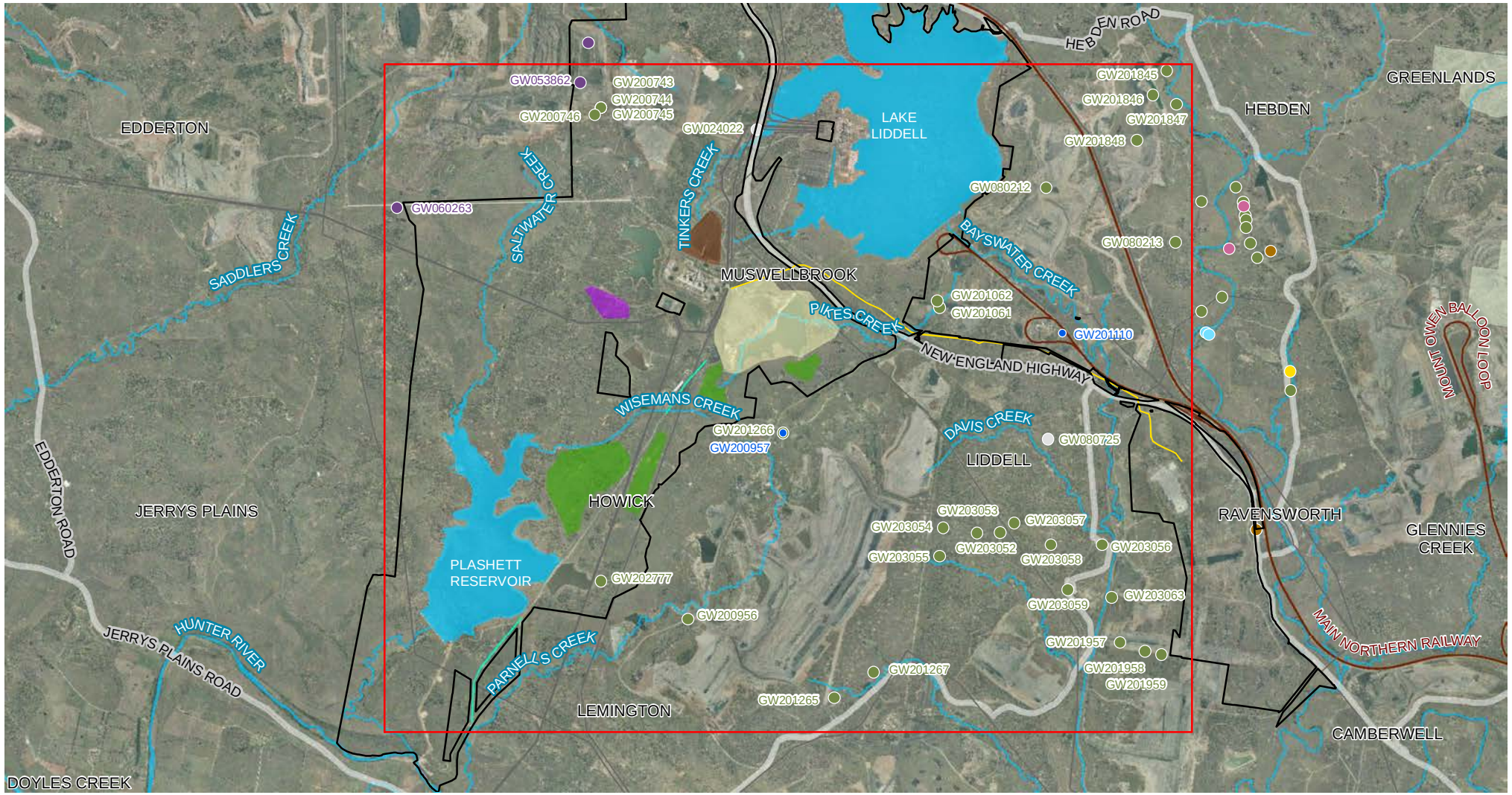
The two commercial/industrial bores, GW053862 and GW060263, are both located approximately 3.6 km north-west of their closest Project elements (Salt cake landfill and CHP). The closest dewatering bore to the Project elements, GW20110, is located approximately 450 metres north of the Ravensworth Ash line. The closest monitoring bore to the Project elements, GW201061, is located approximately 500 metres north of the Ravensworth Ash line.

Standing water levels for the bores ranged from 3 to 43 mBGL (16 mAHD to 182 mAHD).

Table 9-1: Licensed bore summary information

Bore ID	Easting (m)	Northing (m)	Purpose	Approximate ground elevation (mAHD)	Drilled Depth (mBGL)	Standing Water level (mBGL)
GW024022	308245	6416589	Unknown	139.66	3	NULL
GW053862	305106	6417425	Manufacturing and industry	196.15	99	NULL
GW060263	301855	6415205	Manufacturing and industry	260.38	61	NULL
GW080212	313389	6415560	Monitoring	119.05	0	NULL
GW080213	315687	6414594	Monitoring	110.88	0	NULL
GW080725	313424	6411091	Unknown	89.9	130	43
GW200743	305476	6416977	Monitoring	194.16	114	NULL
GW200744	305476	6416977	Monitoring	194.16	196	14
GW200745	305476	6416977	Monitoring	194.16	119	9
GW200746	305371	6416853	Monitoring	203.5	133	28
GW200956	307024	6407896	Monitoring	142.75	97	NULL
GW200957	308715	6411207	Drainage of groundwater	191.6	60	NULL

Bore ID	Easting (m)	Northing (m)	Purpose	Approximate ground elevation (mAHD)	Drilled Depth (mBGL)	Standing Water level (mBGL)
GW201061	311490	6413430	Monitoring	111.79	15	NULL
GW201062	311451	6413551	Monitoring	109.76	17	NULL
GW201110	313676	6412975	Drainage of groundwater	92.67	48	NULL
GW201265	309624	6406493	Monitoring	117.04	74	NULL
GW201266	308715	6411207	Monitoring	160.47	60	NULL
GW201267	310326	6406955	Monitoring	113.58	43	NULL
GW201845	315528	6417638	Monitoring	0	22	3.1
GW201846	315281	6417210	Monitoring	0	23	NULL
GW201847	315703	6417043	Monitoring	0	21	4.8
GW201848	314994	6416402	Monitoring	0	22	4.56
GW201957	314700	6407480	Monitoring	0	78	NULL
GW201958	315140	6407325	Monitoring	0	71	NULL
GW201959	315440	6407265	Monitoring	0	69	NULL
GW202777	305476	6408573	Monitoring	0	854	NULL
GW203052	312568	6409432	Monitoring	0	202	NULL
GW203053	312157	6409431	Monitoring	0	200	NULL
GW203054	311561	6409524	Monitoring	0	200	NULL
GW203055	311490	6409008	Monitoring	0	200	NULL
GW203056	314380	6409215	Monitoring	0	262	NULL
GW203057	312820	6409605	Monitoring	0	248	NULL
GW203058	313476	6409215	Monitoring	0	251	NULL
GW203059	313768	6408418	Monitoring	0	248	NULL
GW203063	314548	6408282	Monitoring	0	300	NULL



Groundwater Impact Assessment Study Area (approximately 14km x 12km)
AGL owned land

Project elements:
- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Salt Cake Landfill
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Ravensworth Ash Line

Borehole purpose
- Commercial and industrial
- Drainage of groundwater
- Exploration or research
- Household
- Irrigated agriculture
- Manufacturing and industry
- Monitoring
- Unknown

0 1 2 km

1:100,000 at A4

N

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 9-2 Licensed surrounding groundwater bores

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Groundwater levels within the Project area

Within Bayswater, there are 26 existing monitored groundwater bores located in proximity to the Project. These are outlined in Table 9-2 and shown in Figure 9-3. An additional drilling programme was carried out between September and October 2019 to collect data within the proposed Borrow Pit areas (Jacobs, 2019a). The drilling programme included drilling 15 shallow boreholes, with nine completed as groundwater monitoring bores. The data from these bores (as presented within Table 9-2) was used to update the groundwater conceptualisation in the areas of the proposed Borrow Pits. The location of the drilling programme bore locations are shown in Figure 9-4.

The existing groundwater data indicates that average groundwater depths ranged from 0.4 mBGL to 11.5 mBGL. It must be noted that the relatively shallow groundwater depths are a result of the bores being located in relatively low-lying land. There are Project elements situated in areas of relatively high elevation, such as significant portions of the Borrow Pits 1 and 2. For these elevated areas, the depth to groundwater is anticipated to be significantly deeper than the depths to groundwater outlined in Table 9-2.

Groundwater was not observed during drilling any of the additional boreholes. Approximately one month after the drilling, groundwater was observed in JBP_MW102, JBP_MW104, JBP_MW106 and JBP_MW109 on 29 October 2019. All other groundwater monitoring wells were dry.

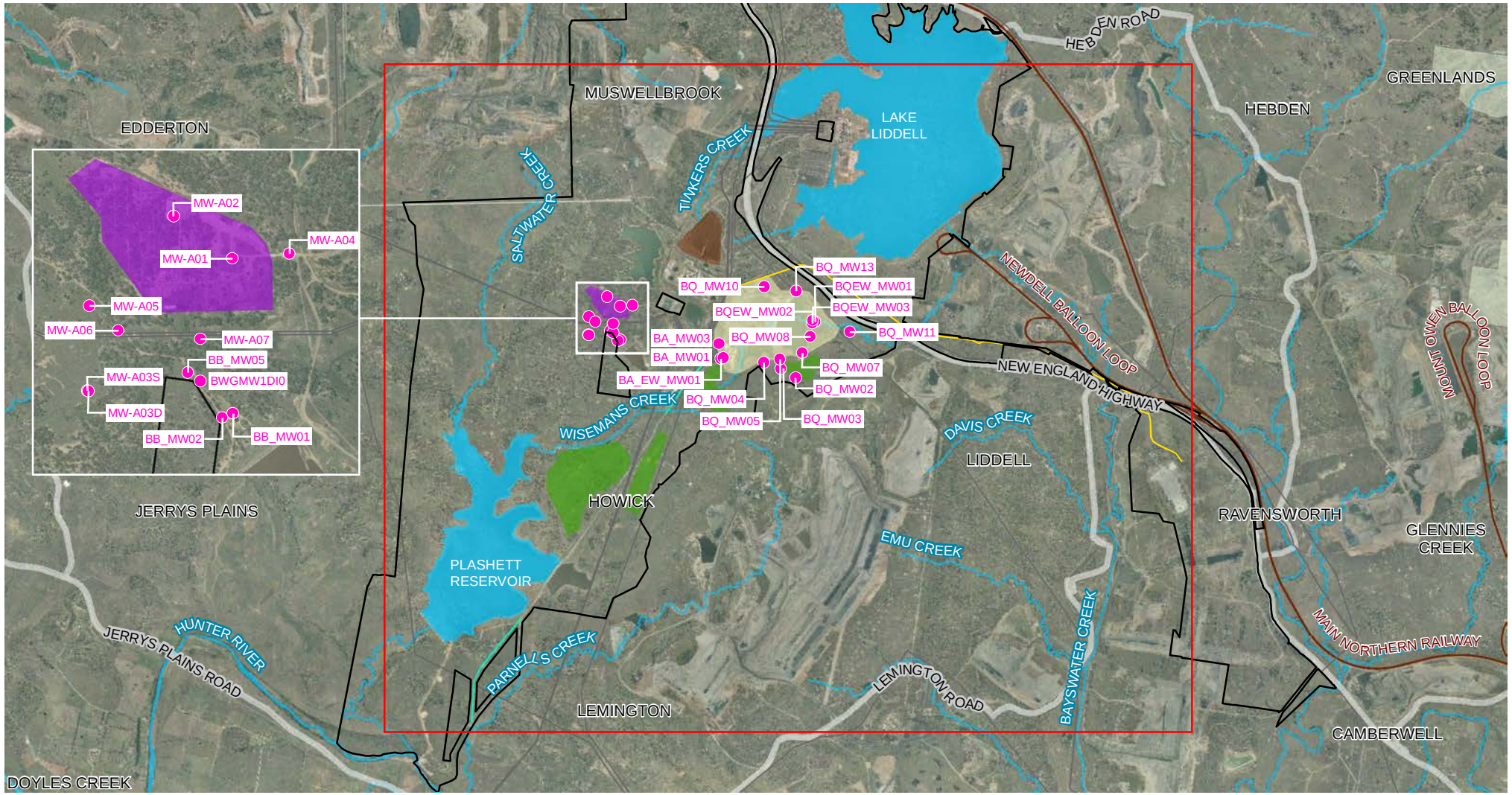
Table 9-2: Summary of borehole details and groundwater levels for existing and additional Project groundwater monitoring bores

Bore ID	Existing / additional	Associated Project element	Elevation (mAHD)	Average depth to water (mBGL)	Screen depth (mBGL)	Screened lithology
BA_EW_MW01	Existing	BWAD	182.69[a]	4.03[a]	-	-
BA_MW01	Existing	BWAD	182.30[b]	6.00	5.5 - 8.5	Clay
BA_MW03	Existing	BWAD	174.29[b]	-0.26	2.0 - 5.0	Shale, generally completely weathered, wet from 3 mBGL
BB_MW01	Existing	Salt cake landfill	170.74[b]	1.93	1.7 - 4.7	Silty clay, sandy clay, gravelly sandy clay
BB_MW02	Existing	Salt cake landfill	172.85[b]	4.13	6.2 - 9.2	Sandstone, sandy clay
BB_MW05	Existing	Salt cake landfill	164.43[b]	1.19	1.0 - 3.0	Sandy clay
BQEW_MW01	Existing	BWAD	134.22[a]	1.09[a]	-	-
BQEW_MW02	Existing	BWAD	135.16[a]	-0.02[a]	-	-
BQEW_MW03	Existing	BWAD	134.65[a]	0.38[a]	-	-
BQ_MW02	Existing	Borrow Pits 1 & 2	148.55[b]	3.71	2.7 - 5.7	Clay
BQ_MW03	Existing	Borrow Pits 1 & 2	158.11[b]	2.32	2.7 - 5.7	Clay
BQ_MW04	Existing	Borrow Pits 1 & 2	178.75[b]	8.58	7.0 - 10.0	Siltstone

Bore ID	Existing / additional	Associated Project element	Elevation (mAHD)	Average depth to water (mBGL)	Screen depth (mBGL)	Screened lithology
BQ_MW05	Existing	BWAD	174.74[b]	7.42	4.5 - 7.5	Shale, sandy clay
BQ_MW07	Existing	BWAD	177.00[b]	9.58	7.0 - 10.0	Shale, sandy clay
BQ_MW08	Existing	BWAD	151.80[b]	3.66	3.5 - 6.5	Sandy clay
BQ_MW10	Existing	BWAD	156.31[b]	-0.51[^]	3.5 - 5.3	Gravel
BQ_MW11	Existing	BWAD	127.92[b]	1.70	2.0 - 5.0	Clay
BQ_MW13	Existing	BWAD	173.51[b]	4.61	2.8 - 5.8	Silty clay
MW-A01	Existing	Salt cake landfill	186.71[a]	11.46	8.0 - 14.0	Silty clay (possibly weathered siltstone) and siltstone
MW-A02	Existing	Salt cake landfill	192.04[a]	11.36	16.0 - 19.0	Siltstone
MW-A03D	Existing	Salt cake landfill	161.29[a]	1.72	11.0 - 14.0	Silty clay, Clayey gravel
MW-A03S	Existing	Salt cake landfill	161.26[a]	2.43	3.0 - 6.0	Siltstone
MW-A04	Existing	Salt cake landfill	192.06[a]	6.58	12.0 - 15.0	Siltstone
MW-A05	Existing	Salt cake landfill	168.99[a]	6.46	9.0 - 12.0	Siltstone
MW-A06	Existing	Salt cake landfill	168.74[a]	6.22	11.0 - 17.0	Siltstone

Bore ID	Existing / additional	Associated Project element	Elevation (mAHD)	Average depth to water (mBGL)	Screen depth (mBGL)	Screened lithology
MW-A07	Existing	Salt cake landfill	174.99[a]	4.01	19.0 - 25.0	Siltstone
BR_MW01	Existing	Ravensworth ash line	104.96	-	49.0 – 52.0	Sandstone
BY_MW20	Existing	Ravensworth ash line	149 [a]	-	NA – soil bore	NA – soil bore. Borehole drilled to 10 mBGL through sandy silt, sandy clay, shale and siltstone. All material dry
JBP_BH101	Additional	Borrow Pit 1	157.65	N/A	N/A	
JBP_BH102	Additional	Borrow Pit 1	176.02	N/A	N/A	
JBP_BH103	Additional	Borrow Pit 1	161.42	N/A	N/A	
JBP_BH104	Additional	Borrow Pit 2	196.48	N/A	N/A	
JBP_BH105	Additional	Borrow Pit 2	209.97	N/A	N/A	
JBP_BH106	Additional	Borrow Pit 4	162.52	N/A	N/A	
JBP_MW101	Additional	Borrow Pit 1	154.22	-	1.50 – 1.91	
JBP_MW102	Additional	Borrow Pit 2	186.65	4.13	1.37 – 4.37	
JBP_MW103	Additional	Borrow Pit 3	153.64	-	1.30 – 4.30	
JBP_MW104	Additional	Borrow Pit 3	155.69	3.25	2.91 – 5.91	
JBP_MW105	Additional	Borrow Pit 3	162.27	-	1.20 – 4.20	

Bore ID	Existing / additional	Associated Project element	Elevation (mAHD)	Average depth to water (mBGL)	Screen depth (mBGL)	Screened lithology
JBP_MW106	Additional	Borrow Pit 4	140.95	4.34	3.94 – 5.94	
JBP_MW107	Additional	Borrow Pit 4	145.69	-	1.00 – 2.00	
JBP_MW108	Additional	Borrow Pit 4	133.08	-	1.10 – 4.10	
JBP_MW109	Additional	Borrow Pit 4	140.29	6.51	4.80 – 7.75	



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AGL owned land

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- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Ravensworth Ash Line

0 1 2 km

1:100,000 at A4

N

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 9-3 Key site groundwater monitoring bores used for impact assessment

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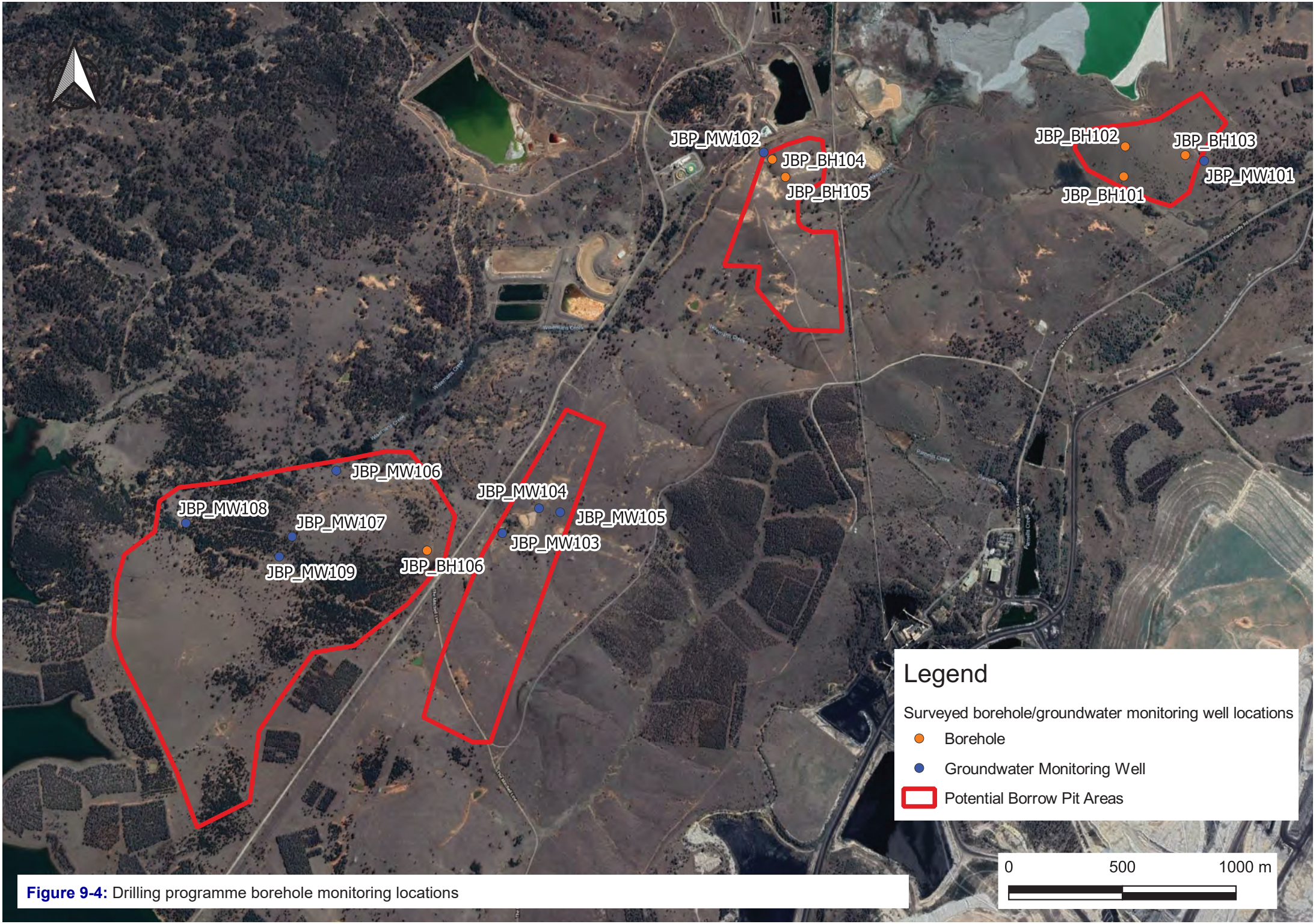


Figure 9-4: Drilling programme borehole monitoring locations

Groundwater quality

Existing groundwater quality is well understood from the data from the existing groundwater bores within the study area. Groundwater quality was not tested from the additional groundwater monitoring bores, due to:

- the extent of existing data available, and
- the proposed Borrow Pits would not intersect with the regional water table.

The data from the existing bores was analysed 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). Further details are presented in Appendix B of Appendix D (Jacobs, 2020a). 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 and
- TRH, BTEXN, PAHs and PCBs concentrations were all below the laboratory detection limits.

Groundwater quality for the BWAD bores, Salt cake landfill bores and bores on the periphery of Borrow Pit 1 are summarised within Appendix C of Appendix D (Jacobs, 2020a).

9.2 Assessment of impacts

9.2.1 Construction

It is not proposed to extract any groundwater for construction use. 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 spills or leaks of hazardous materials occurring during construction and migrating to the water table. Such spills/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. However, a conceptual groundwater model was developed to assist in the identification of potential impacts on groundwater. This conceptual groundwater model was developed for the Project elements, showing a relatively high likelihood of potentially impacting groundwater system at the proposed Salt cake landfill facility and proposed Borrow Pit areas without appropriate mitigation measures being put in place.

Further information is outlined below as well as within Appendix D.

Salt cake landfill

As outlined in Section 2.3 the proposed Salt cake landfill would be constructed in accordance with NSW EPA (2016) guidelines for solid waste landfills and therefore would have a leachate barrier system. However, if a leak does occur, potential applicable surrounding sensitive receptors include the EEC and CEEC vegetation (if these vegetation communities take up saline water from the saturated or unsaturated zone) and down-gradient ephemeral drainage lines and creeks could be impacted. This is discussed further below.

Borrow Pits

Construction of the Borrow Pits would be limited to extraction of materials above the water table, as detailed in Section 2.4. Therefore, it is not anticipated that the proposed works would result in interception of groundwater and subsequent groundwater level drawdown. However mitigation measures are proposed to limit the risk of the Borrow Pits intercepting groundwater (see Section 9.3).

Ravensworth ash line

The majority of the proposed Ravensworth ash line would be constructed above ground. However, there are sections that would be installed below ground through trenching or underboring to avoid impacting existing infrastructure and watercourses, including the New England Highway and roadways, Pikes Creek and Pikes Gully Road.

The conceptual groundwater model did not identify that construction of the Ravensworth ash line would pose a risk to groundwater. Boreholes within the vicinity of the proposed Ravensworth ash line (BR_MW01 and BY_MW20) were drilled up to 10 mBGL and did not encounter groundwater. It is therefore considered unlikely that groundwater would be encountered during trenching. Nevertheless, where trenchless construction (underboring) is adopted, the following potential impacts may occur:

- If underbore excavations intercept groundwater, drilling fluids could contaminate groundwater systems and
- Drilling fluid may escape and enter the environment if there is a spill or frac-out (drilling intercepting faults and fractures in the rock) during underboring.

The boring process would monitor the pressure of the drilling fluid to ensure there is no sudden decrease in pressure.

9.2.2 Operation

Once operational, the upgrade of infrastructure within Bayswater would reduce the risk of failure from aging infrastructure, and thus reduce risks to groundwater and the surrounding environment in general.

Salt cake landfill

As outlined in Section 2.3, the proposed design of the Salt cake landfill includes turkeys nest style landfill cells in order to minimise water ingress. In addition, the landfill would be managed in accordance with the NSW EPA *Environmental Guidelines for solid waste landfills* (EPA, 2016).

Despite this, salt cakes placed in the landfill facility would be a potential source of salt created by the interaction with rainfall creating saline or briny water. The maximum possible total dissolved solids concentration of brine water is approximately 260,000 mg/L, which is about seven times more saline than seawater.

The area of the proposed landfill is elevated and has minimal upslope catchment. Once in the groundwater, saline or brine migration would be towards the south and then along the directional surface water flow path to Plashett Reservoir.

An assessment of possible groundwater impacts has been undertaken in accordance with the NSW Aquifer Interference Policy (NSW Department of Primary Industries, 2012), which has included consideration of:

- long-term water table drawdown or groundwater pressure head reduction and
- downstream impacts to GDE.

Salt migration modelling was undertaken, quantitatively, using two-dimensional cross section flow model, SEEP/W, coupled to C/TRAN, a solute transport model to consider potential downstream impacts to sensitive receptors surrounding the landfill in the event of landfill lining failure.

Surrounding sensitive receivers include:

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- Central Hunter Valley eucalypt forest and woodland CEEC and
- An unnamed ephemeral drainage line which extends from downslope of the proposed landfill, before its confluence with Saltwater Creek. Saltwater Creek flows into Plashett Reservoir.

Overall, no long-term water table drawdown or groundwater pressure head reduction is anticipated to occur as a result of the Project. Therefore, the Project is considered to meet the NSW aquifer interference policy (DPI , 2012) minimal impact consideration. High priority GDEs are not mapped near the site and are therefore not relevant.

In the event of a liner failure, saline/briny water was modelled to migrate from the landfill beyond a distance of 40 metres. The concentrations associated with the saline/briny water are such that the beneficial use category of the groundwater source may be lowered. Therefore, the Project is assessed to not meet the NSW Aquifer Interference Policy (DPI, 2012) minimal impact consideration with regards to groundwater quality. However, the potential change to groundwater salinity is not anticipated to affect the long-term viability of the dependent ecosystem (EECs and CEECs). Further details are provided in Section 7 and Appendix D.

A groundwater monitoring plan would be implemented for the Salt cake landfill to enable identification of potential salt migration. Monitoring and reporting would be undertaken on an annual basis. Further details are provided in Section 8.2 of Appendix D.

Borrow Pits

It is assumed that the operation of the Borrow Pits would be managed to ensure no interactions with groundwater would occur. The design of the proposed Borrow Pits would avoid areas with shallow groundwater. Therefore, it is not considered that there would be any operational impacts associated with the extraction of materials from the Borrow Pits.

However, if groundwater is unexpectantly intersected during Borrow Pit excavations, excavations should cease in that area and the date, location, level and depth of groundwater interception should be documented and conveyed to a suitably qualified hydrogeologist. The hydrogeologist must then determine an appropriate course of action depending on the specifics of the situation. Such a course of action may include re-location of excavations to elevated areas, where groundwater is likely to be deeper and establishment of routine of groundwater monitoring via bores in the vicinity of the Borrow Pits.

9.3 Environmental management measures

Environmental management measures relating to groundwater impacts are outlined in Table 9-3.

Table 9-3 Environmental management measures – groundwater impacts

Ref	Environmental management measure	Timing
GW01	Design Borrow Pit areas to avoid areas with shallow groundwater.	Prior to construction
GW02	If groundwater is unexpectantly intersected during Borrow Pit excavations, excavations should cease in that area and the date, location, level and depth of groundwater interception should be documented and conveyed to a hydrogeologist to determine an appropriate course of action.	Construction
GW03	During detailed design, salt cake landfill design should ensure leachate and salt cakes would not geochemically compromise the elected liner type due to reactions. Since the salt is reported by the proponent to predominantly comprise gypsum, there may be a risk that this material (and leachate) could interact with clay liners and result in compromised liner integrity.	Prior to construction

Ref	Environmental management measure	Timing
GW04	If drilling fluids are required, where possible, freshwater would be used. Where this is not possible, environmentally friendly biodegradable drilling fluid would be used where possible.	Construction
GW05	The above-ground sections of the Ravensworth ash line would be routinely checked for leaks. Observed leaks would be rectified.	Construction and operation
GW06	To minimise the risk of spills/leaks of hazardous materials, the following would be undertaken: • Regular plant maintenance and checks • Onsite spill kits and established spill clean-up procedures, which would include: • Having adequate spill prevention and absorbent materials (including absorbent pads, absorbent booms, granular absorbent and disposal bags) onsite to manage spills and leaks of potential pollutants • Provision of appropriate equipment and materials to capture any drips and spills which occur during the transfer of potential pollutants, and when carrying out maintenance of hydrocarbon filled plant and equipment • Procedures which ensure that spills of potential pollutants are contained and cleaned up immediately. Such spillage must not be cleaned up by hosing, sweeping, or otherwise releasing contaminants to any watercourse, waterway or groundwater • Routine toolbox talks and safe work method statements which cover spill management protocols. Remediation of potential contamination sources and where possible removal of the contamination source (e.g. through offsite removal and disposal to an appropriately licensed waste facility).	Construction and operation
GW07	The BWAD seepage flow rate should be monitored during construction and operation, as well as the effectiveness of the two ash dam seepage collection dams. If monitoring indicates that after implementation of the proposed upgrades to the seepage collection dams that the dams are not effectively collecting seepage, then additional seepage collection dam upgrades should be made, or alternatively, the seepage collection system be re-designed and re-constructed.	Construction and operation

10. Air quality

This chapter summarises the Air Quality Impact Assessment (provided in full in Appendix F). This assessment was undertaken to address the air quality component of the SEARs for the Project which requires a quantitative assessment of potential:

- construction and operational air quality impacts with a particular focus on dust emissions including PM2.5 and PM10 emissions and dust generation from ash transport
- Reasonable and feasible mitigation measures to minimise dust emissions, including evidence that there are no other available measures
- Monitoring and best practice management measures, in particular real-time air quality monitoring.

10.1 Assessment methodology

This chapter considers the potential air quality impacts from the construction, operation and decommissioning of the Project, and summarises the findings of the Air Quality Impact Assessment (Jacobs, 2019c) carried out for the Project (see Appendix F).

The Air Quality Impact Assessment followed the EPA's Approved Methods which specifies how assessments based on the use of air dispersion models should be undertaken. The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model. The model comprises meteorological modelling as well as dispersion modelling.

Meteorological data collected in 2017 from AGL's surface stations and upper air data generated by The Air Pollution Model were used to initialise the CALMET model. CALMET was then set up with two surface observation stations (AGL08 and AGL09) and one upper air station (AGL08), based on TAPM output at AGL09.

Dispersion modelling was performed using the emission estimates (see Section 10.3) and using the meteorological information provided by the CALMET model. Predictions were made at 639 discrete receptors (including the 11 nearby sensitive receptors shown in Figure 10-1) to allow for contouring of results. Further details, including the locations of the model receptors are shown in Appendix F.

10.2 Existing environment

10.2.1 Surrounding land use and receivers

As outlined in Section 1.4, the surrounding landscape is heavily influenced by industrial activity. Local land use is dominated by large-scale infrastructure associated with Bayswater and Liddell and opencast mining activities at Ravensworth Mine Complex, Mount Arthur Coal, Hunter Valley Operations, Liddell Coal Mine and the former Drayton Mine.

Figure 10-1 displays land uses around the Project, including the location of nearby sensitive receiver locations and nearby meteorological and ambient air quality monitoring stations. Eleven representative receiver locations were established, which denote the nearest sensitive receiver locations in different directions from the Project. Details of these locations are listed in Table 10-1 below.

Table 10-1 Surrounding representative receivers

Receiver ID	X co-ordinate (UTM MGA Zone 56)	Y co-ordinate (UTM MGA Zone 56)	Approximate orientation from the Project	Approximate distance from the Project (metres)
RR01	306177	6421554	North	6,400
RR02	316337	6419837	Northeast	9,300
RR03	318041	6411978	East	8,500
RR04	320245	6405818	East southeast	12,500
RR05	316832	6403296	Southeast	11,500
RR06	313729	6403903	South southeast	9,000
RR07	307735	6402915	South	4,900
RR08	302782	6404017	South southwest	1,800
RR09	300275	6406687	Southwest	2,600
RR10	300383	6407252	Southwest	2,500
RR11	295636	6412963	West	9,000

10.2.2 Ambient air quality

To fully assess impacts against the relevant air quality criteria, it is necessary to have information or estimates of the existing air quality conditions. This section provides a description of the existing air quality.

The Air Quality Impact Assessment collated air quality pollutant data from 27 nearby air quality monitoring stations. These are operated by a number of parties including AGL, Glencore Liddell Coal Operations , Glencore Ravensworth Complex, Glencore Mount Owen Complex, Yancoal Hunter Valley Operations (**HVO**), Peabody Wambo Open-Cut Mine, Mount Arthur Coal (**MAC**), and DPIE. Some data from monitoring stations ranged from 2015 to 2018, while other data collected was from 2017 to 2018 only. The location of ambient air quality monitors within the vicinity of the Project are shown on Figure 10-1.

Total suspended particulates (TSP)

TSP is monitored at HVAS20 and HVAS11 for Glencore's Liddell Coal Operations, as well as at HVAS 4, HVAS 5 and HVAS 2/19 for Glencore's Ravensworth Complex. Results collected are presented in Glencore's Annual Environmental Management Review reporting available for Liddell Coal Operations (Glencore, 2019a) and Ravensworth Complex (Glencore, 2019b). These are summarised below in Table 10-2.

Table 10-2 Glencore LCO and RC TSP monitoring results, 2015 to 2018

Year	Measured annual TSP (µg/m3)					Criterion (µg/m3)
	Glencore LCO HVAS20	Glencore LCO HVAS11	Glencore RC HVAS 4	Glencore RC HVAS 5	Glencore RC HVAS 2/19	
2018	59	44	84	71	80	90
2017	33	45	68	59	68	
2016	47	31	59	54	62	
2015	44	29	62	55	57	

As displayed, for 2015 to 2018 inclusive, annually measured TSP at Glencore Liddell Coal Operations and Ravensworth Complex were below the NSW EPA's 90 µg/m^3 criterion and varied between 32% and 93% of the criterion.

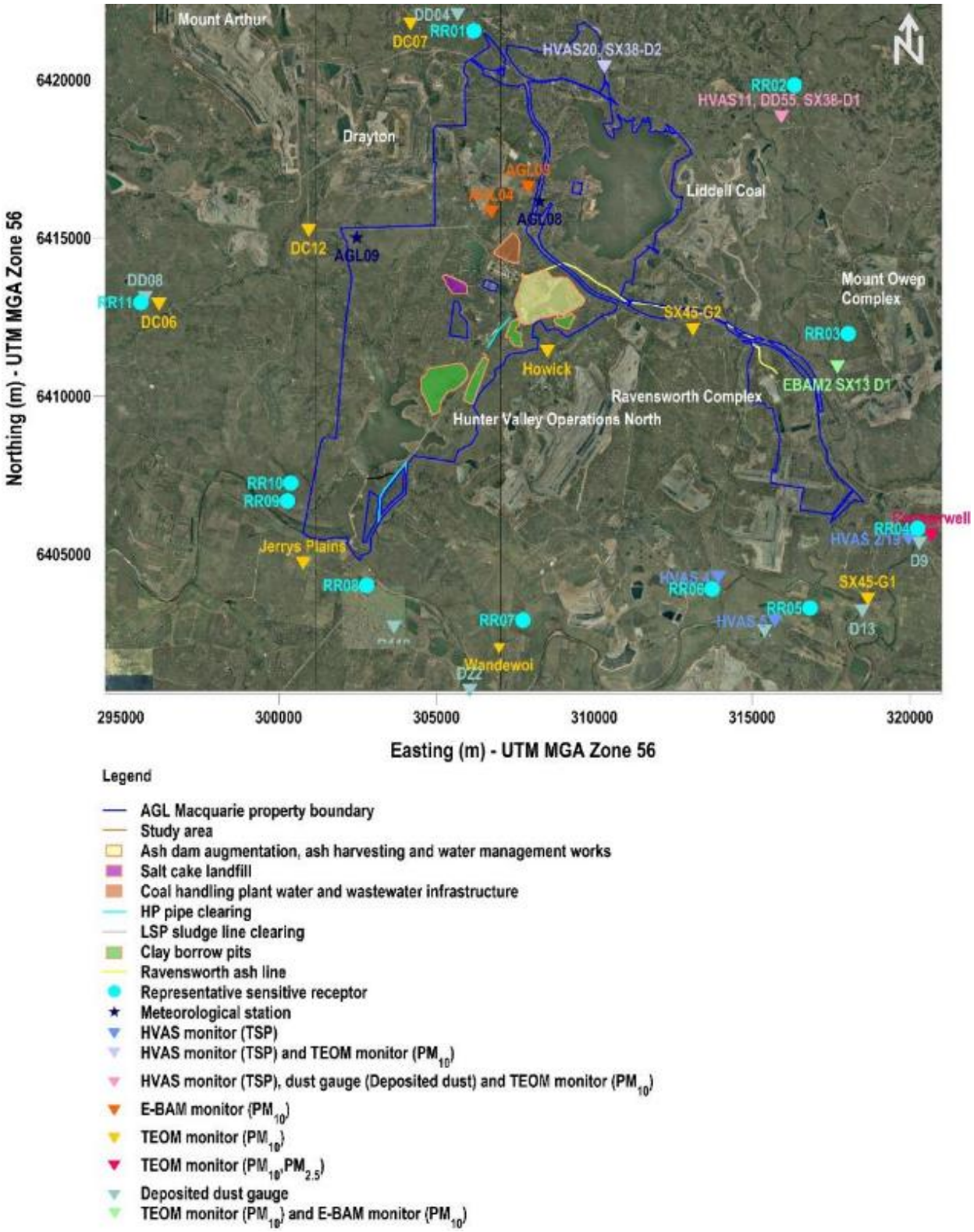


Figure 10-1 Project setting, surrounding representative sensitive receptors and meteorological stations

Particulate matter (as PM_{10})

Several nearby locations where PM_{10} concentrations are measured, and are collected by a number of operators, including AGL, Glencore Liddell Coal Operations and Ravensworth Complex, Glencore Mangoola Open Cut, Yancoal HVO and MAC. DPIE operates a number of air quality monitoring stations across NSW, with two located at Jerrys Plains and Camberwell (refer to Figure 10-1). Data at AGL and Glencore Mount Owen Complex ranged from 2015 to 2018, however data at other monitoring locations was from 2017 to 2018 only.

Across all sites, with the exception of at MAC which monitors PM_{10} around Mount Arthur Coal, each monitoring station recorded at least one day above the 50 µg/m^3 criterion over the period available.

Annual concentrations at all stations remained below the EPA 25 µg/m^3 criterion with the exception of at SX45-G1 at Glencore RC in 2018, where annual average PM_{10} levels reached 25 µg/m^3, at Yancoal HVO (Howick) in 2018 where levels reached 31 µg/m^3 and at MACH (DC12) which reached 45 µg/m^3 and 44 µg/m^3 in 2018 and 2017 respectively.

The DPIE monitoring stations show that Camberwell experienced a notable number of exceedances over the past four years compared to Jerrys Plains, though both locations recorded a significant increase in exceedances in 2018. This outcome has been influenced by drought conditions across NSW.

Particulate matter (as $PM_{2.5}$)

$PM_{2.5}$ is monitored at the DPIE's Camberwell air quality monitoring station (refer to Figure 10-1 for location). Figure 10-2 shows the 24-hour $PM_{2.5}$ averages for the last four years at Camberwell.

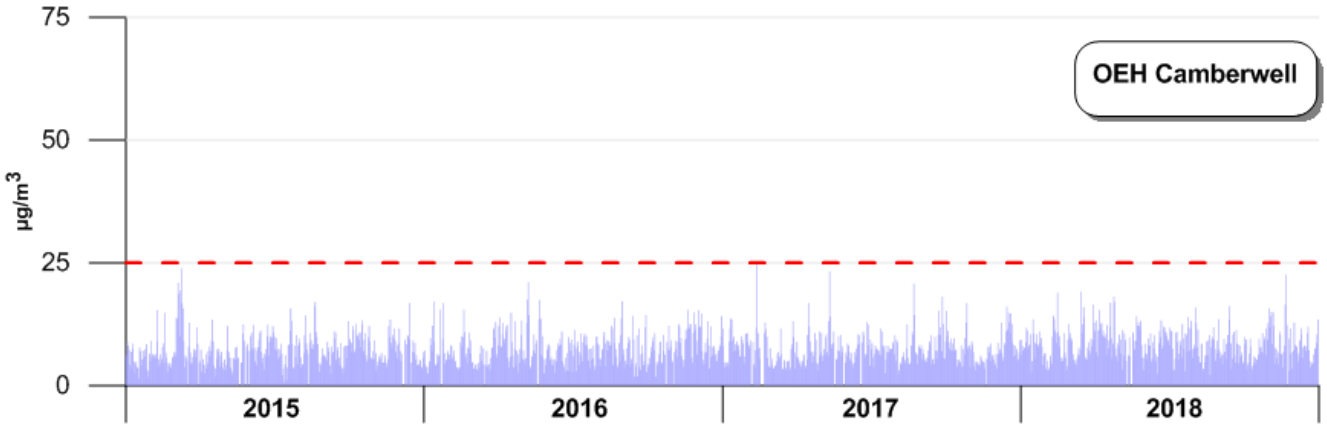


Figure 10-2 Measured 24-hour average $PM_{2.5}$ concentrations at OEH station at Camberwell, 2015 to 2018

As Figure 10-2 shows, there were no exceedances of the daily $PM_{2.5}$ 25 µg/m^3 criterion in the past four years. The monitoring data recorded over this period is summarised in Table 10-3 below. Annual concentrations remained below the EPA's 8 µg/m^3 criterion in 2015, 2016 and 2017 but was exceeded in 2018.

Table 10-3 Summary of measured $PM_{2.5}$ concentrations at OEH monitoring stations

Year	OEH Camberwell	Criterion
Maximum 24-hour average in µg/m^3		
2018	22.6	25 (only applicable from 20 Jan 2017 onwards)
2017	24.7	
2016	21.1	
2015	23.9	
Number of days above 24-hour average criteria (25 µg/m^3)		

Year	OEH Camberwell	Criterion
2018	0	-
2017	0	
2016	0	
2015	0	
Annual average in µg/m³		
2018	8.4	8 (only applicable from 20 Jan 2017 onwards)
2017	7.4	
2016	7.5	
2015	7.2	

Deposited dust

Deposited dust is monitored at several gauges around AGL. The data from these gauges are summarised below in Table 10-4.

Table 10-4. Glencore LCO, Yancoal HVO and MAC DD monitoring results, 2015 to 2018

Year	Measured annual DD (g/m2/month)								Criterion (g/m2/month)
	Glencore LCO DG55	Peabody Wambo D22	MAC DD04	MAC DD08	Glencore RC D9	Glencore RC D12	Glencore RC D13	Yancoal HVO D119	
2018	1.5	3.2	-	1.4	3.6	2.3	2.5	N/A*	4
2017	2.3	2.3	2.3#	1.4	4.1	2.9	2.4	2.0	
2016	2.1	3.9	2.3	1.6	2.6	2	2.5	1.7	
2015	1.6	1.8	-	1.1	2.3	2.1	2.4	2.8	

* Not able to be extracted from monthly monitoring reports (results displayed graphically); # incomplete year

As displayed, for 2015 to 2018 inclusive, all values remained below the EPA's 4 g/m^2/month except in 2017 at Glencore RC's D9 dd gauge.

Summary

The monitoring data from the various stations around the Project indicate that the EPA's daily impact assessment criterion were occasionally being exceeded around the nearby representative receiver locations. Annual PM_{10} and $PM_{2.5}$ concentrations and deposited dust levels were also exceeded in some years at some stations.

Background concentrations for the purpose of assessing cumulative pollutant concentrations and levels were estimated using the 2017 concentration (year of modelling) measured at the nearest station or otherwise most conservative (i.e. highest recorded) value.

10.3 Assessment of impacts

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Potential air quality issues have been identified from a review of the activities and upgrades planned as part of the Project. This identification process has considered the types and quantum of potential emissions to air, as well as the proximity of these emission sources to sensitive receptors.

Emissions to air may occur from a range of different sources during construction and operation of the Project, including:

- Construction and operational activities associated with the additional coal ash recycling and fly ash harvesting upgrades, including the use of additional materials handling plant and equipment, a new diesel fuel storage area, new vehicle internal access routes, and upgrades to the fly ash harvesting plant
- Construction of the Ravensworth ash line
- Construction and operation of the new facility, including the salt cake emplacement area
- Construction and operation of the four Borrow Pit sites. It is expected that materials from these Borrow Pit sites would be used for BWAD augmentation works, use in the Salt cake landfill and other areas of AGL land as required
- Minor civil works and plant modifications to the CHP and existing wastewater infrastructure during construction, as well as minor changes during operations
- Routine vegetation clearing works along the alignments of the LSP Sludge Line and HP Pipeline.

Emissions from these sources would mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}) and particulate matter with equivalent aerodynamic diametre of 2.5 microns or less ($PM_{2.5}$). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide, oxides of nitrogen and particulate matter.

10.3.1 Construction

The main potential air quality impacts during construction would be associated with the disturbance of dust and particulates. The potential for dust generation and movement would be dependent on the silt and moisture content of the soil and daily weather conditions.

During windy conditions, there is potential for dust to become airborne from any exposed surfaces and stockpiles. Stockpiles would be covered or stabilised where possible to minimise dust generation during windy conditions. Construction activities may temporarily be stopped during such conditions to minimise the spread of dust to surrounding areas.

10.3.2 Operation

Estimates of these emissions were developed for the CALPUFF dispersion modelling, and included the identification and intensity of activities, and emission factors drawn from *Emission Estimation Technique Manual for Mining* (NPI, 2012) and AP 42 (US EPA, 1985 and updates).

Dust emission inventories were developed for two scenarios, namely:

- Peak operations
- Post-completion during rehabilitation.

For the peak operations scenario, it was conservatively considered that all Borrow Pits were opened, with the largest (Borrow Pit 4) being actively used to generate materials for the BWAD augmentation and Salt cake landfill facility. The full footprint of the BWAD was also conservatively considered as a source of emissions. Twenty percent of the Salt cake landfill facility was considered to be open and exposed, consistent with the program of use of the facility.

Further details of the estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions (in kg/y) for the two assessment scenarios, and assumptions included in the emission inventories are provided in Appendix F.

Total suspended particulates (TSP)

Table 10-5 summarises predicted TSP contributions and cumulative concentrations at the 11 representative receiver locations identified in Figure 10-1. Background concentrations were estimated using the 2017 annual concentration (year of modelling) measured at the nearest station or otherwise most conservative (i.e. highest

recorded) value. As displayed, the highest contribution at an off-site sensitive receiver location was predicted to be 0.14 µg/m^3 and resulting cumulative concentration were predicted to remain more than 21 µg/m^3 below the 90 µg/m^3 criterion.

Table 10-5 Predicted results, TSP

Location	Peak operations: incremental contribution (µg/m3)	Rehabilitation: incremental contribution (µg/m3)	Background concentration (µg/m3)	Peak operations: cumulative concentration (µg/m3)	Rehabilitation: incremental contribution (µg/m3)	Criterion (µg/m3)
RR01	0.01	<0.01	33	<34	<34	90
RR02	<0.01	<0.01	45	<46	<46	
RR03	0.05	0.02	68	<69	<69	
RR04	0.08	0.04	68	<69	<69	
RR05	0.13	0.05	59	<60	<60	
RR06	0.14	0.05	68	<69	<69	
RR07	0.02	0.01	68	<69	<69	
RR08	0.01	<0.01	68	<69	<69	
RR09	0.01	<0.01	68	<69	<69	
RR10	0.01	<0.01	68	<69	<69	
RR11	0.02	0.01	68	<69	<69	

Particulate matter (PM_{10})

Predicted 24-hour and annually averaged PM_{10} contributions and cumulative concentrations at the 11 representative receiver locations (see Figure 10-1) are listed below in Table 10-6 and Table 10-8 respectively.

Table 10-6 Predicted results, 24-hour averaged PM_{10}

Location	Peak operations: incremental contribution (µg/m3)	Rehabilitation: incremental contribution (µg/m3)	Maximum 24-hour background concentration (µg/m3)	Peak operations: cumulative concentration (µg/m3)	Rehabilitation: incremental contribution (µg/m3)	Criterion (µg/m3)
RR01	0.56	0.24	42	<42	<42	50
RR02	0.21	0.07	49	<49	<49	
RR03	0.74	0.71	**63**	**<63**	**<63**	
RR04	0.43	0.39	**104**	**<104**	**<104**	
RR05	0.51	0.43	**55**	**<56**	**<56**	
RR06	0.65	0.55	**55**	**<56**	**<56**	
RR07	0.50	0.44	48	<49	<49	
RR08	0.27	0.23	**51**	**<52**	**<52**	
RR09	0.30	0.06	**51**	**<52**	**<52**	
RR10	0.43	0.05	**51**	**<52**	**<52**	
RR11	0.30	0.20	38	<39	<39	

Regarding 24-hour averaged PM_{10}, maximum daily background concentrations above the EPA's 50 µg/m^3 criterion were recorded at stations used to characterise conditions around representative receivers RR03, RR04, RR05, RR05, RR06, RR08, RR09 and RR10 (see bolded background concentration values in Table 10-6).

In these instances, and consistent with the Approved Methods, further assessment was completed to determine if the Project would be the cause of additional exceedances. This type of analysis requires daily background concentrations so that they can be added to the daily predicted PM_{10} contributions to determine whether additional exceedances have the potential to occur.

Table 10-7 summarises the results of this review, which indicates contributions from the Project were not predicted to result in any additional exceedances of the EPA's daily PM_{10} criterion at these representative receiver locations.

Table 10-7 Review of changes in the number of PM_{10} exceedances at RR03, RR04, RR05, RR06, RR08, RR09 and RR10

Location	Number of exceedances (background)	Number of exceedances (Background + contributions from Project)	Change in number of exceedances per year
RR03	33	33	0
RR04	33	33	0
RR05	33	33	0
RR06	33	33	0
RR08	1	1	0
RR09	1	1	0
RR10	1	1	0

As listed in Table 10-8, annual PM_{10} contributions at the surrounding representative receivers were predicted to be negligible (i.e. less than 1%) compared with existing background sources. Cumulative concentrations were predicted to remain below the EPA's 25 µg/m^3 impact assessment criterion, except at RR04 where the 2017 background concentration already exceeded this limit.

Table 10-8 Predicted results, annually averaged PM_{10} (µg/m^3)

Location	Peak operations: incremental contribution	Rehabilitation: incremental contribution	Background concentration (µg/m3)	Peak operations: cumulative concentration	Rehabilitation: incremental contribution	Criterion
RR01	0.02	0.01	14	<15	<15	25
RR02	<0.01	<0.01	13	<14	<14	
RR03	0.03	0.02	20	<21	<21	
RR04	0.06	0.03	**27**	<28	<28	
RR05	0.11	0.06	21	<22	<22	
RR06	0.12	0.05	21	<22	<22	
RR07	0.02	0.01	15	<16	<16	
RR08	0.01	<0.01	17	<18	<18	
RR09	0.01	<0.01	17	<18	<18	
RR10	0.01	<0.01	17	<18	<18	
RR11	0.02	0.01	13	<14	<14	

24-hour and annual $PM_{2.5}$ incremental and cumulative predictions at the representative receiver locations are summarised below in Table 10-9 and Table 10-10. Background concentrations were estimated using the 2017 (year of modelling) data monitored at DPIE's station at Camberwell. As Table 10-9 lists the highest daily cumulative concentration was predicted to be 24.8 µg/m^3, below the EPA's 25 µg/m^3 criterion. Existing background sources were estimated to contribute 99.4% of the predicted highest daily cumulative concentration.

Table 10-9 Predicted results, 24-hour averaged $PM_{2.5}$ (µg/m^3)

Location	Peak operations: incremental contribution	Rehabilitation: incremental contribution	Maximum 24-hour background concentration	Peak operations: cumulative concentration	Rehabilitation: incremental contribution	Criterion
RR01	0.09	0.05	24.7	<24.8	<24.8	25
RR02	0.05	0.01		<24.8	<24.8	
RR03	0.16	0.15		<24.9	<24.9	
RR04	0.09	0.08		<24.8	<24.8	
RR05	0.10	0.10		<24.9	<24.9	
RR06	0.12	0.10		<24.9	<24.9	
RR07	0.09	0.08		<24.8	<24.8	
RR08	0.05	0.04		<24.8	<24.8	
RR09	0.04	0.01		<24.8	<24.8	
RR10	0.06	0.01		<24.8	<24.8	
RR11	0.06	0.04		<24.8	<24.8	

Regarding annually averaged $PM_{2.5}$, cumulative concentrations were predicted to remain below the 8 µg/m^3 impact assessment criterion.

Table 10-10 Predicted results, annually averaged $PM_{2.5}$ (µg/m^3)

Location	Peak operations: incremental contribution	Rehabilitation: incremental contribution	Background concentration	Peak operations: cumulative concentration	Rehabilitation: incremental contribution	Criterion
RR01	<0.01	<0.01	7.4	<7.5	<7.5	8
RR02	<0.01	<0.01		<7.5	<7.5	
RR03	0.01	<0.01		<7.5	<7.5	
RR04	0.01	0.01		<7.5	<7.5	
RR05	0.02	0.01		<7.5	<7.5	
RR06	0.02	<0.01		<7.5	<7.5	
RR07	<0.01	<0.01		<7.5	<7.5	
RR08	<0.01	<0.01		<7.5	<7.5	
RR09	<0.01	<0.01		<7.5	<7.5	
RR10	<0.01	<0.01		<7.5	<7.5	
RR11	<0.01	<0.01		<7.5	<7.5	

Deposited dust

Predicted incremental and cumulative levels of annually deposited dust at the surrounding representative receiver locations are summarised in Table 10-11. Cumulative levels were predicted to remain below the 4 g/m^2/month impact assessment criterion at all representative receivers except RR03 and RR04 where 2017 background concentrations were already measured above 4 g/m^2/month (see **bolded** values). The highest contribution from the modified operations at these receivers was 0.014 4 g/m^2/month, or less than 0.35% of background contributions. In 2018, the annual deposited dust level at Glencore RC's D9 was used to characterise background levels at RR03 and RR04 was 3.6 g/m^2/month.

Table 10-11 Predicted results, deposited dust (g/m^2/month)

Location	Peak operations: incremental contribution	Rehabilitation: incremental contribution	Background concentration	Peak operations: cumulative concentration	Rehabilitation: incremental contribution	Criterion
RR01	0.001	0.001	2.3	<2.31	<2.31	4
RR02	<0.001	<0.001	2.3	<2.31	<2.31	
RR03	0.008	0.005	**4.1**	**<4.11**	**<4.11**	
RR04	0.014	0.007	**4.1**	**<4.12**	**<4.11**	
RR05	0.022	0.010	2.9	<2.93	<2.92	
RR06	0.023	0.009	2.9	<2.93	<2.92	
RR07	0.002	0.001	2.3	<2.31	<2.31	
RR08	0.001	<0.001	2.0	<2.01	<2.01	
RR09	0.001	<0.001	2.0	<2.01	<2.01	
RR10	0.001	<0.001	2.0	<2.01	<2.01	
RR11	0.004	0.001	1.4	<1.41	<1.41	

Summary

As presented above, the assessment indicated that EPA impact assessment criteria for TSP and PM2.5 would be met at surrounding sensitive receivers, with no additional exceedances of 24-hour averaged PM10 predicted. Negligible (less than 1%) contributions of annually averaged PM10 and deposited dust were predicted, although levels were noted to be already elevated above criteria at some receiver locations. The results indicate that the Project would not result in unacceptable changes in local air quality.

10.4 Environmental management measures

Environmental management measures relating to air quality impacts are outlined in Table 10-12.

Table 10-12 Environmental management measures - air quality impacts

Ref	Environmental management measure	Timing
AQ01	The CEMS would include requirements to monitor and manage potential air quality impacts associated with the construction of the Project. Each CEMP would identify project construction activities with the potential to have air quality impacts and the controls required to avoid, minimise and mitigate these impacts. The following measures would be implemented as required: • Where possible, limit the extent of exposed areas and quantity of stockpiled dispersible materials;	Construction

Ref	Environmental management measure	Timing
	• Minimise dust generation from stockpiles, haulage routes, work activities and exposed ground surfaces; • Minimise generator and vehicle emissions; • Apply suitable speed limits on site haulage routes to minimise dust emissions; • Undertake watering of all unsealed trafficked haulage routes to minimise visible dust emissions; • Apply watering to activities involving the loading and unloading, compaction and handling of soil materials as required; • Cover or minimise truck loads; • Modify or cease dust generating works during unfavourable weather conditions; and Inspect and address corrective actions.	
AQ02	During operation of the augmented BWAD, the following additional controls would be implemented: • Conduct routine inspections of the ash dam to identify whether cenospheres (floating ash) have accumulated in dry areas beyond the decant pond • Where identified promptly bury, harvest or move dried cenospheres into the decant pond • Where feasible, use less dispersive bottom ash to 'cap' fly ash deposits in the ash dam before they dry out • As possible, restrict discharge from fly ash pipelines to one cell at a time, and utilise bottom ash to 'cap' before moving to the next cell • Where feasible utilise temporary 'flooding' of individual ash dam cells prior to unfavourable meteorological conditions As applicable make use of new access tracks to apply water or dust suppressing agents.	Operation
AQ03	Undertake revegetation of rehabilitation areas at decommissioning.	Decommissioning

10.5 Best practice measures

Although the assessment found that unacceptable changes in local air quality were not expected as a result of the Project, the SEARs require that all reasonable and feasible measures to minimise dust are implemented, and that monitoring and best practice management measures, in particular real-time air quality monitoring is considered. The recommended measures above have been identified as commensurate with the potential air quality impact of the Project. Best-practice measures may also include real-time monitoring and forecasting systems, which can allow emissions to air to be actively managed so that potential issues are identified early. Further details can be found in Appendix F.

Both methods form part of best practice approaches for minimising dust generation and potential impacts however these have not been explicitly included as recommended measures since the modelling showed that the change in ambient air quality at the nearest private sensitive receptors would not lead to exceedances of criteria.

11.Soils and contamination

This chapter summarises the results of the Land Capability Assessment (Kleinfelder, 2020b)*, which* was undertaken in accordance with State Environmental Planning Policy No. 55 – Remediation of Land and considered:

- potential impacts of the development on soils and land capability (including salinisation and land contamination)
- compatibility of the development with other land uses in the vicinity of the development during construction, operation and after decommissioning, including zoning provisions applying to the land, including a description of measures that would be implemented to remediate the land following decommissioning in accordance with State Environmental Planning Policy No 55 - Remediation of Land.

11.1 Assessment methodology

The methodology used for the Land Capability Assessment included:

- A review of the historical development of the project/surrounding areas and existing baseline soil, groundwater and surface water quality using site-specific data presented in recent environmental investigations
- Preparation of site-specific health, safety and environmental management plan
- Detailed visual inspection of the relevant study areas to ground-truth the desk-based study/assessment
- Surface soil samples were taken from six locations. These primary surface soil samples were submitted for laboratory analysis.

For the purposes of this assessment, the study area has been defined as all area of lands within the Project area, together with a buffer area of at least 25 metres (or 50 metres in some areas), in order to take account of any potential indirect adverse (and inadvertent) impacts.

The location and extent of the elements of the Project are presented in Figure 2-1.

11.2 Existing environment

A review of NSW eSPADE (NSW Government Environment and Heritage, 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 11-1. The Project is predominately situated across Liddell soils (**ld**), with Borrow Pit 4 and the majority of Borrow Pit 3 located across Bayswater soils (**Bz**). A description of the soil landscape groups is presented in Table 11-1. Information presented is based on *Soil Landscapes of Central and Eastern NSW* (Office of Environment and Heritage, 2019).

Table 11-1 Soil landscape groups across the Project area

Soil landscape	Description
Liddell soil landscape (**ld)**	**Landscape:** This soil landscape covers undulating low hills with a few undulating hills, ranging in elevation from 140 – 220 metres. Slopes are 4 - 7%, with long slope lengths (1200 – 2000 metres). Local relief is 60 – 120 metres. Drainage lines occur at 300 – 1000 metres 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.

Soil landscape	Description
	Limitations: Minor to severe sheet erosion is common, with some minor rill erosion. Moderate gully erosion (to 1.5 metres) in drainage line where salting may be a feature.
Bayswater soil landscape (**Bz**)	**Landscape**: This soil landscape covers undulating low hills south-west of Muswellbrook ranging in elevation from 140 - 220 metres. Slopes are 3 - 10%, with slope lengths averaging 1,200 metres. Local relief is 40 - 60 metres. Drainage lines occur at 700 – 1,000 metres 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 metres) are associated with the highly erodible yellow solodic soils. Salt scalds and associated erosion are common in some areas.

Bore data present within Bayswater (as detailed in Section 9.1, Figure 9-3) indicate soil depths across the study area range from less than 1 metres to approximately 11 metres, with soil depth for the Borrow Pit drilling programme (Jacobs, 2019) boreholes and groundwater monitoring bores ranging from approximately 0.7 metres to 8 metres (see Figure 9-4). These boreholes encountered clayey soils.

11.2.1 Soil salinity

The online eSPADE mapping portal indicates that the Project area has modelled soil EC as follows:

- 0 – 0.3 mBGL: generally, 0.05 to 0.10 DS/m
- 0.3 – 1 mBGL: generally, 0.05 to 0.20 DS/m.

These soils are considered ‘non saline’ as per soil salinity class ranges provided by Agriculture Victoria (October 2019). However, the eSPADE profile data in the broad vicinity of the Project indicates the soil salinity values range from ‘non saline’ to ‘highly saline’ as per the soil salinity class ranges provided by Agriculture Victoria.

A review of existing processes and historic groundwater monitoring data indicates the following areas which are likely to be impacted by salinity, either associated with existing activities, or salinity from adjacent soils and groundwater:

- CHP upgrade study area:
  - Brine Concentrator Decant Basin: receives highly saline wastewater from the Brine Concentrator treatment process, historically associated with high levels of salinity in groundwater.
  - Brine Concentrator Holding Pond: waste products from the Cooling Water Treatment Plants transferred to this dam and associated with groundwater salinity impacts.
  - Lime Softening Plant Sludge Lagoons: calcium oxides, magnesium hydroxide and other precipitates from the water treatment process. Groundwater monitoring at this locale has been recorded as trending above background salinity.
- BWAD: receives runoff from sluiceways draining from the Bayswater, historically associated with high levels of salinity in groundwater.

11.2.2 Acid sulfate soil

Acid Sulfate Soils (**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 5 mAHD.

As shown on Figure 11-2 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. All land within the Project area is mapped as a 'low probability of occurrence' for ASS, with a 'very low' level of confidence.

As the study area has elevations ranging from approximately 100 mAHD to 220 mAHD, ASS is not anticipated. Regional geological conditions are presented in Figure 9-1.

11.2.3 Land and soil capability

Land and soil capability is the physical capacity of land to sustain a range of land uses and management practices. 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 capability and classifications of the Project is shown on Figure 11-3. The land within the Project area ranges from 'Severe' to 'Very Severe' limitations, which corresponds to Land and Soil Capability Class 5 and 6 respectively. Further details are provided in Table 11-2 .

Table 11-2 Land and soil capability classes – general definitions

Land and Soil Capability class	Description
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land:** Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land:** Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
7	**Very low capability land:** Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.

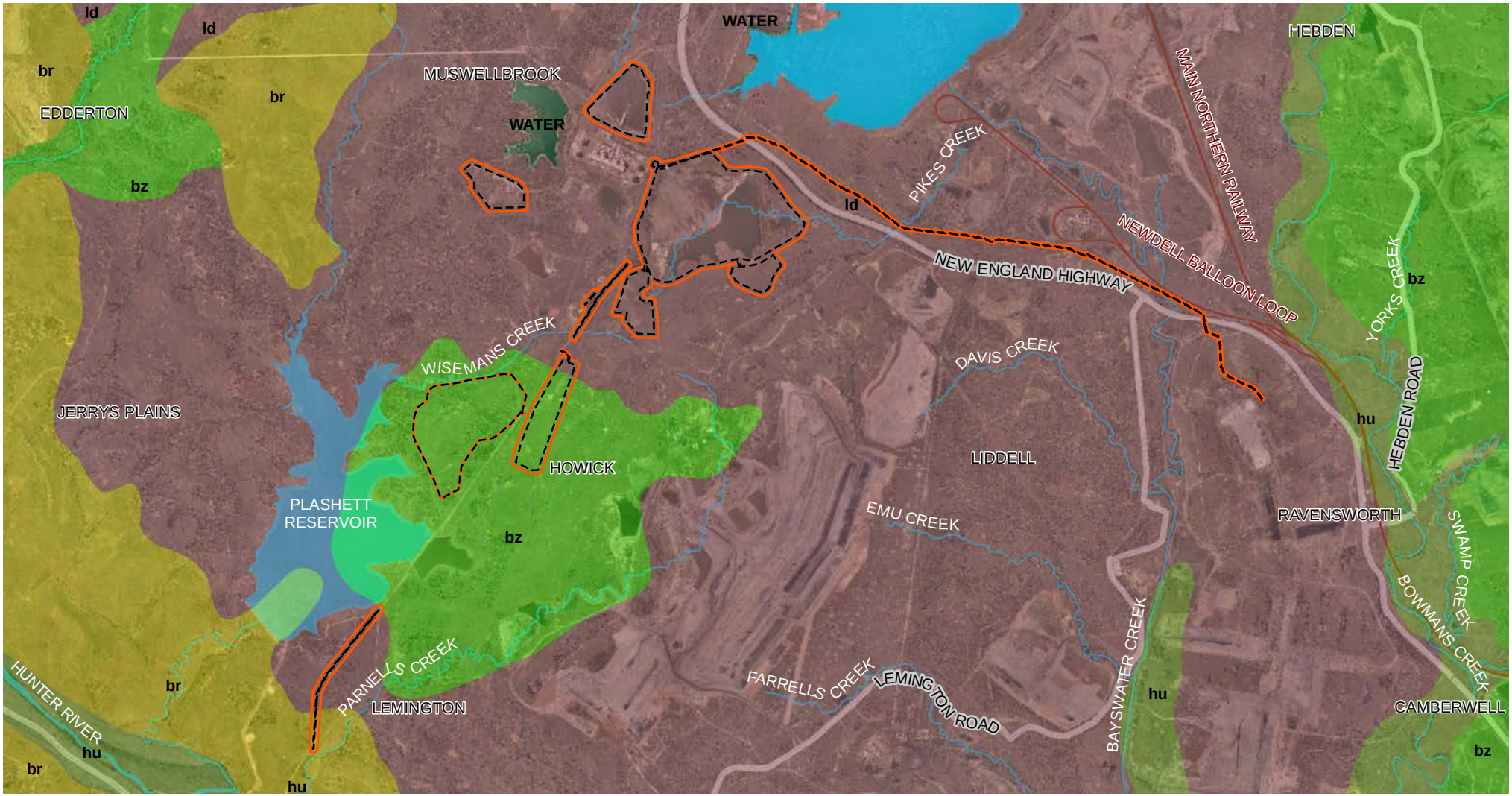
Land and Soil Capability class	Description
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

Source: *The land and soil capability assessment scheme: A general rural land evaluation system for NSW* (Office of Environment and Heritage, 2012)

11.2.4 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 Bayswater 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 and off-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 and
- Residents on rural properties along the Hunter River, east of Saltwater Creek, including users of irrigation water for agricultural purposes.



Study area
Proposal area

Soil landscape
Bayswater
Brays Hill
Hunter
Liddell

0 1 2 km

1:75,000 at A4

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
OEH 2019

GDA94 MGA56

Figure 11-1 Soil landscapes

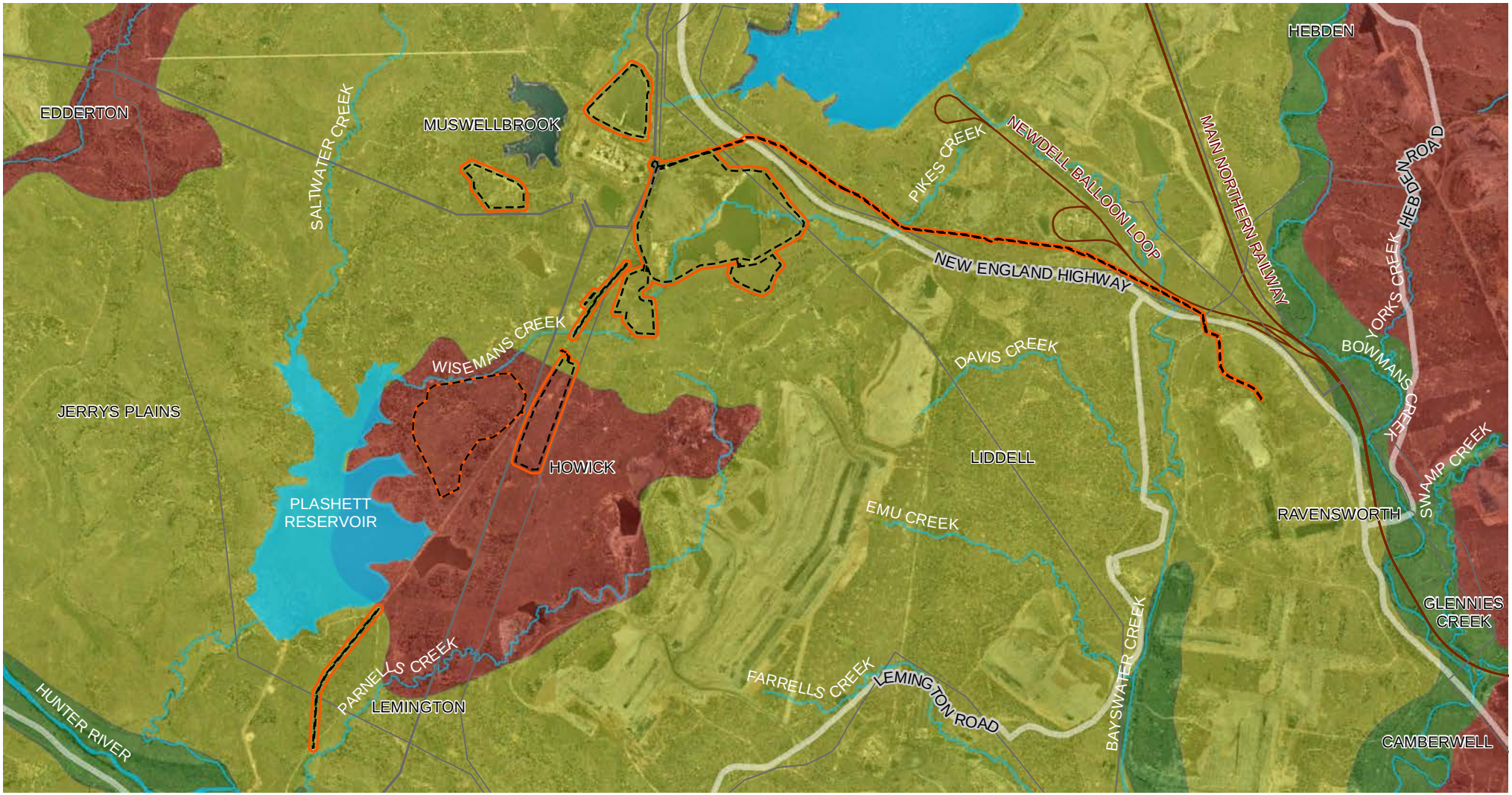
Date: 27/11/2019 Path: J:\IE\Projects\04_Eastern\IA215400\22_Spatial\GIS\Directory\Templates\Figures\WOAOW_EIS\IA215400_GIS_EIS_F005_r1v1_SoilLandscapes.mxd
Created by : XX | QA by : XX

Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
CSIRO 2019

GDA94 MGA56

Figure 11-2 Acid sulphate soils



Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
CSIRO 2019

GDA94 MGA56

Figure 11-3 Land and soil capability mapping

11.2.5 Contamination

Areas of environmental concern

Based on the consideration of known and potentially contaminated sites, a total of six areas were identified as potential Areas of Environmental Concern **(AEC)** within the vicinity of the Project that warranted further consideration.

Table 11-3: AEC and potential contaminants

AEC	Identified AEC	Location	Potential contaminants
AEC 1	BWAD	BWAD study area	Asbestos
AEC 2	Coal storage area	CHP upgrade study area	Asbestos, TRH, BTEX, PAH, heavy metals
AEC 3	Fire-fighting training area	CHP upgrade study area	PFAS compounds – PFOA, PFOS
AEC 4	Mobile plant workshop and refuelling area	CHP upgrade study area	TRH, BTEX, PAH, Heavy metals
AEC 5	Ravensworth ash line	Ravensworth ash line study area	Asbestos
AEC 6	Salt cake landfill	Salt cake landfill study area	Heavy metals, asbestos

Given the typically rural setting of areas surrounding Bayswater, and the absence of any foreseen interaction with groundwater as part of the proposed Project works, no off-site potential sources of contamination have been identified during this assessment that would have an impact upon the Project.

11.2.6 Historic contamination investigations

Data supplied by AGL was reviewed for all Project elements including for exceedances in metals and metalloids, Total Recoverable Hydrocarbons (**TRH**), BTEXN, PAH, OC/OP Pesticides. Results indicated that no exceedances of the adopted human health or ecological screening values were identified for each analyte considered, with the exception of exceedances at the following locations:

- **BWAD:** asbestos was detected in surface soils at 16 of the 32 locations sampled directly beneath pipeline known to containing asbestos containing materials (**ACM**)
- **Salt cake landfill:** Three samples reported concentrations exceeding the Ecological Investigation Level (**EIL**) for zinc
- CHP:
  - Two samples reported F2 Fraction (>C_{10}-C_{16}) concentrations exceeding the applicable ecological screening levels criteria, with one also exceeding the F3 (>C_{16}-C_{34}) Fraction ecological screening levels
  - Asbestos fibres were detected within a single surface soil sample located along the eastern boundary of the CHP study area
  - PFAS concentrations have been reported above the laboratory limit of reporting in two shallow soil samples (0.1 mBGL) immediately to south of the CHP.

There was no soil data available across the four proposed Borrow Pit areas.

11.2.7 Additional soil sampling

Given the proximity of proposed Borrow pits 1 and 2 to Bayswater operational areas and the existing BWAD, the collection and analysis of preliminary surface soil samples (top 150 mm) from both Borrow pit areas was undertaken to address the data gaps in these locations.

Six surface soil samples were collected from Borrow Pits 1 and 2, with three collected from each Borrow Pit. The results from soil sampling undertaken as part of this assessment revealed no exceedances of the adopted human health or ecological screening values were identified for TRH, BTEXN, PAH, OC/OP Pesticides or heavy metals within surface soil samples collected from Borrow Pits 1 and 2. Further details are provided in Appendix G (Kleinfelder, 2020b).

Proposed Borrow Pits 3 and 4 are located a significant distance from existing operational infrastructure and based on their previous and current land use, are therefore determined unlikely to be impacted. As these areas have not previously been identified as areas requiring investigation in previous reports, a detailed visual inspection was deemed sufficient across these areas.

11.3 Assessment of impacts

Table 11-4 and Table 11-5 provide an initial assessment as to the likelihood of exposure pathways being completed in on and off site environment for the Project which would continue the existing commercial/industrial land use.

Exceedances of the adopted screening criteria do not necessarily mean that there is a significant risk of harm associated with the Project, and therefore should not be used as action criteria for remediation and/or management. The criteria adopted in this initial stage of assessment have been used to provide an initial understanding of likely soil and water conditions within identified AEC that may impact upon the Project during its construction and operation. This preliminary information has been used to characterise current conditions across the Project footprint to allow an informed decision to be made regarding the suitability of Bayswater for the proposed infrastructure and wider site improvements.

11.3.1 Construction

If not managed appropriately, construction has the potential to disturb and interact with existing contaminants on or in proximity to the Project area, for example asbestos materials around the BWAD and CHP upgrades. Exclusion zones would be maintained to protect workers and minimise the risk of impact.

During earthworks and vegetation clearance it is possible that soil erosion may occur. Proper soil stabilisation and revegetation would minimise potential soil dispersion impacts. Mitigation measures to manage potential impacts of erosion and sedimentation on surrounding watercourses is provided in Section 8.3.

Construction of the Project would also involve the storage, treatment or handling of fuels, chemicals, building materials, wastes and other potential contaminants. Any contamination spill during construction would be managed and mitigated to make the land suitable for the Project and to prevent impacts on human health and the environment. Contamination risks 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.

Table 11-4: Areas of environmental concern (pathway relationships (on site))

Sources	Transport Mechanism	Potential Receptors	Potential Exposure Pathways	Exposure Pathway Potentially Complete / Risks Acceptable?
Ash dam (asbestos containing material (ACM)) Piping Ravensworth ash line Coal storage area	Shallow soils	Current Workers	Inhalation of soil dust / asbestos fibres	Above ground asbestos piping is present from Dry Fly ash collection area to pumping station to the east of Bayswater Ash Dam. Asbestos has been detected in surface soils below the pipeline at 16 of 32 sample locations. Asbestos fibres have also been reported in one location within the Coal storage area and are potentially present within an abandoned building along the Ravensworth ash line. Pathway considered potentially complete; however these receptors are unlikely to be repeatedly exposed to soil contaminants over a prolonged period, especially since AGL have occupational hygiene controls in place to mitigate exposure with asbestos. It is considered that potential exposure to construction/maintenance workers would be managed via similar controls, including industry standard practice of wearing personal protective equipment and adopting good hygiene practices. Contamination risks associated with the Project are therefore considered to be low and acceptable.
			Dermal/Oral contact with soil	
		Future construction/ maintenance workers (incl. sub-surface workers)	Inhalation of soil dust / asbestos fibres	
			Dermal/oral contact with soil	
Fire-fighting training area	Surface water	Current Workers	Ingestion/inhalation of soil/soil dust	PFAS analysis of soil in this area did not record detections above the adopted screening criteria. Moreover, it is understood that the area of Project disturbance is remote from this AEC. Although groundwater may contain concentrations of PFAS, groundwater would not be intercepted by the Project. The Project footprint is located within an existing commercial/industrial premise with substantial fill in places. Therefore, ecological receptors are considered to be of low significance with respect to the Project. Contamination risks associated with the Project are therefore considered to be low and acceptable.
			Dermal contact with soil/soil dust	
		Future construction/ maintenance workers (incl. sub-surface workers)	Ingestion/inhalation of soil/soil dust	
			Dermal contact with soil/soil dust	
		Terrestrial ecology	Ingestion of soil	
			Dermal contact with soil	

Sources	Transport Mechanism	Potential Receptors	Potential Exposure Pathways	Exposure Pathway Potentially Complete / Risks Acceptable?
	Groundwater	Construction/ maintenance workers (incl. sub-surface workers)	Incidental ingestion of groundwater	It is understood that the area of Project disturbance is remote from this AEC. Although groundwater may contain concentrations of PFAS, groundwater would not be intercepted by the Project. Contamination risks associated with the Project are therefore considered to be low and acceptable.
			Dermal contact with groundwater	
		Construction/ maintenance workers (incl. sub-surface workers)	Incidental ingestion of surface water	
			Dermal contact with surface water	
Salt cake landfill	Soil	Terrestrial ecology	Ingestion of soil	Concentrations of zinc have been found to be present above the EIL however no concentration was greater than 250% of the site acceptance criteria and the standard deviation of the sample population did not exceed 50% of the site acceptance criteria. Furthermore, material from the area is planned for excavation and placement onsite as part of the Salt cake landfill works. The Project footprint is located within an existing commercial/industrial premise with substantial fill in places. Therefore, ecological receptors are considered to be of low significance with respect to the Project. Contamination risks are therefore considered to be low and acceptable.
			Dermal contact with soil	
Salinity Impacted Areas	Stored Process Dams / Soil / Groundwater	Terrestrial ecology / Infrastructure	Direct contact with flora / fauna	Saline impacted stored water and sludge are present within dams and lagoons as would be expected given the processes adopted at power station sites. Incidental leaching of stored water to groundwater has also been recorded during groundwater quality monitoring. Associated areas of localised salinity impact to surface soils have also been recorded in some surface water drainage channels discharging stored waters, as would be expected. Pathway considered potentially complete. However, given the industrial nature of the site significant impacts to flora and fauna in relation to the Project are considered unlikely. Current infrastructure across Bayswater has not been reported to be suffering from severe damage due to the deleterious effects of saline soils, and foundation materials can readily be designed to be resistant to salt damage. Contamination risks are therefore considered to be low and acceptable.
			Direct contact with building materials	

Table 11-5 Areas of environmental concern (pathway relationships (off site))

Sources / Migration Mechanism	Transport Mechanism	Potential Receptors	Hypothetical Exposure Pathways	Exposure Pathway Potentially Complete?
Ash dam ACM piping Ravensworth ash line Coal storage area	Windblown dust from surface soils	Off-site commercial / industrial workers (incl. sub-surface maintenance workers)	Ingestion of soil dust	Pathway considered incomplete. Areas of asbestos impact have been previously identified with access to impacted areas already controlled on the site. No disturbance or excavation works are planned within previously identified asbestos impacted areas as part of the Project. Provided appropriate exclusion zones and occupational hygiene procedures are maintained during works, the risk of exposure to off-site receptors is unlikely. Contamination risks are therefore considered to be low and acceptable.
			Dermal contact with soil dust	
			Inhalation of soil dust / asbestos fibres	
	Groundwater	Off-site commercial / industrial workers (incl. sub-surface maintenance workers)	Ingestion of groundwater	Pathway considered incomplete since planned excavations occurring within study areas are not anticipated to interact with the groundwater table during construction. Further consideration of possible impacts to GDE during operation of the Salt cake landfill is provided Section 7.3.2. Contamination risks considered to be low and acceptable.
			Dermal contact with groundwater	
		Off-site commercial / industrial workers and residents (adults and children)	Ingestion of groundwater	
			Dermal contact with groundwater	
		Off-site terrestrial ecology	Ingestion of groundwater	

11.3.2 Operation and decommissioning

The Project would change the topography and current landscape in the vicinity of the proposed Borrow Pits, Salt cake landfill and BWAD. Earthworks in these locations would impact the land capability and topography within the Project area. However, the proposed works are consistent with the ongoing operational status of Bayswater.

As outlined in Chapter 4, it is expected that when the Project reaches the end of its operational lifetime, project elements would be decommissioned. Decommissioning is expected to take approximately 24 months to complete and would comprise of the rehabilitation of Project elements into the existing landscape in so far as possible, in accordance with industry standards and best practice. As such, the assessment of potential (adverse) impacts of the Project during its decommissioning are not outlined below as it is expected that any environmental assessment would need to be in accordance with future industry standards and best practice that are not yet published.

11.4 Environmental management measures

Environmental management measures for soils and contamination impacts are outlined below in Table 11-6.

Table 11-6: Environmental management measures for soils and land contamination

Ref	Environmental management measure	Timing
SC01	Appropriate demarcation and restriction of access to previously identified asbestos impacted areas in the CHP Coal storage area and along the pipelines with the BWAD augmentation area should be undertaken to reduce potential exposure to workers in the short term.	Construction
SC02	Each CEMP would identify appropriate control measures to mitigate the potential for pollution incidents occurring that could lead to contamination of study areas. Each CEMP would also be required to include an unexpected finds protocol to manage actual or potential contamination encountered during construction. The protocol would include measures for appropriate sampling, analysis and interpretation of results by a qualified environmental consultant.	Construction
SC03	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
SC04	A rehabilitation plan would be developed covering all Project elements, which would include measures to remediate the land where required following decommissioning in accordance with State Environmental Planning Policy No 55—Remediation of Land.	Decommissioning

12. Aboriginal heritage

This chapter addresses the heritage component of the SEARs for the Project, which requires an assessment of the potential Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community. An ACHAR was prepared to assess the potential Aboriginal heritage impacts associated with the Project (Jacobs, 2019d). *The ACHAR is provided in Appendix H.*

12.1 Assessment methodology

Aboriginal stakeholder engagement and involvement is important for the identification of Aboriginal cultural values relevant to the Project. A summary of the consultation process relating to the organisation and conduct of the ACHAR is provided in Section 5.5. Details of consultation including meeting minutes, examples of letters sent to RAPs and knowledge holders, conversations undertaken during archaeological survey, native title search results, records of cultural heritage values interviews and a detailed consultation log are included in Appendix H.

Table 12-1 provides a summary of the stages of consultation undertaken throughout the ACHAR.

Table 12-1 Summary of consultation process

Task Name	Start	Finish
Stage 1- Agency Letters	May 10, 2019	May 10, 2019
Stage 1- Newspaper advertisements	May 15, 2019	May 29, 2019
Stage 1- Project Notification and invitation to register supplied to potential Aboriginal stakeholders	June 20, 2019	July 5, 2019
Stage 1- Supply of the list of RAPs to DPIE and Wanaruah LALC	July 11, 2019	July 11, 2019
Stage 2- RAP review of project information and methodology	Aug 7, 2019	Sep 4, 2019
Stage 2- Engage Aboriginal stakeholders to undertake a site survey	Aug 7, 2019	Sep 4, 2019
Stage 3- Seek the names of Aboriginal people with cultural knowledge by letter or notify native title holders	May 10, 2019	July 5, 2019
Stage 3- Notify Aboriginal people with cultural knowledge by letter, and invite input on cultural significance	June 20, 2019	Nov 25, 2019
Stage 4- Carry out archaeological survey and prepare a draft ACHAR	Sep 9, 2019	Oct 2, 2019
Stage 4- Present the draft ACHAR to RAPs for review and comment	Oct 23, 2019	Nov 25, 2019

12.2 Existing environment

12.2.1 Environmental context

The Project lies within the catchment area of the Upper Hunter, which is the largest coastal catchment within NSW. The environmental context of the Upper Hunter is described in Section 1.4. The Upper Hunter contains a range of ecological zones within a relatively small area. Major rivers and smaller watercourses would have provided relatively easy access to fresh water across most of the region. Ecological communities would have varied considerably from low lying watered areas around rivers and streams, to open and forested areas on valley floors, hills and mountainous regions bordering the valley to the north, south and west. The area would likely have supported a large population of Aboriginal people.

12.2.2 Ethnohistoric 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.

12.2.3 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

One of the first archaeological investigations of the study area was carried out between 1976 and 1979 as part of the Mount Arthur Mine Project. A survey was undertaken of three mining sites and artefacts were found in three small areas of open ground. The assessment concluded that the only Aboriginal sites within the area were located within the Saltwater Creek reservoir area. It recommended salvage of these Aboriginal heritage sites before the area was flooded to create Lake Liddell (The Electricity Commission of New South Wales, 1979).

Report on Aboriginal Relics on Mount Arthur North Coal Lease, Muswellbrook

This assessment included a survey immediately south of the Bayswater Colliery, recording three sites on the banks of Saddler's Creek. The sites were scatters of flaked stone artefacts, including cores and backed artefacts. The artefacts were made from chert, rhyolite and quartz. (Dyall L, 1980).

Aboriginal Relics on the Mount Arthur South Coal Lease

In 1981, a survey of Mount Arthur South Coal Lease, which is located immediately south of Mount Arthur, was undertaken. The survey recorded 24 open sites along Saltwater and Saddlers Creeks. The sites were stone artefact scatters, two of which contained more than 500 artefacts. Artefacts recorded included backed artefacts, ground stone axes, choppers and grindstones.

Mount Arthur South Coal Project: Archaeological Survey

A subsequent archaeological survey of Mount Arthur South Coal Lease was carried out, which recorded a number of sites along the banks of Saltwater Creek. One scatter of stone artefacts recorded covered more than one acre, extending up to 100 metres back from the creek bank. The report also records 27 axe grinding grooves on a sandstone shelf. The majority of sites recorded are open artefact scatters and are located adjacent to the creek.

An Archaeological Survey of the Bayswater No. 2 Colliery Proposed Lease Extension Area, Muswellbrook, the Hunter Valley

As part of the Bayswater Colliery Proposed Lease Extension, an archaeological survey was undertaken in 1981, which recorded nine Aboriginal sites. The sites were open artefact scatters, six of which are located on creek lines. (Hughes, 1981)

Bayswater Ash Disposal Project: Archaeological Survey of Proposed Slurry Pipeline and Water Storage Pond

A survey of a proposed slurry pipeline and water storage pond within the Bayswater Ash Disposal Project was undertaken. The area was assessed as being highly modified by European settlement and Aboriginal sites were likely to have been disturbed or destroyed. Six sites were identified, consisting of five artefact scatters and one isolated artefact. Avoidance and protection were recommended. Subsequent test excavation in the area of the proposed work identified an absence of artefacts in subsurface deposits (McIntrre, 1992).

Bayswater Power Station Fly Ash Disposal in Ravensworth No. 2 Mine Void and Mine Rehabilitation Environmental Impact Statement

In 1993 an Environmental Impact Assessment of Bayswater was undertaken as part of the Fly Ash Disposal in Ravensworth No.2 Mine Void and Mine Rehabilitation project. As part of the assessment an examination of Heritage registers and field examination was performed. The research showed no European heritage items along the transport corridor and two Aboriginal open artefacts scatter sites and an isolated Aboriginal artefact (Pacific Power, 1993)

Archaeological Assessment - Proposed Modifications to Coal Preparation and Transport System - Bayswater Coal Mine Project

A survey was undertaken of three areas of the southern section of the Bayswater No. 3 mining lease. The survey recorded 36 sites comprising 28 open artefact scatters and eight isolated artefacts. The majority of sites were located adjacent to watercourses, namely Saddlers Creek and its tributaries. Sites were located on the watercourses' banks, as well as on elevated ground such as upper slopes and ridge tops adjacent to the watercourses. Artefacts included retouched flakes and cores, and one hammerstone. (Umwelt Australia, 1997)

Bayswater Power Station River Intake Project: Indigenous Archaeological Assessment

An assessment of Bayswater was undertaken as part of the Bayswater Power Station River Intake Project. During the survey an isolated mudstone flake was identified. Due to the lack of further sites in the study area, it was inferred that extensive levels of past disturbance had impacted and destroyed sites in the area (McCardle Cultural Heritage Pty Ltd, 2007).

Bayswater Liddell Power Generation Complex Environmental Assessment: Heritage Bayswater

An archaeological assessment of the Bayswater and Liddell Power Generation complex was carried out in 2009, recording 47 Aboriginal sites. All sites were open artefact scatters and isolated artefacts. It was noted that flat areas associated with Saltwater Creek and its tributaries contained surface sites and potential for associated potential archaeological deposit (**PAD**) and that elevated landforms and hillslopes were landforms with low archaeological sensitivity (AECOM, 2009).

Aboriginal Archaeological Due Diligence Assessment for Proposed Pipeline at Bayswater Power Station

An Aboriginal due diligence assessment was carried out for the *Bayswater Ash Dam Overland Water Pipeline Project* (AECOM, 2017b). The majority of sites consisted of artefacts identified on exposed ground surfaces. From these results it was concluded that the area did not contain areas of subsurface potential, and that this was probably due to erosion and past disturbance.

Preliminary Aboriginal Heritage Assessment for Proposed Electrical Works Modification, Bayswater Brine Concentration Decant Basin

A preliminarily Aboriginal heritage assessment for proposed electrical works modifications at the Bayswater Brine Concentrator Decant Basin was carried out in 2018 and as part of the assessment a search of the Aboriginal Heritage Information System (**AHIMS**) database was completed (AECOM, 2018). This search identified 113 Aboriginal archaeological sites (two sites were classified as "destroyed").

12.2.4 Database search results

An extensive search of the AHIMS register was carried out on 15 July 2019 for the study area. Fourteen previously recorded sites are present within the search area, one of which is recorded as being destroyed. One of the sites is recorded under two AHIMS numbers (37-2-0047 and 37-2-0050). Further details are provided in Table 12-2.

12.3 Field survey

The field survey was carried out between 10 to 13 September 2019. The survey investigated the areas proposed to be impacted by the Project. No sub-sampling of these areas was employed. The survey was carried out on foot by a team of two archaeologists and nine 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. Decisions to exclude areas in this way were made in the field, through a consensus of all field team members.

12.3.1 Archaeological survey results

In addition to the 14 sites previously recorded within the study area, the field identified an additional 23 sites (including isolated artefacts, artefact scatters, areas of PAD, and artefact scatters with associated areas of PAD). A summary of these items, including the current status and approximate location within the study area, is provided in Table 12-2, and shown in Figure 12-1 to Figure 12-5. Further details are provided in Appendix H.

Table 12-2 Summary of Aboriginal sites in the study area

Site ID	Project component area	Recorded by	Site type	Number of stone artefacts recorded	Other site features	Current status
37-3-1128	Ravensworth ash line	Umwelt, 2010	Isolated artefact	1		Recorded as destroyed
37-3-0491	Ravensworth ash line	Umwelt, 2000	Artefact scatter	3		Intact
37-2-0063	CHP upgrade	Dyall, 1978	Artefact scatter	More than 240		Presumed destroyed [1]
37-2-0062	CHP upgrade	Dyall, 1978	Artefact scatter	Unquantified	Hearths	Presumed destroyed [1]
37-2-0065	BWAD augmentation	Unknown (no site card exists for this site)	Unknown	Unknown	Unknown	Presumed destroyed [1]
37-2-0047 / 37-2-0050	BWAD augmentation	Dyall, 1978	Artefact scatter	Unquantified		Presumed destroyed [1]
37-3-007	BWAD augmentation	Dyall, 1978	Artefact scatter	6		Presumed destroyed [1]
37-2-0048	BWAD augmentation	Dyall, 1978	Artefact scatter	Unquantified		Intact

Site ID	Project component area	Recorded by	Site type	Number of stone artefacts recorded	Other site features	Current status
37-2-0058	Borrow Pits	Koettig 1992	Artefact scatter	4		Intact
37-2-0557	Borrow Pits	Koettig, 1992	Artefact scatter	20		Intact
37-2-0556	Borrow Pits	Koettig, 1992	Artefact scatter	Unquantified		Intact
37-2-0555	Borrow Pits	Koettig, 1992	Artefact scatter	Unquantified		Intact
37-2-0553	Borrow Pits	Koettig, 1992	Artefact scatter	Unquantified		Intact
37-2-0554	Borrow Pits	Koettig, 1992	Artefact scatter	Unquantified		Intact
BAYS PAD17	Ravensworth ash line	This assessment	PAD	0		Intact
BAYS PAD18	Ravensworth ash line	This assessment	PAD	0		Intact
BAYS PAD19	Ravensworth ash line	This assessment	PAD	0		Intact
BAYS PAD13	Salt cake landfill	This assessment	PAD	0		Intact
BAYS PAD08	HP and LSP Pipe clearing	This assessment	PAD	0		Intact
BAYS PAD16	BWAD augmentation	This assessment	PAD	0		Intact
BAYS PAD14	BWAD augmentation	This assessment	PAD	0		Intact
BAYS AS and PAD15	Borrow Pits	This assessment	Artefact scatter and PAD	13		Intact
BAYS AS09	Borrow Pits	This assessment	Artefact scatter	4		Intact
BAYS AS and PAD10	Borrow Pits	This assessment	Artefact scatter and PAD	6		Intact
BAYS PAD12	Borrow Pits	This assessment	PAD	0		Intact
BAYS AS and PAD11	Borrow Pits	This assessment	Artefact scatter and PAD	27	Probable Aboriginal hearth	Intact
BAYS AS and PAD07	Borrow Pits	This assessment	Artefact scatter and PAD	17		Intact
BAYS AS06	Borrow Pits	This assessment	Artefact scatter	6		Intact

Site ID	Project component area	Recorded by	Site type	Number of stone artefacts recorded	Other site features	Current status
BAYS AS and PAD05	Borrow Pits	This assessment	Artefact scatter and PAD	135		Intact
BAYS AS04	Borrow Pits	This assessment	Artefact scatter	25		Intact
BAYS AS and PAD03	Borrow Pits	This assessment	Artefact scatter and PAD	8		Intact
BAYS IF04	Borrow Pits	This assessment	Isolated artefact	1		Intact
BAYS AS and PAD02	Borrow Pits	This assessment	Artefact scatter and PAD	1		Intact
BAYS IF03	Borrow Pits	This assessment	Isolated artefact	1		Intact
BAYS IF02	Borrow Pits	This assessment	Isolated artefact	1		Intact
BAYS IF01	Borrow Pits	This assessment	Isolated artefact	1		Intact
BAYS PAD01	HP and LSP line clearing	This assessment	PAD	0		Intact

Note 1: Site presumed destroyed as its recorded location is within an area severely impacted by existing operational infrastructure.

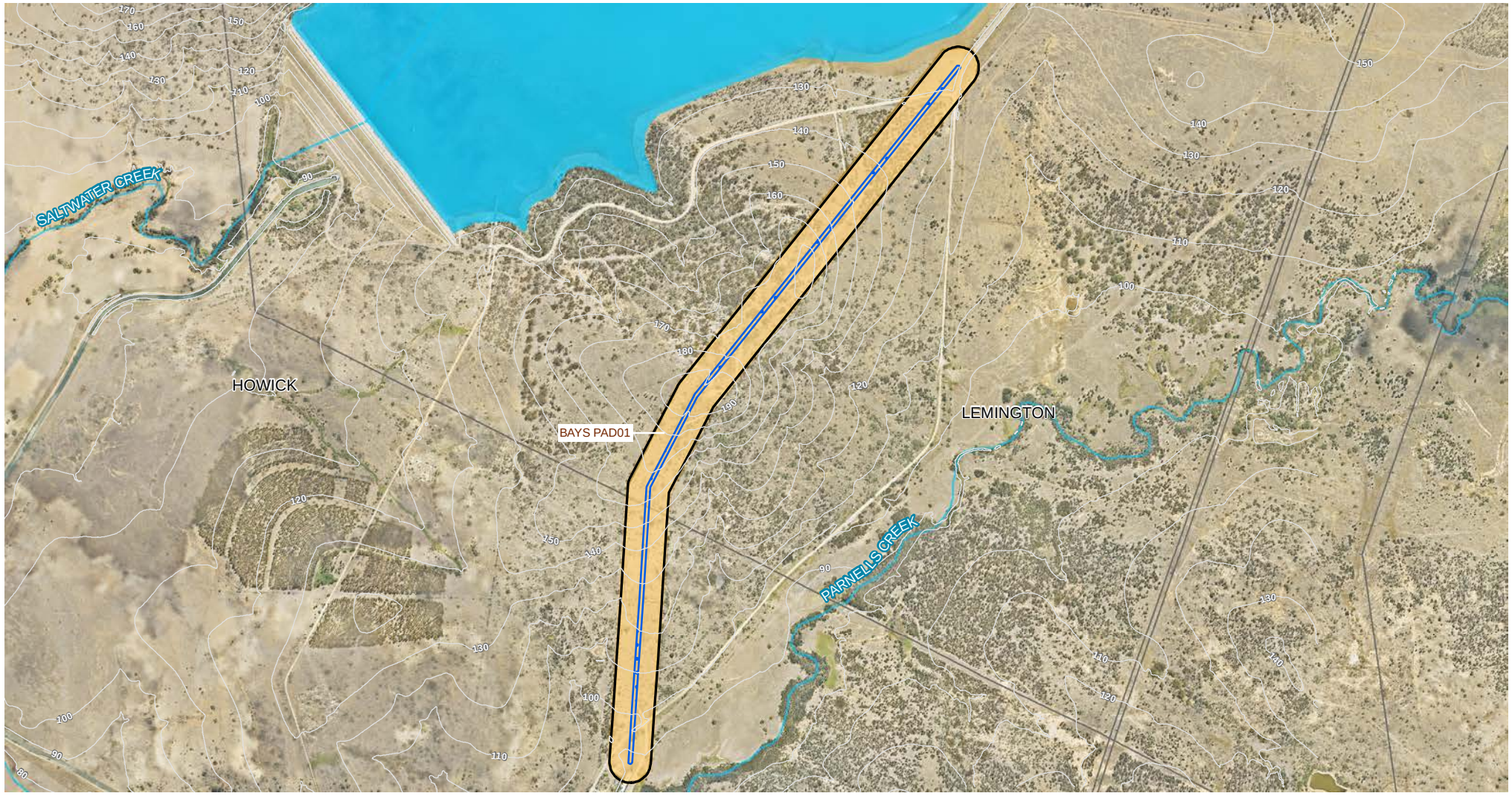


Figure 12-1 Aboriginal sites within the HP pipe clearing area (south)

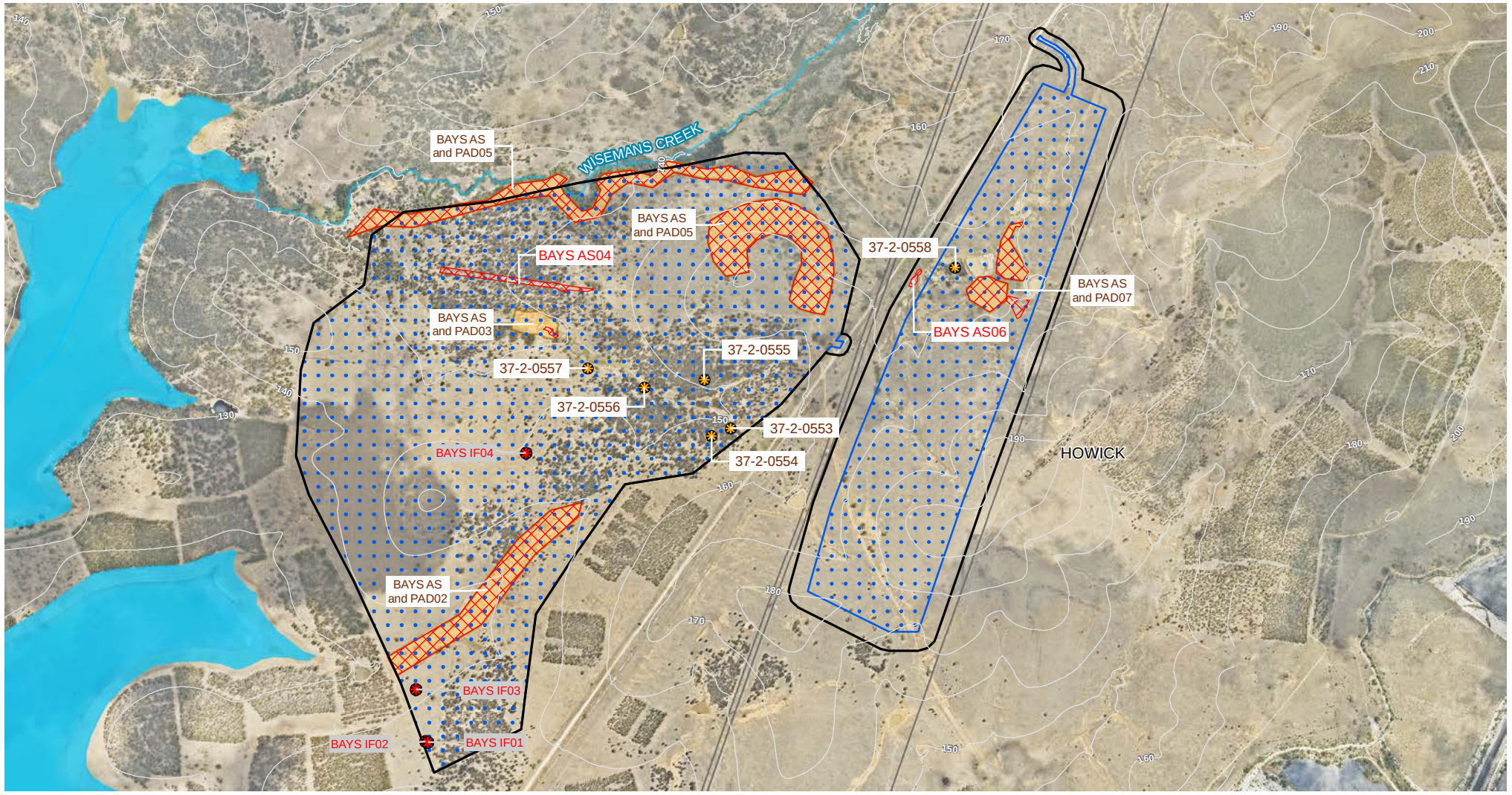


Figure 12-2 Aboriginal sites within borrow pit 3 and borrow pit 4

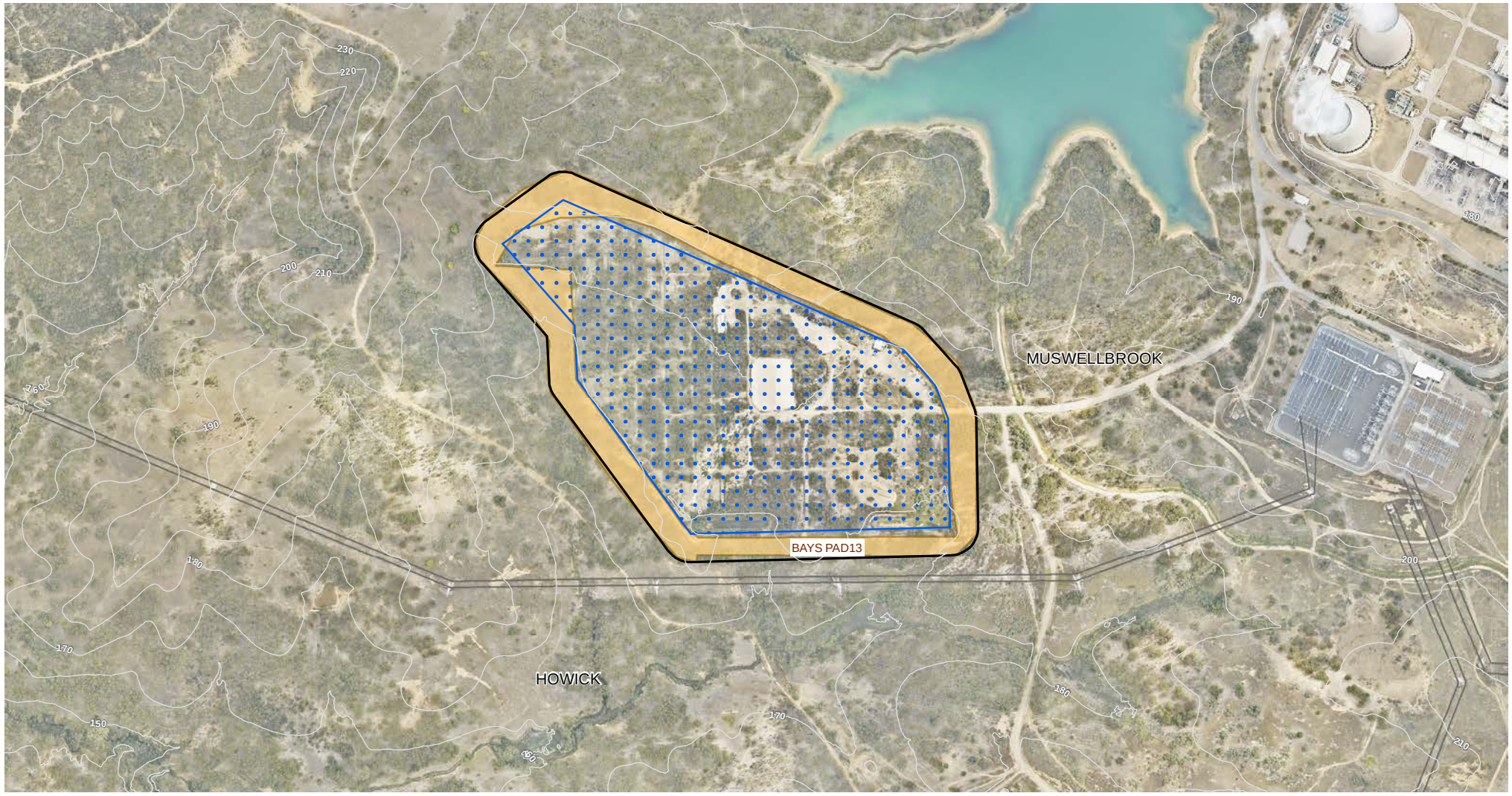


Figure 12-3 Aboriginal sites within the salt cake landfill

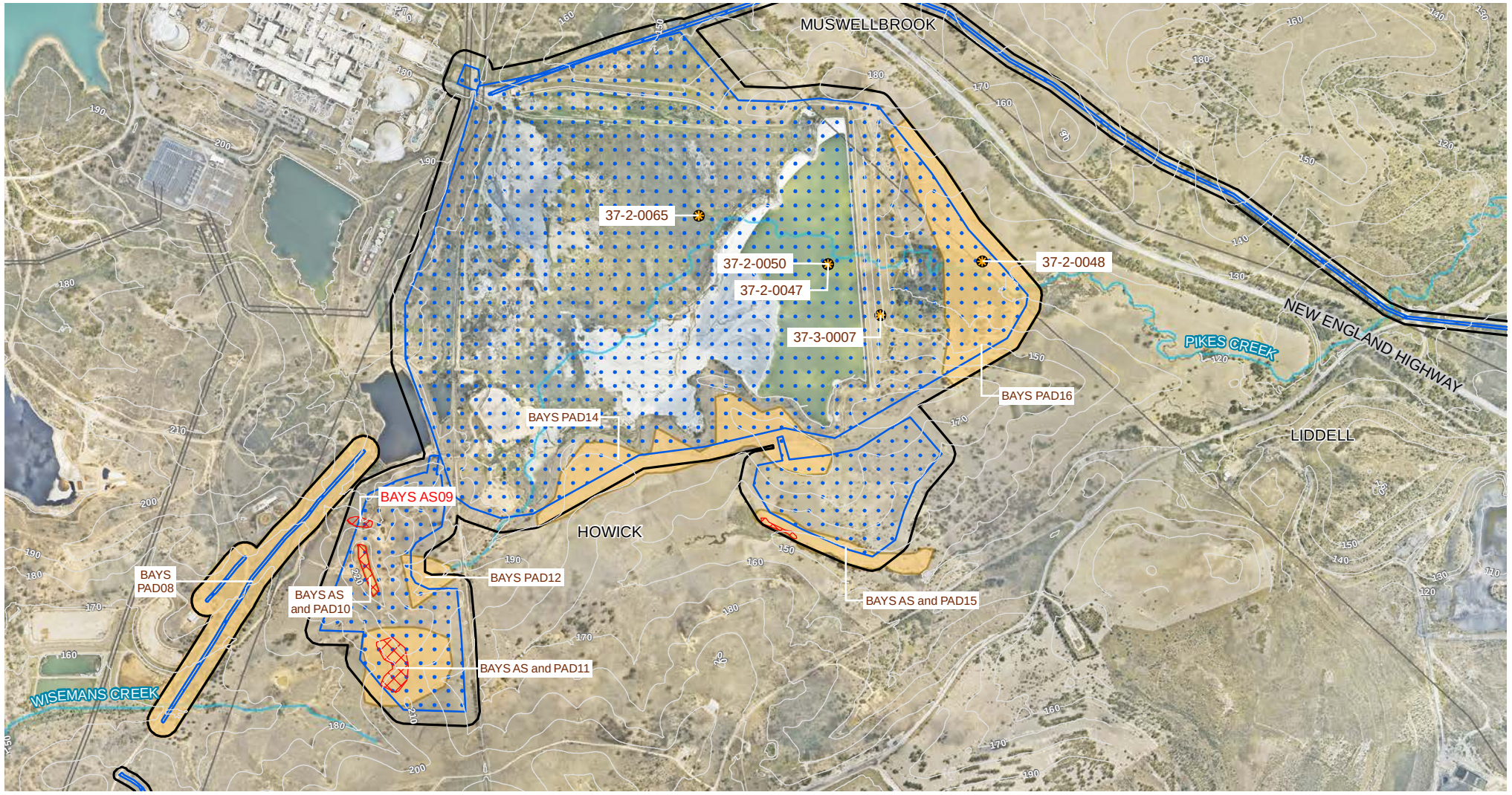


Figure 12-4 Aboriginal sites within the HP (north) and LSP pipe clearing area; borrow pit 1; borrow pit 2; and ash dam augmentation area

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Figure 12-5 Aboriginal sites within the Ravensworth ash line area

The significance of those Aboriginal sites within the study area is summarised in Table 12-3 and has been assessed based on the four values of the Australia ICOMOS Burra Charter (Australia ICOMOS, 2000):

- Social values
- Historical values
- Scientific values and
- Aesthetic values.

Aboriginal cultural significance was assessed through consultation with the relevant RAPs during the archaeological survey and consultation process.

The significance assessment here is limited by the nature of the data available from the archaeological work carried out to date. Surface survey provides an understanding of the nature, and consequently the significance, of Aboriginal objects currently visible on the ground surface only. The significance of areas of PAD could not be assessed on the basis of the data gathered during the archaeological survey. It is proposed to carry out test excavations to assess the nature and significance of any subsurface material present in areas of PAD which detailed design confirms would be impacted by the Project. Test excavations would be carried out prior to the determination of the Project (see Section 12.5 for further details).

Table 12-3 Significance of Aboriginal sites within the study area

Site ID	Project component	Significance assessment of site	Significance assessment of PAD	Relevant notes
BAYS PAD13	Salt cake landfill	NA	Cannot be assessed	Further work required
37-2-0063	CHP upgrades	None	NA	Site presumed destroyed [1]
37-2-0062	CHP upgrades	None	NA	Site presumed destroyed [1]
BAYS PAD16	BWAD augmentation	NA	Cannot be assessed	Further work required
BAYS PAD12	BWAD augmentation	NA	Cannot be assessed	Further work required
37-2-0065	BWAD augmentation	None	NA	Site presumed destroyed [1]
37-2-0047 / 37-2-0050	BWAD augmentation	None	NA	Site presumed destroyed [1]
37-3-0007	BWAD augmentation	None	NA	Site presumed destroyed [1]
37-2-0048	BWAD augmentation	Low-Moderate	NA	Artefact scatter of unspecified size, some artefacts have been removed by previous archaeological surface collection
BAYS PAD08	HP and LSP pipe clearing	NA	Cannot be assessed	Further work required
BAYS PAD01	HP pipe clearing	NA	Cannot be assessed	Further work required
BAYS PAD17	Ravensworth ash line	NA	Cannot be assessed	Further work required
BAYS PAD18	Ravensworth ash line	NA	Cannot be assessed	Further work required

Site ID	Project component	Significance assessment of site	Significance assessment of PAD	Relevant notes
BAYS PAD19	Ravensworth ash line	NA	Cannot be assessed	Further work required
37-3-1128	Ravensworth ash line	None	NA	Site destroyed
37-3-0491	Ravensworth ash line	Low - Moderate	See BAYS PAD09	Small artefact scatter on stable landform, within BAYS PAD09
BAYS AS and PAD15	Borrow Pits	Low - Moderate	Cannot be assessed	Artefact scatter on unstable landform (eroding creek bank)
BAYS AS09	Borrow Pits	Low	NA	Highly disturbed small artefact scatter on severely eroded steep hillslope
BAYS AS and PAD 10	Borrow Pits	Moderate	Cannot be assessed	Minimally disturbed knapping floor on stable landform (hilltop)
BAYS PAD12	Borrow Pits	NA	Cannot be assessed	Further work required
BAYS AS and PAD11	Borrow Pits	Moderate	Cannot be assessed	Disturbed artefact scatter on unstable landform (sheet eroding slope). Undisturbed probable Aboriginal hearth partially buried in stable ground.
BAYS AS06	Borrow Pits	Low	NA	Small artefact scatter on unstable landform (eroding creekline)
BAYS AS and PAD07	Borrow Pits	Low-Moderate	Cannot be assessed	Artefact scatter on somewhat unstable landform (erosion exposures associated with adjacent creeklines)
37-2-0558	Borrow Pits	Low-Moderate	Cannot be assessed	Artefact scatter on somewhat unstable landform (erosion exposures associated with adjacent creeklines)
BAYS AS and PAD05	Borrow Pits	Moderate	Cannot be assessed	Large artefact scatter on stable and unstable landforms (hilltop, low gradient slope, and erosion exposures associated with adjacent creekline)
BAYS AS04	Borrow Pits	Low	NA	Artefact scatter on previously impacted landform (vehicle track)
BAYS AS and PAD03	Borrow Pits	Low	Cannot be assessed	Small artefact scatter on unstable landform (erosion exposures adjacent to creekline)
BAYS IF04	Borrow Pits	Low	NA	Isolated surface artefact
BAYS AS and PAD02	Borrow Pits	Low	Cannot be assessed	Small artefact scatter on unstable landform (erosion exposures adjacent to creekline)
BAYS IF03	Borrow Pits	Low	NA	Isolated surface artefact

Site ID	Project component	Significance assessment of site	Significance assessment of PAD	Relevant notes
BAYS IF02	Borrow Pits	Low	NA	Isolated surface artefact
BAYS IF01	Borrow Pits	Low	NA	Isolated surface artefact
37-3-0557	Borrow Pits	Low	NA	Small artefact scatter on erosional surface
37-2-0556	Borrow Pits	Low-Moderate	Cannot be assessed	Small artefact scatter, recorded as having subsurface potential
37-2-0555	Borrow Pits	Low-Moderate	Cannot be assessed	Small artefact scatter, recorded as having subsurface potential
37-3-0554	Borrow Pits	Low	NA	Small artefact scatter on erosional surface
37-2-0553	Borrow Pits	Low	NA	Small artefact scatter on erosional surface

Note 1: Site presumed destroyed as its recorded location is within an area severely impacted by existing operational infrastructure.

12.4 Assessment of impacts

12.4.1 Construction

For the purpose of this assessment, a precautionary approach has been adopted, and it is assumed that all sites and PADs within the Project area would be subject to direct impact, and all items within the study area, but outside of the Project area would be subject to indirect impact. A summary of potential impacts is provided in Table 12-4. Where sites have been identified as destroyed, these are excluded from Table 12-4.

However, the detailed design of the Project would seek to avoid impacts to Aboriginal sites and areas of PAD (see recommendations in Section 12.5) where possible.

Table 12-4 Summary of potential Aboriginal heritage impacts

Site name / AHIMS number	Project element	Site type	Type of harm	Degree of potential harm	Consequence of harm	Notes
BAYS PAD17	Ravensworth ash line	PAD	Direct and indirect	Partial destruction	Partial loss of value	Most of PAD is outside the study area. A portion of the PAD is within the study area. A portion of the PAD is within the Project area
BAYS PAD18	Ravensworth ash line	PAD	Direct and indirect	Partial destruction	Partial loss of value	Most of PAD is outside the study area. A portion of the PAD is within the study area. A portion of the PAD is within the Project area
BAYS PAD19	Ravensworth ash line	PAD	Direct	Partial destruction	Partial loss of value	Most of PAD is outside the study area. A portion of the PAD is within the study area. A portion of the PAD is within the Project area
37-3-1128	Ravensworth ash line	Artefact scatter	NA	None (site already destroyed)	None	Site is recorded on AHIMS as destroyed
37-3-0419	Ravensworth ash line	Artefact scatter	Indirect	Total destruction	Total loss of value	Site is within the buffer zone, and outside the Project area
BAYS PAD13	Salt cake landfill	PAD	Direct and indirect	Total destruction	Total loss of value	Most of the PAD is within the study area. A portion of the PAD extends into Project area
BAYS PAD14	BWAD augmentation	PAD	Direct and indirect	Total or Partial destruction	Total or Partial loss of value	A portion of the PAD is within the study area. Most of the PAD is within the Project area
BAYS PAD16	BWAD augmentation and Borrow Pit 1	PAD	Direct and indirect	Total or partial destruction	Total or partial loss of value	A portion of the PAD is within the study area. Most of the PAD is within the Project area
37-2-0048	BWAD augmentation	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area
BAYS PAD01	HP Pipe clearing (south)	PAD	Direct and indirect	Total destruction	Total loss of value	Most of the PAD is within the study area. A portion of the PAD extends into Project area

Site name / AHIMS number	Project element	Site type	Type of harm	Degree of potential harm	Consequence of harm	Notes
BAYS PAD08	HP pipe (north) and LSP pipe clearing	PAD	Direct and indirect	Total destruction	Total loss of value	Most of the PAD is within the study area. A portion of the PAD extends into Project area
BAYS AS and PAD15	Borrow Pit 1	Artefact scatter and PAD	Direct and indirect	Complete destruction of artefact scatter, partial destruction of PAD	Partial loss of value	Most of the site is within the study area. A portion of the site extends into Project area
BAYS AS 09	Borrow Pit 2	Artefact scatter	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS AS and PAD 10	Borrow Pit 2	Artefact scatter and PAD	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS AS and PAD11	Borrow Pit 2	Artefact scatter and PAD	Direct and indirect	Total destruction	Total loss of value	A portion of the site is within the study area. A portion of the site is within the Project area (PAD)
BAYS PAD12	Borrow Pit 2	PAD	Direct and indirect	Total destruction	Total loss of value	A portion of the PAD is within the study area. A portion of the PAD is within the Project area
BAYS AS and PAD07	Borrow Pit 3	Artefact scatter and PAD	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS AS06	Borrow Pit 3	Artefact scatter	Indirect	Total destruction	Total loss of value	Site is entirely within the study area, and outside the Project area
37-2-0558	Borrow Pit 3	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area

Site name / AHIMS number	Project element	Site type	Type of harm	Degree of potential harm	Consequence of harm	Notes
BAYS AS and PAD05	Borrow Pit 4	Artefact scatter and PAD	Direct and indirect	Partial destruction	Partial loss of value	Most of the site is within the Project area. A portion of the site extends outside the Project area
BAYS AS04	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS AS and PAD03	Borrow Pit 4	Artefact scatter and PAD	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS IF04	Borrow Pit 4	Isolated artefact	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS AS and PAD02	Borrow Pit 4	Artefact scatter and PAD	Direct	Total destruction	Total loss of value	Site is entirely within the Project area
BAYS IF03	Borrow Pit 4	Isolated artefact	Direct	Total destruction	Total loss of value	Site is within the Project area
BAYS IF02	Borrow Pit 4	Isolated artefact	Direct	Total destruction	Total loss of value	Site is within the Project area
BAYS IF01	Borrow Pit 4	Isolated artefact	Direct	Total destruction	Total loss of value	Site is within the Project area
37-2-0557	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area

Site name / AHIMS number	Project element	Site type	Type of harm	Degree of potential harm	Consequence of harm	Notes
37-2-0556	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project are
37-2-0555	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area
37-2-0553	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area
37-2-0554	Borrow Pit 4	Artefact scatter	Direct	Total destruction	Total loss of value	Site is within the Project area

12.4.2 Operation

There are not expected to be any Aboriginal heritage impacts from the operation of the Project.

12.4.3 Cumulative impacts

The cumulative impact to the archaeological resource of the region cannot be gauged at present, due to the significance of PAD areas requiring further work to be assessed. The cumulative impact represented by the Project will be assessed following test excavations, as these would establish the nature and significance of any subsurface archaeological material present within each of the areas of PAD.

It is noted that impacts to AGL land has been cited by RAPs as an area of interest due to it being a pocket of relatively undisturbed land in an area that has been subject to extensive impact from mining operations. Prior impact to large areas of land in the immediate surrounding region, and across the Hunter Valley overall, have increased the concern that the Aboriginal community has with impacts proposed by future projects. This interest with the cumulative impact of successive development projects is consistent with feedback on other projects in the region (Sutton, 2013)).

12.5 Environmental management measures

Environmental management measures relating to Aboriginal heritage impacts are outlined in Table 13-6.

Table 12-5 Environmental management measures – Aboriginal heritage impacts

Ref	Environmental management measure	Timing
AH1	The detailed design of the Project would seek to avoid impacts to Aboriginal sites and areas of PAD where possible.	Pre-construction
AH2	Establish 'no-go' areas, through fencing or other appropriate measures, to protect all sites and areas of PAD (or portions thereof) that have been assessed as subject to potential indirect (inadvertent) impact.	Pre-construction
AH3	Where direct impacts are proposed to occur to areas of PAD (including those areas of PAD associated with surface artefact scatters), the following process would be carried out prior to construction: • A program of detailed survey and test excavation would be carried out to assess the nature and significance of any subsurface archaeological material • Develop further proposed management measures for areas of subsurface archaeological material, based on the results of test excavations • Management may include salvage excavation, or further design refinements to avoid impacts and establishment of no-go areas.	Pre-construction
AH4	Carry out collection of surface artefacts from all sites or portions of sites that would be impacted by the Project. Collection of surface artefacts and archaeological excavations would be undertaken by a qualitied archaeologist and Site Officers supplied by the RAPs.	Pre-construction
AH5	Cultural awareness induction for any personnel involved in ground breaking activities. This could include a Cultural Awareness Training Program.	Construction
AH6	A Cultural Heritage Management Plan including potential monitoring and salvage works procedures would be prepared and implemented for the Project construction.	Construction

Ref	Environmental management measure	Timing
AH7	A Chance Finds Procedure would be included in the Cultural Heritage Management Plan and be followed for any previously unidentified Aboriginal heritage objects found during the works. The Procedure would require that: • In the event that a previously unidentified Aboriginal heritage object is found, all activity in the immediate area must cease and an appropriately qualified heritage professional should be consulted. Heritage NSW and local Aboriginal stakeholder groups must be immediately contacted and informed of the Aboriginal heritage object found. The qualified heritage professional should record the location and the attributes of the site and determine its Aboriginal cultural significance • If Aboriginal remains (human skeletal material or suspected human skeletal material) are discovered during construction all activities in the immediate area must cease. The State Police and NSW Heritage must be contacted and any sand or soil removed from the near vicinity identified and set aside for investigation purposes.	Construction

13. Traffic and transport

This chapter summarises the findings of the Traffic and Transport Assessment (Jacobs, 2019e) *(see Appendix J) and addresses the SEARs for traffic and transport including:*

- *an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation;*
- *an assessment of the likely transport impacts to the site access route, site access point and any Crown land, particularly in relation to the capacity and condition of the roads;*
- *a cumulative impact assessment of traffic from nearby developments;*
- *a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and*
- *a description of the measures that would be implemented to mitigate any transport impacts during construction and operation;*

13.1 Existing environment

13.1.1 Road network and access

Bayswater is connected to the surrounding road network via an access road and grade-separated interchange to and from the New England Highway (**Bayswater access road**). Bayswater access road is single carriageway with one lane in each direction. The maximum operating speed is 60km/h. Bayswater is accessed from the New England Highway via an interchange that is shared by Liddell, as shown in Figure 13-1.

The New England Highway is a national highway that links Newcastle to Brisbane. Near to Bayswater, the New England Highway is dual carriageway with two lanes in each direction and a central median. The speed limit in the vicinity of Bayswater is 100km/h.

Figure 13-1: Interchange with the New England Highway

13.1.2 Traffic volumes

Traffic volumes for the New England Highway were obtained from the TfNSW permanent count station (ID 6154) located to the north of Bayswater, 1.64 kilometres south of Muscle Creek Road, Muswellbrook.

The average weekday traffic volumes are approximately 9,400 vehicles per day with 30 per cent of these volumes being heavy vehicles. The hourly traffic volume profile for an average weekday in 2018 is shown in Figure 13-2.

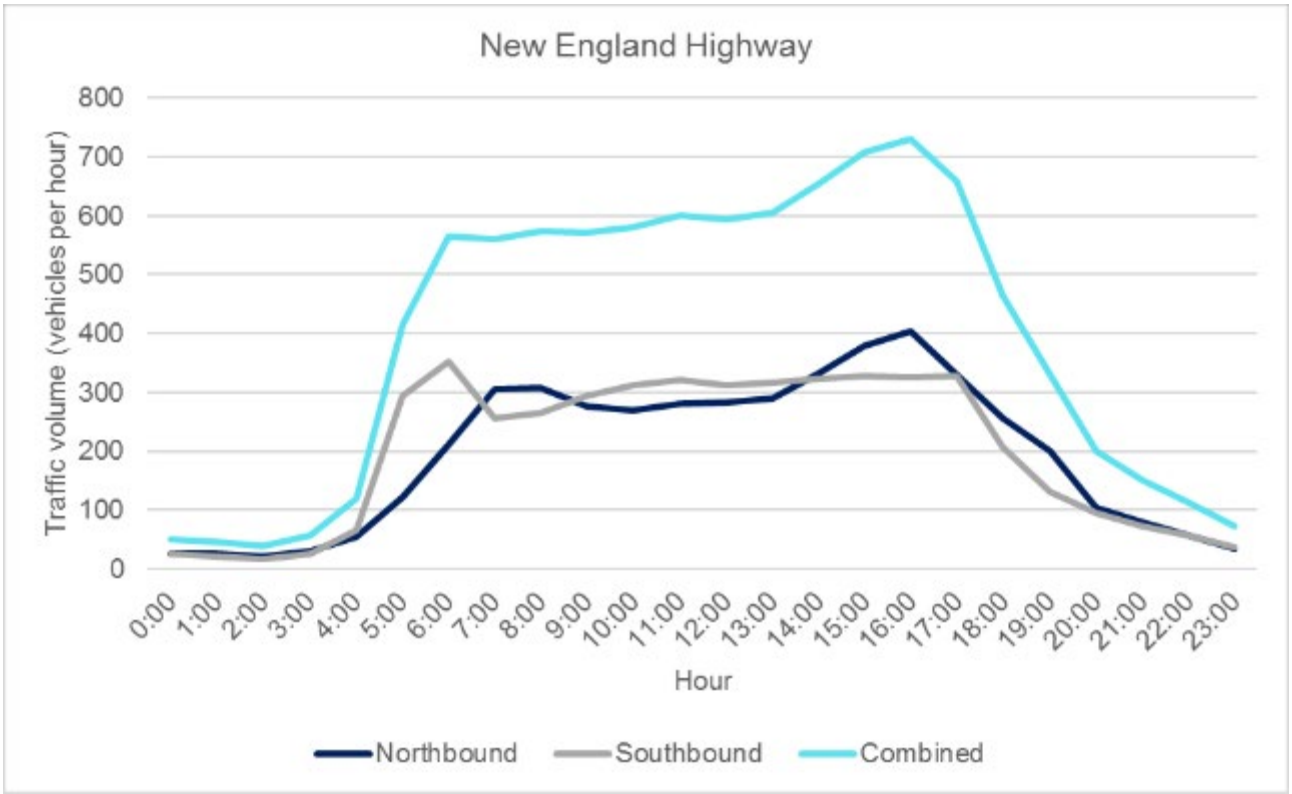


Figure 13-2: Hourly traffic volumes (2018) average weekday

The data indicates that peak traffic periods occur in the hours starting 8:00am and 4:00pm for the morning and evening peaks respectively. Between 5:00am and 6:00pm, traffic volumes are similar to volumes during the peak hours.

13.1.3 Interchange and Bayswater access road

Traffic volumes for the Bayswater access road and the interchange with New England Highway were commissioned from traffic surveys which were undertaken on Tuesday 22 May 2018. At this time, Bayswater was operating during its annual maintenance shutdown period where 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 operation at Bayswater.

At the interchange, the morning peak hour was 6:00am – 7:00am and the evening peak hour was 5:30pm – 6:30pm. Figure 13-3, Figure 13-4 and Figure 13-5 show the daily traffic, morning peak hour and evening peak hour traffic volumes respectively. Most 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 per cent of the total volume of traffic.

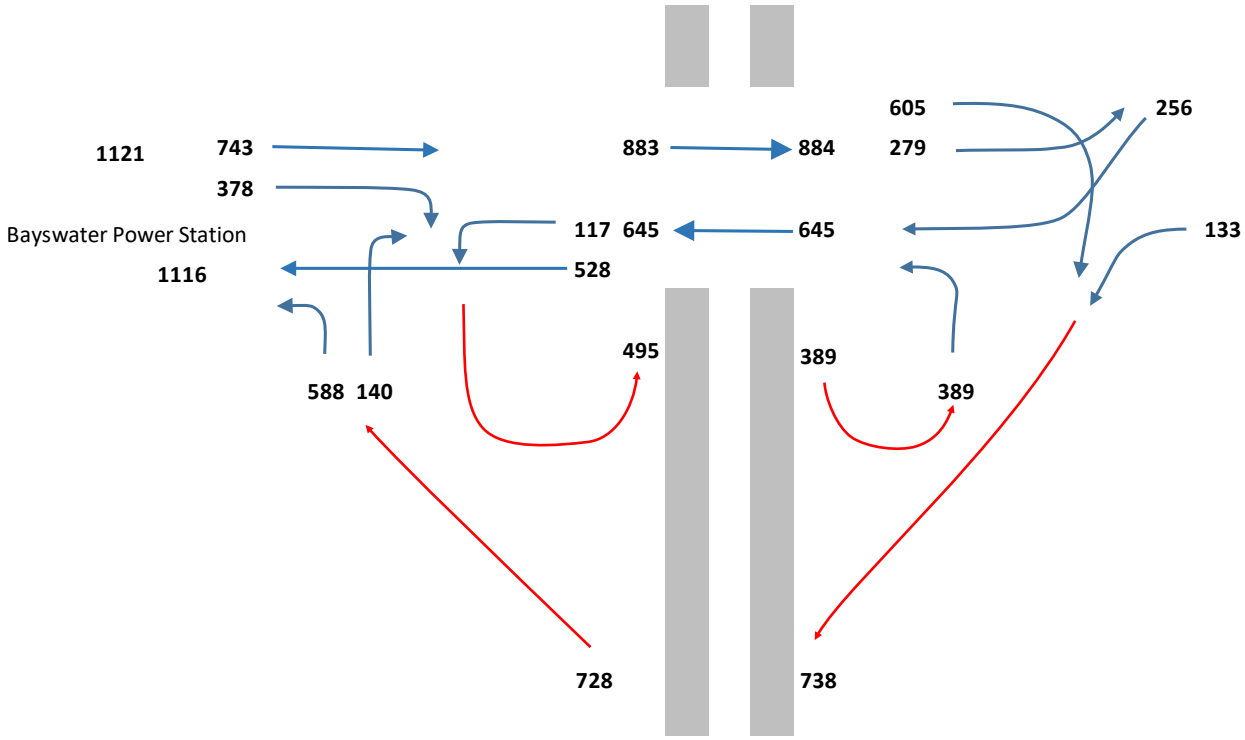


Figure 13-3: Bayswater access road daily traffic volumes

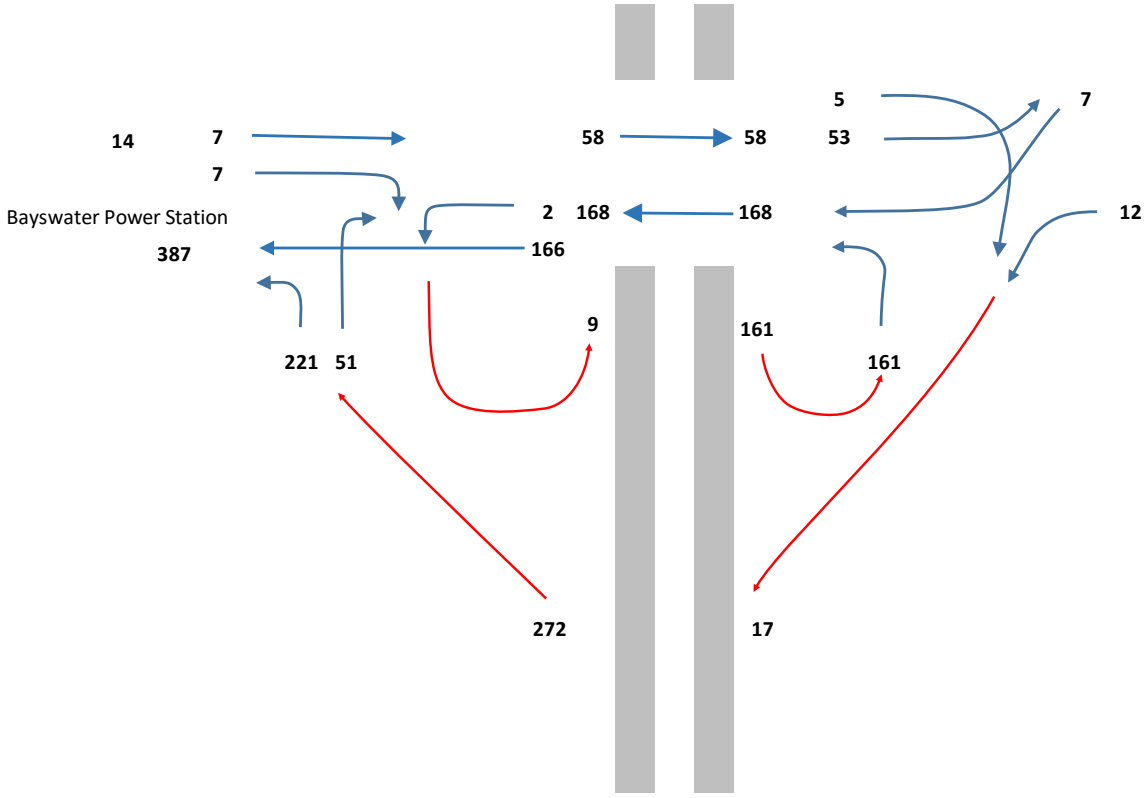


Figure 13-4: Bayswater access road morning peak hour traffic volumes (6:00am - 7:00am)

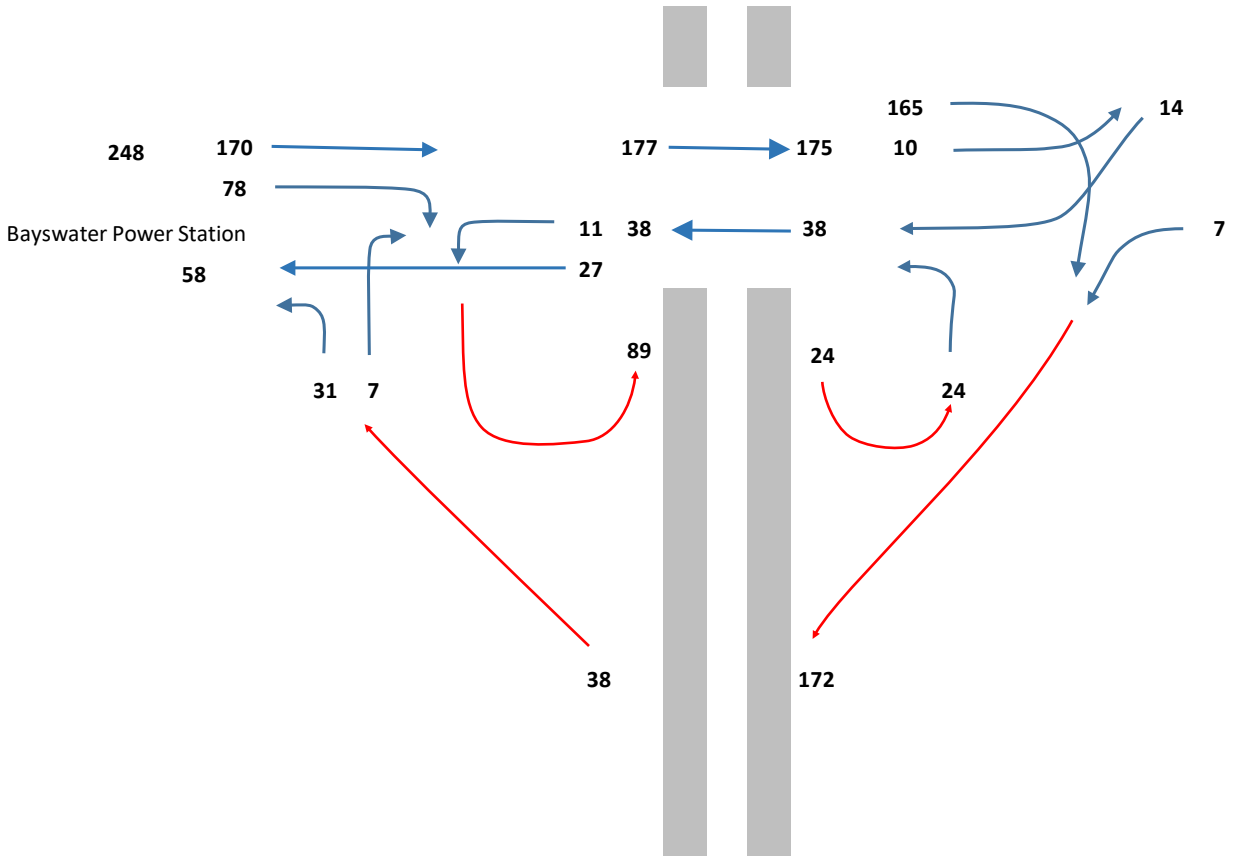


Figure 13-5: Bayswater access road evening peak hour traffic volumes (5:30pm - 6:30pm)

The existing traffic generated by Bayswater during the morning and evening peak hours is summarised in Table 13-1.

Table 13-1: Existing traffic generation

Period	To the site (vehicles)	From the site (vehicles)	Total
Morning peak hour (6:00am – 7:00am)	387	14	401
Evening peak hour (5:30pm – 6:30pm)	58	248	306
Daily traffic volume	1,116	1,121	2,237

13.1.4 Crash history

Crash data was provided by TfNSW in August 2019 for the most recent five-year period from October 2013 to September 2018. During this period, five crashes occurred near to Bayswater, with three on the New England Highway and two on the interchange. Two of the crashes occurred in darkness or when raining, and three crashes involved striking a kangaroo or straying stock.

13.2 Assessment of impacts

Traffic generated by the Project would involve personnel and transportation of containers and construction materials. The majority of traffic movements would occur between 6:00am to 6:00pm within the operating hours of Bayswater, with some ash harvesting activities associated with the operation of the Project to occur outside of

these hours. It is assumed that heavy vehicle movements would be distributed evenly throughout the day across these operating hours.

For the purposes of the traffic assessment, it has been assumed that the following developments would operate concurrently with the various stages of the Project:

- Bayswater Turbine Efficiency Upgrade
- Ravensworth Composting Facility
- Liddell closure and rehabilitation.

The traffic generation associated with these developments has been considered cumulatively alongside the Project in the traffic impact assessment (see Appendix J for further details). As with the Project, the majority of heavy vehicle traffic movements of nearby developments are assumed to be distributed evenly throughout the day from 6:00am to 6:00pm.

It should be noted that this assessment is conservative as it assumes that construction of all Project elements would be undertaken concurrently. Some works may be staged and it is anticipated that staging would result in a reduction of cumulative construction-related traffic impacts.

13.2.1 Road Network Performance

Bayswater access road and intersection performance

SIDRA Intersection 7 was used to model the performance of two key constraint intersections at the interchange using the existing traffic volumes and the traffic associated with the Project, and other developments in the area. The modelled locations are shown in Figure 13-6 and the existing and future peak year traffic modelling results of the T-intersection and merge are shown in Table 13-3.

A target Level of Service (**LoS**) of C (see Table 13-2) was adopted for the modelled intersections as consistent with Section 4.2.4 of the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). Furthermore, queue lengths were modelled to determine whether safety on the New England Highway would be affected by queue spillback onto the highway.

The assessment of intersection performance is based on criteria outlined and defined in the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002) as shown in Table 13-2. The average delay assessed for signalised intersections is for all movements, and for priority (sign-controlled) intersections is for the worst movement and is expressed in seconds per vehicle.

Table 13-2 : Level of Service (LoS) criteria for intersections

LoS	Average delay per vehicle (seconds / vehicle)	Traffic signals and roundabouts	Give way and stop signs
A	Less than 15	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity, and accident study required
E	57 to 70	At capacity, incidents will cause delays. Roundabouts require other control mode	At capacity, requires other control mode
F	Over 70	Extra capacity required	Extreme delay, traffic signal or other major treatment required

Source: Guide to Traffic Generating Developments (RMS, 2002)

Figure 13-6: Intersection model locations

Table 13-3: SIDRA results – T-intersection

Scenario	Intersection and peak period	Average delay (seconds)	Degree of Saturation	LoS	Queue length (metres)
Existing scenario	Morning peak - Merge	4.4	0.130	A	0
	Evening peak - T-intersection	2.4	0.095	A	0.2
Future peak year scenario	Morning peak - Merge	4.5	0.194	A	0
	Evening peak - T-intersection	2.6	0.156	A	0.4

The modelling indicates that the interchange currently operates at excellent LoS with abundant spare capacity. In the future peak year, the cumulative impact of the Project and nearby developments is not expected to significantly 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.

The length of the exit ramp from the New England Highway to the T-intersection is approximately 750 metres. The future year peak scenario queue lengths are expected to be very low and not expected to extend into nor impact upon the operation of the highway.

New England Highway performance

The peak hour traffic volumes on the New England Highway are approximately 400 vehicles per hour in each direction across the two lanes.

To assess the capacity of the highway, Exhibit 10-5 of the *Highway Capacity Manual 2010* specifies the base capacity of a freeway based on the free-flow speed and is shown in Table 13-4.

Table 13-4: Base capacity of a freeway

Free flow speed (kilometres/hour)	Base capacity (passenger car units /hour/lane)
120	2,400
113	2,400
105	2,350
97	2,300
89	2,250

Source: Highway Capacity Manual 2010

For a free flow speed of 100 km/h, the base capacity of the New England Highway is 4,600 passenger car units per hour. This indicates that there is excess capacity to accommodate the cumulative additional traffic generation on the New England Highway without significantly impacting the operation of the highway.

13.2.2 Construction

As outlined in Section 2.1 during peak construction, the Project would provide employment for up to 90 workers, generating an expected 90 two-way light vehicle movements per day. Furthermore, an additional 25 two-way heavy vehicle movements are expected to be generated per day for construction.

It should be noted that this assessment is conservative as it assumes that construction of all project elements would be undertaken concurrently. The finalised construction schedule would be further developed as part of design refinements, based on AGL operational requirements and in consultation with delivery contractors. Some works may be staged and it is anticipated that this would result in a reduction of cumulative construction-related traffic impacts.

Overall it is expected that additional traffic generated by the Project and nearby developments would consist of:

- 160 light vehicles to and from Bayswater during the morning and evening peak, respectively
- 10 heavy vehicles to and from Bayswater; and
- 3 heavy vehicles to and from Liddell.

The internal road network within Bayswater has sufficient capacity to accommodate the increased internal vehicle movements and no additional upgrades to the internal road network are required.

The distribution of vehicles is shown in Figure 13-7 and Figure 13-8, with heavy vehicle volumes consisting of between 5 and 10 percent of the total volume of traffic.

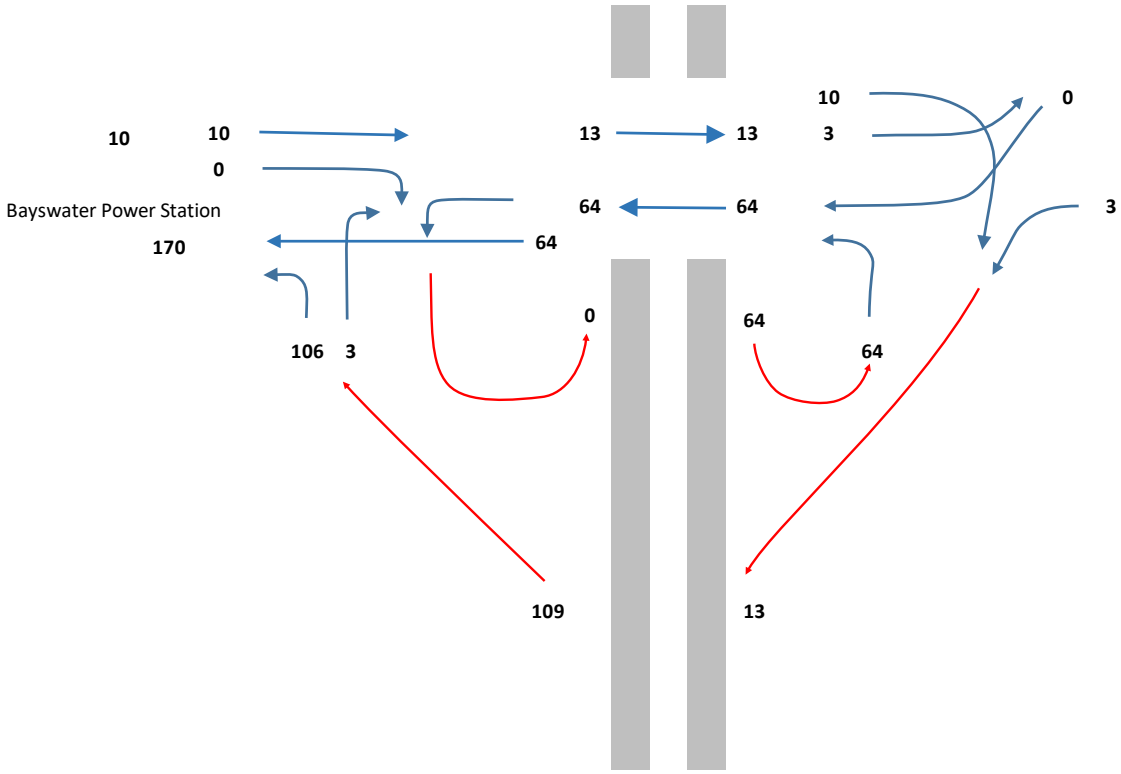


Figure 13-7 Bayswater access road cumulative morning peak traffic generation volumes (6:00am – 7:00am)

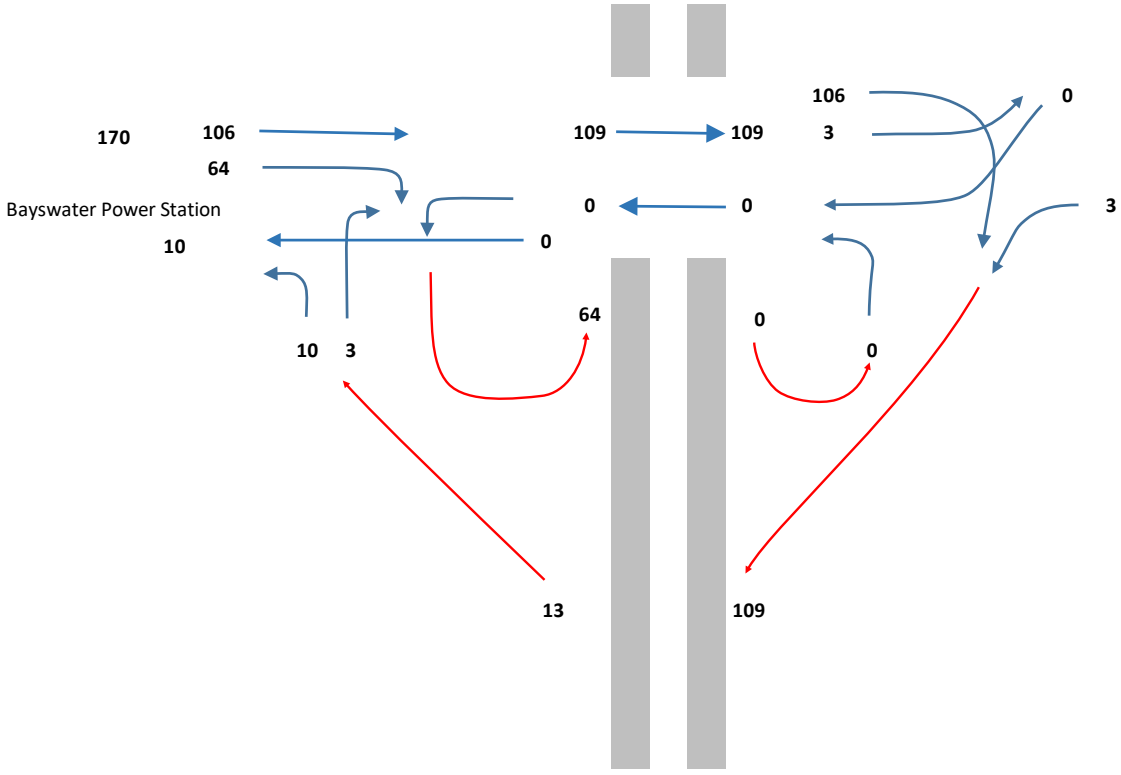


Figure 13-8 Bayswater access road cumulative evening peak traffic generation volumes (5:30pm – 6:30pm)

Merge and diverge analysis

To assess the capacity of the entry ramp from the Bayswater access road to the New England Highway in the southbound direction, the *Highway Capacity Manual 2010* specifies the LoS criteria for merge segments on a freeway. Merge LoS is defined in terms of density with a target LoS of C for rural roads.

Table 13-5: Level of service definitions

LoS	Density (passenger car units /kilometres/lane)	Comments
A	Less than 6.2	Unrestricted operations
B	6.2 to 12.4	Merging and diverging manoeuvres noticeable to drivers
C	12.4 to 17.4	Influence area speeds begin to decline
D	17.4 to 22.7	Influence area turbulence becomes intrusive
E	Over 22.7	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

Source: Highway Capacity Manual 2010

An additional 106 light vehicles and 3 heavy vehicles are expected to merge from the interchange to the New England Highway in the southbound direction during the evening peak. The calculated density of vehicles merging on the entry ramp influence area is 5.2 passenger car units per kilometre per lane, which corresponds to LoS A. This indicates that there is excess capacity on the entry ramp to accommodate the cumulative additional traffic generation without significantly impacting the operation of the entry ramp.

Heavy vehicle access routes

Heavy vehicle routes to and from Bayswater would only use the existing oversized and over-mass load approved road network as shown in Figure 13-9. This includes the use of New England Highway and the Bayswater access road.

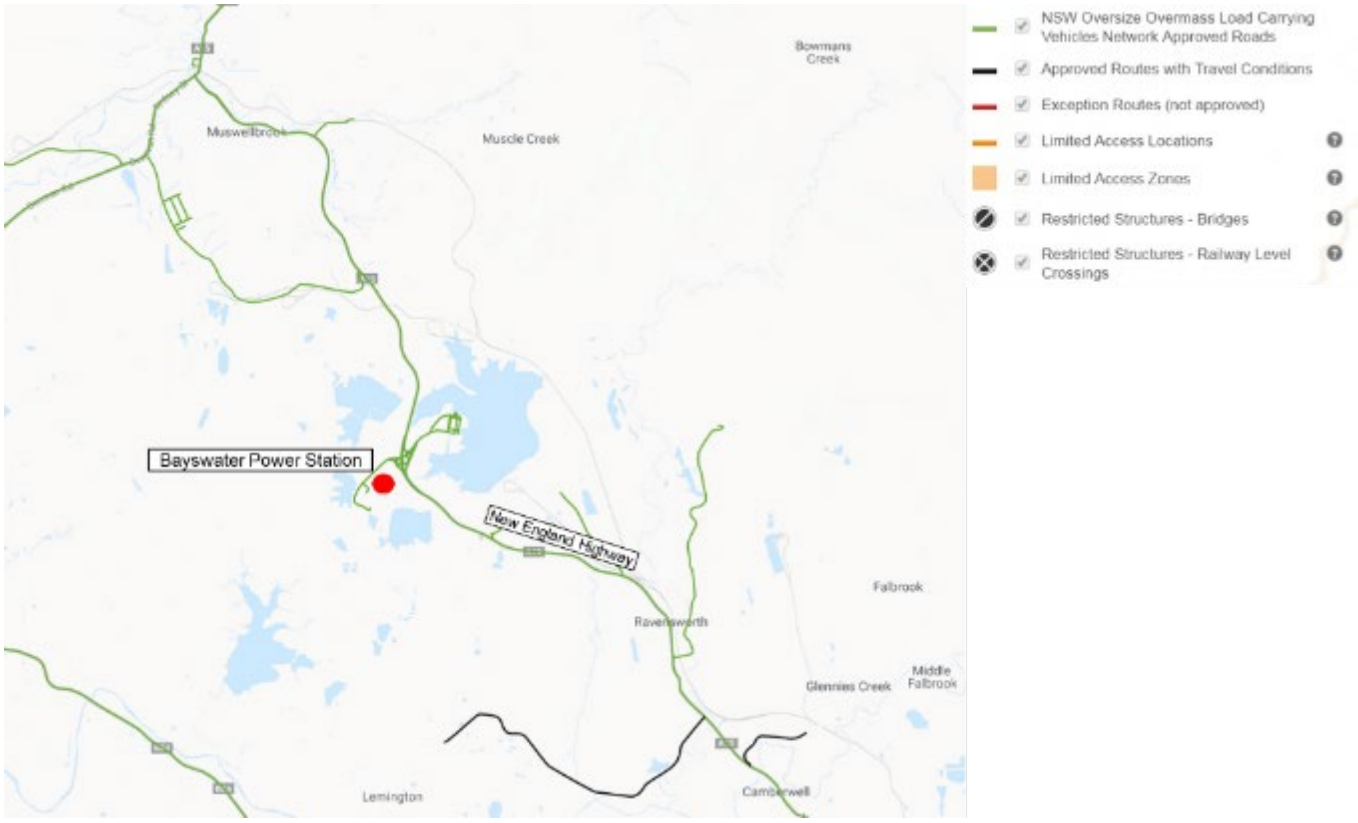


Figure 13-9: Over-size over-mass load carrying network ((Transport for NSW, 2019))

Oversized vehicles

Up to four two-way oversized vehicle movements are expected throughout the duration of the Project works for the delivery of three weighbridges and an ash silo. The scheduling of these oversized vehicles would be confirmed when subcontractors and the construction schedule have been finalised.

Lane and shoulder width

Lane and shoulder widths of public roads servicing Bayswater conform with the Austroads *Guide to Road Design.* No road upgrades would be required to accommodate additional vehicle movements.

Stopping sight distance

Stopping sight distance was assessed at the westbound approach to the Bayswater access road intersection, west of the northbound exit ramp. The access road is a horizontal curve with the grade and vegetation obstructing sight on the inside of the curve. Vehicle line of sight is shown in Figure 13-10.

Figure 13-10: Stopping sight distance to access road intersection

Table 5.6 of the Austroads *Guide to Road Design Part 3: Geometric Design* specifies the stopping sight distances for single unit trucks, semi-trailers and B-doubles. For an assumed operating speed of 60 km/h and an assumed reaction time of 2.5 seconds, the required stopping sight distance is 91 metres. The provided stopping sight distance is approximately 195 metres, which satisfies the Austroads requirement. No road upgrades would be required to accommodate additional vehicle movements.

Crash history

As outlined in Section 13.1.4, five crashes occurred near Bayswater from October 2013 to September 2018. The low frequency of crashes indicates that additional traffic generation is unlikely to have an impact on future crash frequency. However, it should be noted that the majority of observed crashes involved striking an animal. To mitigate this risk, personnel should be notified of the risk of collisions, particularly with animals during rain or periods of low light.

13.2.3 Operation

During operation, an additional 25 operational personnel are expected on site. Personnel are expected to travel to and from the site using personal light vehicles, generating approximately 25 two-way light vehicle movements per day. Furthermore, an additional 180 two-way heavy vehicle movements are expected to be generated per day for the transportation of ash.

Modelling has indicated the New England Highway and the southbound entry ramp from the interchange have excess capacity to accommodate the additional cumulative traffic generation. The interchange currently operates at excellent levels of service with abundant spare capacity.

Operation of the Project would not result in impacts to the performance of the road network.

13.2.4 Decommissioning and rehabilitation

During decommissioning and rehabilitation, delivery of materials would be required from the Ravensworth Composting Facility for the remediation of the proposed BWAD. It is estimated that approximately 15 two-way heavy vehicle movements per day would be required from 2035 until rehabilitation works are completed (up to 2040).

In addition, there would be up to 15 two-way heavy vehicle movements a day associated with the delivery of over 150,000 tonnes of organics required for progressive rehabilitation works of other elements of the Project. These progressive works would continue over the life of the Project until rehabilitation works are completed. For the purposes of this assessment it is assumed that these works would be undertaken concurrently over five years from 2035. However, rehabilitation works may not occur simultaneously. It is assumed that there is sufficient capacity within the existing internal road network within Bayswater. As noted, vehicle movements associated with the Ravensworth Composting Facilities on the road network are approved under the existing development consent for the facilities (DA140/2016 and DA173/2016).

Decommissioning and rehabilitation of the Project would not result in impacts to the performance of the road network.

13.3 Environmental management measures

Environmental management measures relating to traffic and transport impacts are outlined in Table 13-6.

Table 13-6 Environmental management measures - traffic and transport impacts

Ref	Environmental management measure	Timing
TT1	An oversized vehicle permit would be sought for all oversized vehicle movements. Oversized vehicles would be escorted by an appropriately qualified subcontractor and would endeavour to travel outside of peak traffic periods.	Pre-construction
TT2	The haulage contractor to prepare and implement a traffic management plan for oversize vehicle movements, which would 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.	Construction
TT3	The CEMS and general site induction would inform construction and operational personnel of the risk of collisions, particularly with animals during rain or periods of low light.	Construction / operation

14. Noise and vibration

This chapter presents an assessment of the construction noise impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and operational noise impacts in accordance with the NSW Noise Policy for Industry 2017, in accordance with the Project SEARs.

14.1 Existing environment

14.1.1 Surrounding sensitive receivers

As displayed in Figure 10-1, the nearest residential receivers are located several kilometres from the main works associated with the Project. Activities associated with the construction of the ash pipeline from Bayswater to Ravensworth Void 3 are closest to surrounding residential receivers but are still around 2 kilometres away. There are also several mining industrial operations nearby. Yancoal's Hunter Valley Operations North and Glencore's Liddell Coal and Ravensworth Complex are located closest to the Project, with the nearest industrial building located approximately 400 metres away.

14.1.2 Terrain

Terrain features are important as they can provide screening between noise source and receiver locations. A three-dimensional schematic of terrain features around the Project is shown below in Figure 14-1. As shown, there are intervening terrain features between Project activity areas and the identified nearest residential receivers.

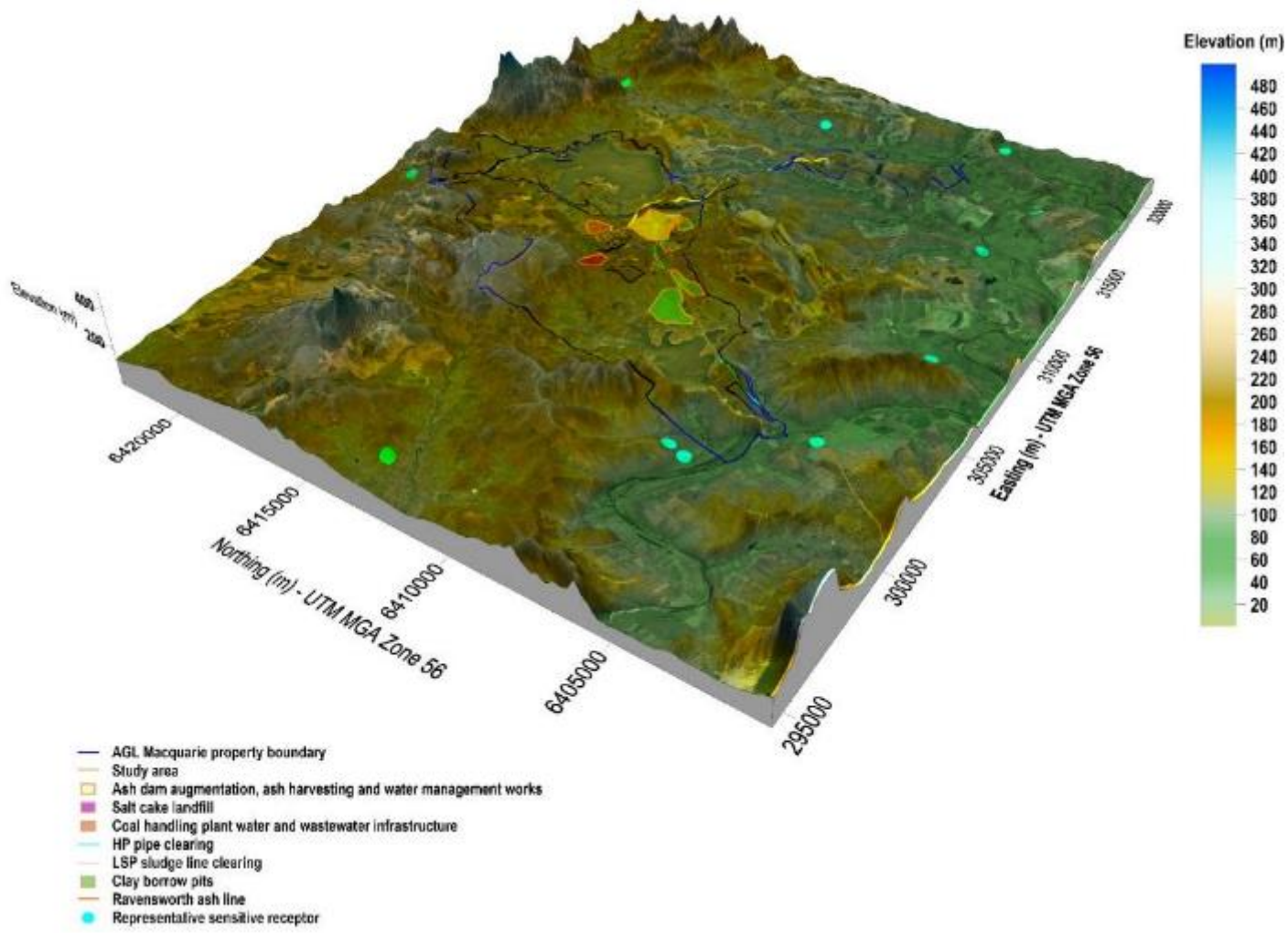


Figure 14-1: Three-dimensional schematic of Project setting

14.1.3 Meteorology

Certain meteorological conditions can enhance the propagation of noise and their influence is required to be accounted for where they are found to be a feature of the locality. A review was undertaken to assess whether prevailing winds and temperature inversions were ‘significant’ features of the local environment, consistent with the methods detailed in Fact Sheet D of the NSW EPA’s “Noise Policy for Industry” (**NPI**). This review found that winds blowing from the southeast were ‘significant’ during evenings in Autumn and frequency of occurrence of temperature inversions in winter months was also ‘significant’ such that noise-enhancing meteorological effects required consideration.

14.1.4 Background noise levels

In the absence of monitored background noise levels the NPI provides the following minimum rating background levels (**RBLs**) to be used for the purpose of noise assessment:

Table 14-1: Estimated worst-case RBLs

Time of day	L90 (RBL) dB (A)
Day (7 am to 6 pm)	35
Evening (6 pm to 10 pm)	30
Night (10 pm to 7 am)	30

14.2 Assessment methodology

14.2.1 Construction noise

The "Interim Construction Noise Guideline" (**ICNG**) (Department of Environment and Climate Change, 2009) provides guidance for assessing noise from construction activities in NSW. It establishes noise management levels (**NMLs**) according to the hours in which construction may take place. Construction is considered to have the potential to cause a noise impact if the predicted noise exceeds the noise management levels.

Considering the adopted RBLs above and the guidance for establishing NMLs from the ICNG, the following NMLs were established to assess potential construction noise impacts at the identified surrounding residential receiver locations:

Table 14-2: Construction NMLs for residential receivers

Receiver type	Day (during standard hours)		Day (outside standard hours)		Evening		Night	
	L90 (RBL) dB (A)	NML Leq 15 min dB(A)	L90 (RBL) dB (A)	NML Leq 15 min dB(A)	L90 (RBL) dB (A)	NML Leq 15 min dB(A)	L90 (RBL) dB (A)	NML Leq 15 min dB(A)
Residential receivers	35	45	35	40	30	35	30	35

The ICNG also provides construction NMLs for non-residential land uses. No separate criteria for out-of-hours construction works is provided for non-residential sensitive receivers as it is assumed that the buildings would be vacated during the evening and night-time periods. For the nearby industrial receivers, the ICNG recommends a NML of 75 dB(A).

14.2.2 Construction traffic noise impacts

Section 9 of the *Construction Noise and Vibration Guideline* (**CNVG**), (Roads and Maritime , 2016)provides guidance for the assessment of noise associated with additional traffic generated during construction. This guidance was adopted for this assessment and has been reproduced below:

> *For Roads and Maritime projects an initial screening test should first be applied by evaluating whether noise levels will increase by more than 2dB(A) due to construction traffic or a temporary reroute due to a road closure. Where increases are 2dBA or less no further assessment is required.*
>
> *Where noise levels increase by more than 2dB(A) [i.e. 2.1 dBA] further assessment is required using Roads and Maritimes Criteria Guideline. This documents Roads and Maritimes'' approach to implementing the Road Noise Policy. Consideration should be given under the Noise Criteria Guideline as to whether construction traffic or temporary reroute triggers new road criteria due to changes in road category'.*

This guidance was considered for the purpose of reviewing potential noise associated with additional traffic generated as a result of the Project.

14.2.3 Operational noise

The NPI seeks to regulate noise impact from 'industrial activity'. The guideline applies two separate noise levels; one aimed at limiting the intrusiveness of the Project's noise against the prevailing level of background noise, and the other focused on achieving suitable acoustic amenity for the surrounding land uses from industry. The more stringent of these is used to define the operational noise criteria for the Project.

Considering the adopted RBLs and nature of the surrounding receiving environment, the following intrusiveness and amenity criteria were developed:

Table 14-3: NPI intrusiveness noise criteria

Receiver type	Time of day	L90 (RBL) dB (A)	Allowance	Noise intrusiveness criteria dB(A)
Residential receivers	Day (7 am to 6 pm)	35	+5 dB(A)	40
	Evening (6 pm to 10 pm)	30		35
	Night (10 pm to 7 am)	30		35

Table 14-4: NPI project amenity noise criteria

Receiver type	Time of day	Recommended LAeq Noise Level dB(A)	Project LAeq Noise Level dB(A)
Residential receivers	Day (7 am to 6 pm)	50	48
	Evening (6 pm to 10 pm)	45	43
	Night (10 pm to 7 am)	40	38
Industrial premises	When in use	70	65

Based on these criteria, the following most stringent operational noise criteria were adopted for the assessment:

Table 14-5: Project operational noise criteria

Receiver type	Time of day	L90 (RBL)dB (A)
Residential receivers	Day (7 am to 6 pm)	40
	Evening (6 pm to 10 pm)	35
	Night (10 pm to 7 am)	35
Industrial premises	When in use	65

Potential noise impacts from traffic generated during the operation of the development were assessed against guidance presented in Section 3.4.1 of the "NSW Road Noise Policy" (DECCW, 2011). This involved reviewing whether additional traffic generated by the project would result in changes of more than 2 dB(A) at surrounding sensitive receivers.

14.2.4 Vibration

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criteria levels, with the effects of vibration on human comfort having a lower threshold. Section 7 of the CNVG provides useful guidance for safe working distances to achieve human comfort ("Assessing Vibration: a technical guideline", (DECC, February 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. These have been reproduced below.

Table 14-6: Recommended safe working distances for vibration-intensive plant and equipment, (Roads and Maritime , 2016)

Plant	Rating / description	Safe working distance (metres)	
		Cosmetic damage (BS7385-2: 1993)	Human response (DECC, 2006)
Vibratory Roller	<50 kN (typically 1-2 t) <100 kN (typically 2-4 t) <200 kN (typically 4-6 t) <300 kN (typically 7-13 t) >300 kN (typically 13-18 t) >300 kN (> 18 t)	5 metres 6 metres 12 metres 15 metres 20 metres 25 metres	15 to 20 metres 20 metres 40 metres 100 metres 100 metres 100 metres
Small hydraulic hammer	300 kg – 5 to 12 t excavator	2 metres	7 metres
Medium hydraulic hammer	900 kg – 12 to 18 t excavator	7 metres	23 metres
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 metres	73 metres
Vibratory pile driver	Sheet piles	2 to 20 metres	20 metres
Pile boring	≤800 mm	2 metres (nominal)	4 metres
Jackhammer	Hand held	1 metres (nominal)	2 metres

14.3 Assessment of impacts

14.3.1 Construction

The key activities considered to have the potential to generate noise and vibration during the Project include:

- Earthworks associated with the BWAD augmentation, Salt cake landfill, Borrow Pits 1 to 4, and Ravensworth ash pipeline
- Upgrades to the existing infrastructure
- Vegetation removal and
- Associated traffic movements.

Overall sound power levels (**SPLs**) were predicted for each activity and phase associated with the Project. These were determined based on sequencing and plant and equipment agreed with AGL. The overall SPLs were estimated with reference to individual plant and equipment levels presented in national and international standards and guidelines, as well as from Jacobs measurement database. Table 14-7 below summarises estimated overall noise emissions for the agreed assessment scenarios.

Table 14-7: Noise emissions inventory

ID	Activity	Location	Plant and equipment	Overall sound power level dB(A)
01	BWAD augmentation	BWAD	2 x Dozer 2 x Crane 2 x Excavator 1 x Excavator mounted breaker 1 x Cement truck 4 x Truck and dog 2 x Hiab 2 x Dump truck 2 x Lighting towers 1 x Watercart 1 x Compactor 2 x Generator 2 x Graders	123 dB(A)
02	Upgrades to coal ash recycling facility	Coal ash recycling facility	2 x Dozer 2 x Mobile crane 2 x Excavator 1 x Cement truck 2 x Truck and dog 1 x Watercart 2 x Compactors/Rollers 2 x Graders	117 dB(A)
03	Fly ash harvesting upgrades	Fly ash harvesting area	2 x Dozer 1 x Mobile crane 2 x Excavator 1 x Cement truck 2 x Truck and dog 1 x Skidsteer 1 x Watercart 1 x Compactor 1 x Paving machine 1 x Grader	119 dB(A)
04	Construction of ash pipeline from Bayswater to Ravensworth Void 3	Bayswater to Ravensworth Void 3	2 x Dozer 1 x Chipper 2 x Excavator 1 x Chainsaw 2 x Truck and dog 1 x Compactor 1 x Front end loader 1 x Under boring machine	119 dB(A)
05	Salt cake landfill activities	Salt cake landfill	2 x Dozer 2 x Excavator 4 x Truck and dog 2 x HIAB	117 dB(A)

ID	Activity	Location	Plant and equipment	Overall sound power level dB(A)
			2 x Front end loader	
06	Activities at Borrow Pits	Borrow Pits 1 to 4	2 x Dozer 1 x Chipper 2 x Excavator 1 x Chainsaw 2 x Truck and Dog 1 x Watercart 2 x Boom lift	116 dB(A)
07	Upgrades to CHP	CHP	2 x Dozer 2 x Excavator 2 x Truck and Dog 1 x Skidsteer 2 x Daymaker	116 dB(A)
08	Rehabilitation activities	All areas	2 x Dozer 1 x Chipper 2 x Excavator 1 x Chainsaw	115 dB(A)

The Project would also result in additional traffic movements which could result in additional vehicle-related noise emissions.

- During construction it is estimated that there would be:
  - 180 additional light vehicle movements per day
  - 50 additional heavy vehicle movements per day.

The potential for construction noise impacts from the Project was evaluated by using TfNSW Service's Construction Noise Estimator to predict noise levels resulting from the activities listed in Table 14-7 at the nearest receiver locations identified (see Section 14.1.1 and Section 10.2.1). Given the large setback distance of these nearest residential receivers from the Project, the resulting noise contributions at each location was predicted to be less than 30 dB(A). When considered with the adopted background noise levels, the highest predicted resulting noise level was 31 dB(A); below the NMLs established for the project. As such it can be concluded that noise from construction activities at the Project site would not result in off-site impacts at surrounding residential receivers. Levels were also predicted to remain below the ICNG NMLs at the nearest industrial receivers.

As outlined above, additional off-site light and heavy vehicle movements would be generated during construction. Existing traffic flows along the New England Highway were estimated using two-way classified annual average daily traffic data collected in 2018 at TfNSW's permanent classifier station ID 6153 located approximately 200 metres north of Rix Creek Lane. Considering the estimated additional traffic along the New England Highway generated during construction and operations at the nearest receiver location (approximately 60 metres away), the resulting change was predicted to be 0.1 dB(A) or less, below the 2 dB(A) criterion.

Some vibration-intensive equipment is planned to be used during the Project including excavator mounted rock breakers, under boring equipment and compactors (e.g. vibratory rollers). The setback distances to the nearest sensitive receivers exceed the safe distances in Table 14-6 by several orders of magnitude. As such it was concluded that vibration resulting from the Project would not be an issue.

14.3.2 Operation

During operation, the key additional noise-generating activity at the site from the Project would be the additional 50 light and 360 heavy vehicle movements per day. Noise associated with these additional traffic movements at the site would result in noise levels well below the project operational criteria listed in Table 14-5. Regarding potential off-site traffic-related noise impacts, the predicted change was up to approximately 0.2 dB(A), below the 2 dB(A) criterion.

14.4 Environmental management measures

The assessment found that construction and operational noise and vibration impacts were not expected as a result of the Project. However, the following environmental management measures are recommended to limit noise emissions during the Project.

Table 14-8: Recommended safeguards – noise and vibration

Ref	Proposed mitigation measure	Timing
NV01	Each CEMP would identify project construction activities with the potential to have noise impacts and the controls required to avoid, minimise and mitigate these impacts. Each CEMP would adopt the following measures where reasonable and feasible: • Conduct construction activities during standard hours of construction, and noisy operational works during day time hours • Schedule deliveries during standard hours of construction • Ensure on-site and public speed limits are adhered to • Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site, such as by including drive-through for parking and deliveries • Use mains power supply rather than use generators; • Switch off generators when not in use • Wherever possible and practical, select low noise plant and equipment • Operate and maintain plant and equipment in an efficient and proper manner • Turn off plant and equipment when not in-use • Consider the application of alternative, low-impact construction techniques • Avoid dropping materials from a height • Avoid dragging equipment and materials • Dampen or line metal trays as necessary • Ensure that road plates are installed as per specifications • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.	Construction

15.Socio-economic

This chapter considers the socio-economic components of the SEARs, focusing on likely impacts to the local community. It also includes consideration of the construction workforce accommodation requirements.

15.1 Assessment methodology

The Project is located within the Muswellbrook Shire Council and Singleton Council LGAs in the Hunter region of NSW. The study area for this assessment includes the Muswellbrook and Singleton LGAs. Potential impacts on a Regional and State level have also been considered, where relevant.

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, September 2017* (Department of Planning and Environment, 2017). It involved:

- Scoping of the potential socio-economic issues relevant to the Project and of communities likely to be most affected by the Project
- Describing the existing socio-economic environment of the study area to provide a baseline from which impacts of the Project were assessed
- Identifying and 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
- Identifying measures to manage or mitigate potential impacts on the socio-economic environment and maximise potential benefits.

A matrix was used to evaluate the potential significance of socio-economic impacts as outlined in the *Social impact assessment guideline for State significant mining, petroleum production, and extractive industry development, September 2017* (refer to Figure 15-1). This considered the following:

- consequences of a potential impact, being minimal, minor, moderate, major or catastrophic and
- likelihood of the impact occurring, being rare, unlikely, possible, likely, almost certain.

Figure 15-1: Social risk matrix

			Consequence Level				
			1	2	3	4	5
			Minimal	Minor	Moderate	Major	Catastrophic
Likelihood Level	A	Almost certain	A1	A2	A3	A4	A5
	B	Likely	B1	B2	B3	B4	B5
	C	Possible	C1	C2	C3	C4	C5
	D	Unlikely	D1	D2	D3	D4	D5
	E	Rare	E1	E2	E3	E4	E5
Social Risk Rating							
	Low		Moderate		High		Extreme

Source: Department of Planning and Environment (2017)

The consequence level was determined based on the definitions in Table 15-1 and the likelihood level based on the definitions in Table 15-2.

Table 15-1: Consequence level

Category	Description
Minimal	Negligible impact on/ improvement to quality of life and/or the socio-economic environment, effect on local populations unlikely to be detectable (i.e. by more than a few individuals), repairable over time
Minor	Minor changes to the social environment and unlikely to have any significant impact on/ benefit to quality of life or social conditions, may be detectable but easily reversible over time
Moderate	Moderate impact on/ benefit to quality of life or social conditions, social environment altered but systems continue to function
Major	Effect is likely to have a large, but temporary impact on/ benefit to quality of life or social conditions, and/or likely to affect vulnerable groups, cause serious social issues or result in functioning of systems to temporarily cease
Catastrophic	Effect is likely to have a significant effect and enduring impact on/ benefit to a large proportion of the catchment population and quality of life or social conditions, irreparable damage to/ destruction of highly valued items of great social significance or complete breakdown of social order

Table 15-2: Likelihood level

Category	Description
Rare	Chance of impact occurring is nearly impossible
Unlikely	Less than 10% chance of the impact occurring
Possible	10-50% chance of the impact occurring
Likely	50-90% chance of the impact occurring
Almost certain	Greater than 90% chance of the impact occurring

15.2 Policy context

This section provides an overview of the social and economic policies relevant to the Project. Information on Australian and NSW Government policies and AGLE policies relevant to the project are also discussed in Section 1.5.

15.2.1 Muswellbrook Shire Council

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

The MSC Strategic Plan recognises the importance of the power industry to the Muswellbrook Shire's economy and employment. Jobs and job security were identified in the MSC Strategic Plan as a key economic issue for the Shire, with increased employment identified as important by local residents. The Project's construction phase would support both direct and indirect job opportunities, with direct employment opportunities also supported through the Project's operation phase.

Initiatives which reduce the community's impact on the environment is also identified as a key goal in the Strategic Plan. The Project will support improved environmental outcomes in relation to water and wastewater management through proposed enhancements and upgrades to existing infrastructure.

15.2.2 Singleton Council

The *Singleton Community Strategic Plan – 2017-2027* (**SC Strategic Plan**) ((Singleton Council, 2013)) 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 will support improved environmental outcomes in relation to water and wastewater management through proposed enhancements and upgrades to existing infrastructure.

15.3 Existing environment

This section describes the existing social and economic characteristics and features of the study area. It includes information on the study area's population and demography, employment and industry, social infrastructure and community values.

15.3.1 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 Shire LGA is located in the Upper Hunter, approximately 130 kilometres north-west of Newcastle. The Muswellbrook LGA covers an area of about 3,405 square kilometres and consists of two larger towns – Muswellbrook and Denman – and a number of rural communities (www.economyprofile.com.au/muswellbrook). 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 (NSW Department of Planning and Environment, 2016).

Singleton Council LGA is located approximately 75 kilometres north-west of Newcastle and covers an area of approximately 4,893 square kilometres. 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 (NSW Department of Planning and Environment, 2016)

Bayswater is located between Singleton and Muswellbrook and produces approximately 15,000 GWh of electricity a year, enough power for 2 million houses. The production of electricity from Bayswater and Liddell currently meets approximately 30% of the electricity needs of NSW.

15.3.2 Community profile

Key population and demographic characteristics of communities in the study area is presented in Table 15-3. Muswellbrook LGA had an estimated resident population 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. More recently, both LGAs have experienced negative population growth. The population of the Muswellbrook LGA is projected to grow to 20,300 people by 2036, while the Singleton LGA is projected to grow to 28,600 people. This represents an average rate of growth of 0.9% and 0.8% respectively, which 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 lower proportions of people born overseas and who speak a language other than English at home
- 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 and lower rental costs and
- 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.

Table 15-3 Population and demographic characteristics

Characteristic	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%
Change in ERP (2017-2018)*	-0.4%	-0.3%	1.5%
Population projection (2036)**	20,300	28,600	9,925,550
Projected annual change in population (2011-2036)**	0.9%	0.8%	1.3%
Age profile* **			
Median age (years)	35	36	38
0-14 years	22.5%	21.2%	18.5%
15-64 years	64.6%	66.1%	65.2%
65+ years	12.9%	12.7%	16.3%
Cultural diversity* **			
Overseas born	7.8%	7.9%	27.7%
Speaks language other than English	3.7%	3.2%	25.2%
Families and households* **			
Couple family with no children	37.2%	36.1%	36.6%
Families with children (one parent and couple families)	61.9%	62.6%	61.8%
Total families	4,095	5,962	1,940,226
Housing* **			
Total occupied private dwellings	5,764	7,741	2,604,314
Separate houses	87.8%	87.7%	66.4%
Semi-detached, row or terrace house, townhouse, flat, apartment, etc	11.0%	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%

*Sources: *Based on ABS (2019) and ABS (2019a); **Based on NSW Department of Planning & Environment (2019), ***Based on ABS (2016)*

15.3.3 Economic profile

Table 15-4 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 and
- 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 15-4 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	20.1%	15.7%	17.7%
Households with income >$3,000/ week	12.1%	17.2%	16.8%
Employment			
Total labour force*	7,337	11,525	3,605,881
Participation rate (%)*	58.9%	63.6%	59.2%
Unemployment (%)*	8.2%	6.1%	6.3%
Main industries of employment	• Mining (21.9%) • Retail trade (8.8%) • Health care and social assistance (8.2%) • Agriculture, forestry and fishing (6.3%) • Accommodation and food services (6.5%)	• Mining (23.4%) • Health care and social assistance (7.7%) • Accommodation and food services (7.6%) • Retail trade (7.5%) • Public administration and safety (6.6%)	• 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 local and regional economy, contributing about $1.8 billion to the Hunter regional economy and directly employing about 12,200 people in 2015-2016 (Deloitte Access Economics, 2017). In 2015, the Hunter region attracted about 9.4 million domestic and international visitors of which about 65.5% were domestic day trippers and a further 32.8% domestic overnight visitors. International and domestic overnight visitors stayed for a total of 11.2 million nights, with international visitors staying for an average of 16 days and domestic overnight visitors for three days (based on Tourism Research Australia, 2015).

Holiday and visiting friends or relatives were the main reasons for visiting the Hunter region, with this group comprising about 77.7% of domestic and international visitors and 71.5% of total visitor nights. Business travellers accounted for about 10.8% of visitors and about 14% of total visitor nights. About 31.5% of overnight visitors stayed in a hotel or similar, with a further 11.7% staying in caravan/camping (based on Tourism Research Australia, 2015).

In the June quarter 2016, there were 120 hotels, motels and serviced apartments with 15 or more rooms in the Hunter region offering a total of 5,811 rooms. Fourteen establishments were located in the towns of Singleton and Muswellbrook, which offered a total of 521 rooms. Between July 2015 and June 2016, average room occupancy rates in Singleton and Muswellbrook were generally lowest in December/ January, with higher occupancy rates experienced in September, November and May in Singleton and August and October/November in Muswellbrook. Peak occupancy rates between July 2015 and June 2016 were 50.8% in Muswellbrook and 56% in Singleton. At a regional level, occupancy rates tend to be higher and less variable, generally peaking in October/ November, with lower occupancy rates generally in June/July (based on ABS, 2016a).

15.3.4 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.

Bayswater is located within an area dominated by mining and power generation and the Project site is removed from social infrastructure. The closest social infrastructure is located more than five kilometres northeast of the Project site, being the Lake Liddell recreation area. No private residents are located within about five kilometres of the Project site.

15.3.5 Community values

The character and identity of the Muswellbrook and Singleton LGAs is influenced by the region's rural amenity and rural industries, as well as presence of equine industry, coal mining and power generation. Consultation for the Muswellbrook Shire Community Strategic Plan identified jobs and jobs security and economic diversification and resilience as key issues for local communities. 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.

Residents of the Singleton LGA have indicated in the Singleton Community 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.

15.3.6 Transport and access

Access to Bayswater is provided from 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. Bayswater 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.

15.4 Assessment of impacts

15.4.1 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.

Employment

The Project would impact positively on employment through the creation of direct employment opportunities for up to 90 people through the construction phase, with most construction workers expected to be sourced from within NSW. As indicated in Section 15.3.2, the Muswellbrook LGA community reported levels of unemployment above the NSW average at the 2016 Census, while the Singleton LGA reported levels of unemployment similar to NSW as a whole. The creation of employment opportunities from the project would benefit local and regional workers and have potential to support improved incomes for individuals.

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.

Local business

During construction, potential benefits for businesses would mainly be associated with provision of goods and services to support construction activities (e.g. equipment hire, fuel supplies, transportation, administrated services). Increased spending by workers on such things as accommodation, food and services is also likely to impact positively on local businesses.

It is expected that construction workers from outside local and regional communities would be accommodated in rental housing or temporary visitor accommodation in towns near Bayswater such as Muswellbrook and Singleton. The use of some of the available, under-utilised tourist accommodation for temporary workforce accommodation would provide economic benefits for the owners of tourist accommodation by providing a base load demand. While Muswellbrook and Singleton have businesses that provide accommodation to workers for the power and mining industries, the use of visitor accommodation by construction workers for the Project has potential to impact on the availability of some visitor accommodation in these towns, potentially causing tourists to travel to other towns and locations in the Hunter region. This may have flow on effects for other tourism related businesses such as visitor attractions and restaurants/ cafes. The timing of peak construction works to avoid peak visitor periods would help to minimise potential impacts on tourist accommodation.

Locally, there are no businesses near the Project site that would be impacted by increased construction activity.

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.

The roads used for construction haulage are currently used for the movement of freight and equipment, including the movement of oversized loads, to support power, mining and agricultural industries in the study area. Overall, 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.

The study area is a key tourist area attracting visitors from across NSW, interstate and internationally and increased construction traffic, including oversized loads, may influence perceptions of road safety for some drivers who may be unfamiliar with the road and traffic conditions. The implementation of traffic management measures for oversized loads would help to minimise potential impacts on these transport tasks for communities, workers and visitors to the study area. This includes consideration of key tourist events and peak traffic periods in the timing of haulage activities for oversized loads.

Housing and accommodation

During construction, the Project would generate employment for up to 90 people. As previously indicated, it is likely that construction workers form outside local and regional communities would be accommodated in rental housing or temporary visitor accommodation in towns near Bayswater.

Increased demand for rental housing during construction may put pressure on rental prices resulting in increased rents. This would have the greatest impact on affordable rental housing access, resulting in potential increase in housing stress for some households on low or fixed incomes. As indicated in Table 15-3, 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 Muswellbrook LGA also had higher proportions of households with lower incomes (i.e. less than $650 per week) compared to NSW who may be at risk of housing stress.

The construction phase is also expected to increase demand for temporary accommodation options, such as motels and other ‘guest’ accommodation. As indicated in Section 15.3.2, between July 2015 and June 2016 occupancy rates for tourist accommodation peaked at 56% in Singleton and 50.8% in Muswellbrook, suggesting that there would be some capacity in existing tourist accommodation to accommodate construction workers. The use of some of the available, under-utilised tourist accommodation for temporary workforce accommodation would help to ease demand for private rental accommodation.

Community values

Clearing of vegetation would be required at various locations within the Project footprint during the early phases of construction. Where possible, the ash pipeline would be located adjacent to the existing ash pipeline in previously disturbed areas, although clearing may be required at some locations. Clearing of vegetation may also be required for construction of the Borrow Pits.

As indicated in Section 15.3.5, 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 a concern for 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.

15.4.2 Operation

Beyond the BWAD, Salt cake landfill facility and additional Ash recycling works, there are not expected to be any changes to the existing approved operation of Bayswater as part of the Project. This approval would not directly impact on the main generation activities carried out at Bayswater 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.

Potential benefits and impacts associated with the operation of the project would mainly be associated with direct employment opportunities, increased heavy vehicle traffic and impacts on community values.

Employment

Once operational, the Project would impact positively on employment through the creation of direct employment opportunities such as those associated with the additional ash recycling. It is expected that operation of the Project would generate an additional 25 jobs. It is likely that many of these workers would be sourced from local and regional communities. The creation of employment opportunities on the Project would benefit local and regional workers and have potential to support improved incomes for individuals.

Local business

Once operational, the Project is not expected to have any additional benefits for local businesses to those provided through current operations.

Transport and access

Operation of the Project would generate an increase in traffic associated with the additional ash recycling. The New England Highway would be mainly used for the transportation of ash. This road is currently used for the movement of freight and equipment to support power, mining and agricultural industries in the study area. 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.

The study area attracts day trippers and overnight visitors from across NSW, interstate and internationally. While an increase in heavy vehicles may influence perceptions of safety for some drivers who are unfamiliar with local road and traffic conditions, the additional traffic generation is unlikely to have an impact on future crash frequency. Further discussion about potential traffic and transport impacts is provided in Chapter 13.

Housing and accommodation

It is likely that the additional workers required to support the operation of the Project would mainly be sourced from local and regional communities. As such, the operation of the project is not expected to impact on demand or cost of housing and accommodation in the Muswellbrook or Singleton LGAs.

Community values

The Project would support improved environmental outcomes in relation water management through the enhancement and upgrade to existing infrastructure and additional ash recycling. This is likely to be considered a positive by community members, with protection of the environment, waste management and managing and reducing risks from environmental pollution identified as key outcomes for the Singleton Council and Muswellbrook Shire Strategic Plans. Provision of direct employment on the Project would also support community values relating to local jobs.

15.5 Evaluation of significance

Table 15-5 presents a summary of the socio-economic impacts of the Project's construction and operation, along with the outcomes of the evaluation of significance. The evaluation of significance is based on the social risk matrix presented in Figure 15-1.

Table 15-5: Summary of socio-economic impacts and evaluation of significance

Impact	Phase	Likelihood	Consequence	Ranking
Negative socio-economic impacts				
Potential impacts on local tourism businesses due to impacts on 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	Moderate
Impact on community values relating to the environment	Construction	Possible	Minor	Moderate
Changes to perceptions of safety for some road users due to increased traffic, including heavy vehicles, on the New England Highway	Construction/ Operation	Possible	Minimal	Low
Positive socio-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	Moderate

15.6 Environmental management measures

Table 15-6 outlines measures for managing, avoiding or mitigating potential socio-economic impacts from the construction and operation of the Project. Additional measures relating to areas such as traffic and transport are also described in other chapters of the EIS.

Table 15-6 Environmental management measures -socio-economic impacts

Ref	Environmental management measure	Timing
SE1	To manage the increase in construction traffic, including heavy and oversize vehicles, on the New England Highway: • Implementation of a traffic management plan for management of construction traffic, including oversized loads • Consider the timing of key tourist activities and events in the planning of major haulage tasks • Communication with key stakeholders and communities about potential changes in construction traffic and major haulage tasks.	Construction
SE2	Identify opportunities to maximise the use of local suppliers and businesses in the provision of goods and services for construction.	Pre-construction

16. Visual amenity

This chapter summarises the findings of the Visual Impact Assessment carried out for the Project (Jacobs, 2019f) *(see Appendix K) and addresses the SEARs for visual impacts including a detailed assessment of the:*

- changing landforms on site during the various stages of the development;
- potential visual impacts of the development on private landowners in the surrounding area as well as from key vantage points in the public domain
- a detailed description of the measures that would be implemented to minimise the visual impacts of the development.

16.1 Existing environment

The surrounding area is characterised by mining operations, rolling hills, grazing land and bushland. 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 former Drayton Mine.

The existing surrounding land uses have a low number of sensitive receivers. The nearest sensitive receivers are located 1.8 km south south-west of the Project (see Figure 10-1). Visibility of Bayswater is limited to users of the New England Highway, where occasional, elevated, open stretches of highway offer broad views across the landscape towards far ridgelines, however much of the route in the vicinity of Bayswater is visually contained on both sides of the road by mature woodland vegetation or landform.

There are no key vantage points in the public domain which afford views to Bayswater with the exception of the cooling towers and stacks.

16.2 Assessment of impacts

16.2.1 Construction

As outlined in Chapter 2, the Project consists of a number of elements of work. 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 AGL personnel, and construction personnel.

16.2.2 Operation

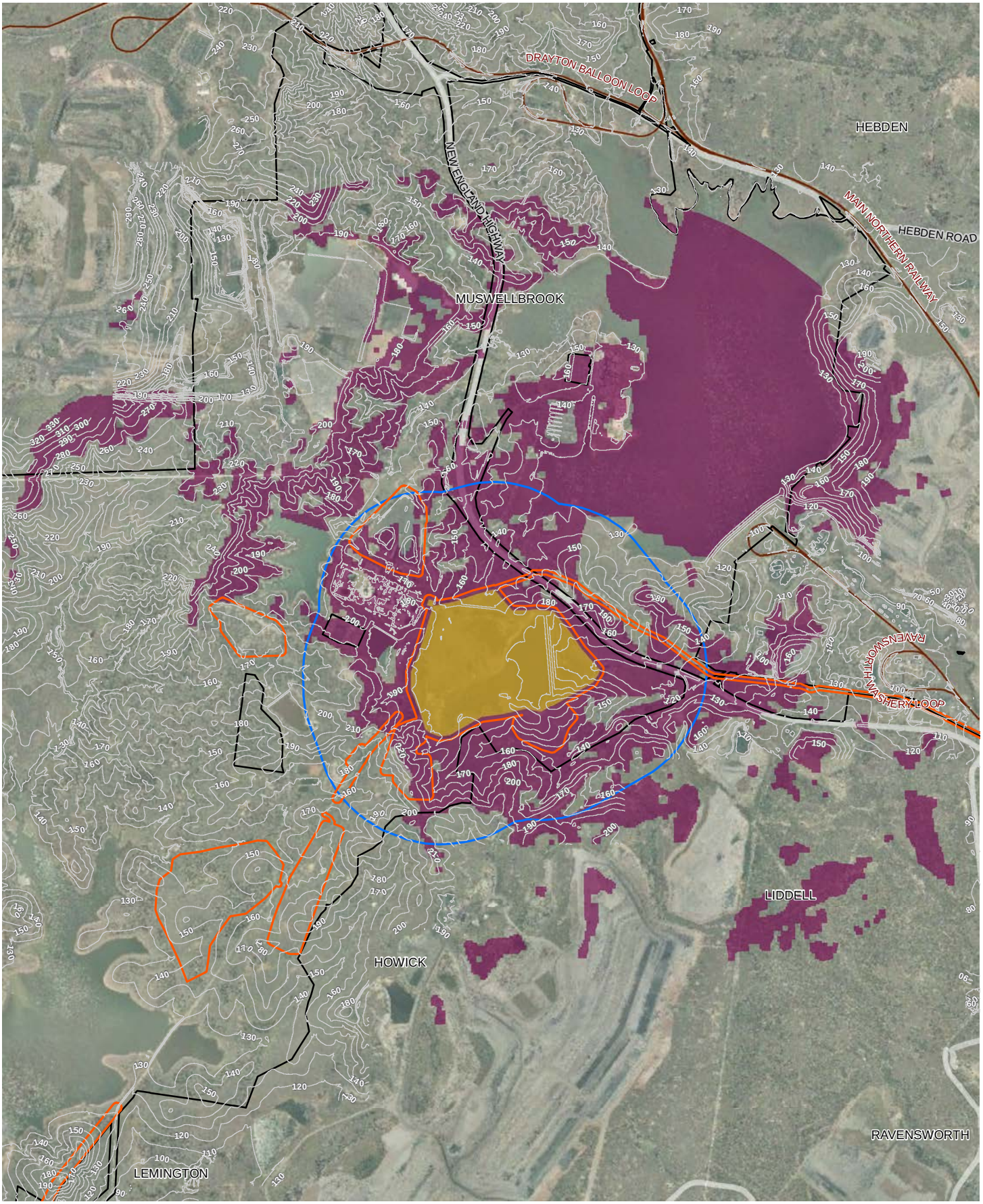
Once operational the proposed increase in height of the BWAD (see Section 2.2.1) by 11.5 metres is the most visually prominent element of the Project. The BWAD has therefore been used to define the viewshed for this Project, as it is the only potentially visible element of the Project. The augmented BWAD is also located adjacent to the New England Highway road corridor.

The distance over which the proposed, additional 11.5 metre height change of the ash dam wall could be viewed by the 0.5% vertical field of vision is 1.26 km. A Visual Envelope (VE) and Zone of Visual Influence (ZVI) has been prepared within the study area. The VE is an approximation of the extent of potential visibility of the Project, calculated from a viewer (assumed to be 1.6 metres tall) standing in the centre of the site. Figure 16-1 illustrates the ZVI, which is defined as the area from which the modified landform would potentially be visible. The 1.26km viewshed has been overlaid over the ZVI for reference to demonstrate the areas in which the BWAD, once constructed could be visible from in the absence of vegetative screening.

Two Landscape Character Units (**LCU**) have been identified as landscape receptors for the Project:

- LCU 1: Mining and Industrial Activities
- LCU 2: Rural Agricultural Lands

Description of these LCUs and the Project impacts on each are summarised as follows:



Study area
AGL owned land
Ash Dam Augmentation, Ash Harvesting and Water Management Works
Theoretical visibility extent (11.5m ash dam wall increase)
Viewshed
10m contours

0 1 2 km

1:60,000 at A4

Data sources

Jacobs 2019, AGL 2019, OEH 2019
NSW Spatial Services 2019

Figure 16-1 **Theoretical zone of visual influence**

GDA94 MGA56

LCU 1: Mining and Industrial Activities

The receiving landscape is associated with long term, large-scale industrial operations. Whilst remnants of the pre-existing agricultural landscape remain, the surrounding area has been degraded with feature detracting elements comprising spoil dumps, industrial buildings and associated infrastructure such as above ground pipelines and electricity pylons.

The Project would result in very minor loss or alteration to key elements/features of the remnant agricultural landscape and the changes would be characteristic within the environs of the power stations and mining operations within the LCU. It is unlikely that the changes would be remarkable within the context of Bayswater and the magnitude of change upon LCU 1 is therefore negligible.

LCU 2: Rural Agricultural Lands

The receiving landscape presents as cleared agricultural and pastoral land typical of the surrounding region. Stock grazing (currently cattle) is prevalent with fenced boundaries as typically found throughout the Upper Hunter. Outside of the major operational elements of Bayswater, large swathes of land still exist as cleared grassland. Previously pastoral, these areas operate as grazing land for cattle under a schedule of grazing licenses to local farmers. As part of these operations, there is remnant infrastructure (e.g. cattle yards of varying age), fencing (both modern barbed wire and older post and rail), and other small-scale agricultural elements (such as contour banks and farm dams) throughout the landscape.

The Project would result in minor alteration to key elements/features/characteristics of the receiving landscape. Views of infrastructure associated with the power stations and mining operations are characteristic within the LCU therefore the proposed changes would not be considered to be totally uncharacteristic when set within the receiving landscape. The Project has been assessed as typically being of ordinary quality, with land use being dominated by cattle grazing and with a broad, undulating landform of a scale tolerant to change. It is unlikely that the changes would be remarkable within the context of Bayswater and the magnitude of change upon LCU 2 is therefore negligible.

Overall it is considered that the Project would have a negligible effect on both LCU 1: Mining and Industrial Activities and LCU 2: Rural Agricultural Lands. In the absence of any sensitive visual receptor within the ZVI, overall visual impacts associated with the Project would be minimal.

16.3 Environmental management measures

As part of the design development process, AGL would seek to minimise disturbance associated with the Project, for example by retaining existing mature vegetation and limiting areas of disturbance where possible. This would have the effect of also mitigating the visual impacts of the Project. Table 16-1 provides mitigation strategies available to further manage visual impacts.

Table 16-1 Environmental management measures – visual impacts

Reference	Environmental management measures	Timing
VI01	Visual impacts would be considered in the detailed design to minimise visual impacts where compatible with biodiversity and heritage management measures and Project requirements.	Design
VI02	A rehabilitation management plan would be developed and include prioritising screening vegetation in areas able to support larger vegetation around permanent, unnatural landforms.	Operation

17.Non-Aboriginal Heritage

This chapter addresses the heritage component of the SEARs for the Project, which requires an assessment of the potential historic heritage (cultural and archaeological) impacts of the development.

17.1 Assessment methodology

Jacobs has prepared a non-Aboriginal heritage assessment to support the development of the Project (Jacobs, 2019g). The findings of this assessment are summarised in this chapter, and the full assessment can be found in Appendix I.

As part of this assessment, a site inspection of the Project area was conducted between 9 to 13 September 2019 by Jacobs Heritage Consultants. Areas that appeared free of major prior disturbance were surveyed on foot. Areas with obvious major ground disturbance, resulting in negligible archaeological potential and/or an obvious lack of heritage potential, were surveyed from the site vehicle.

17.2 Existing environment

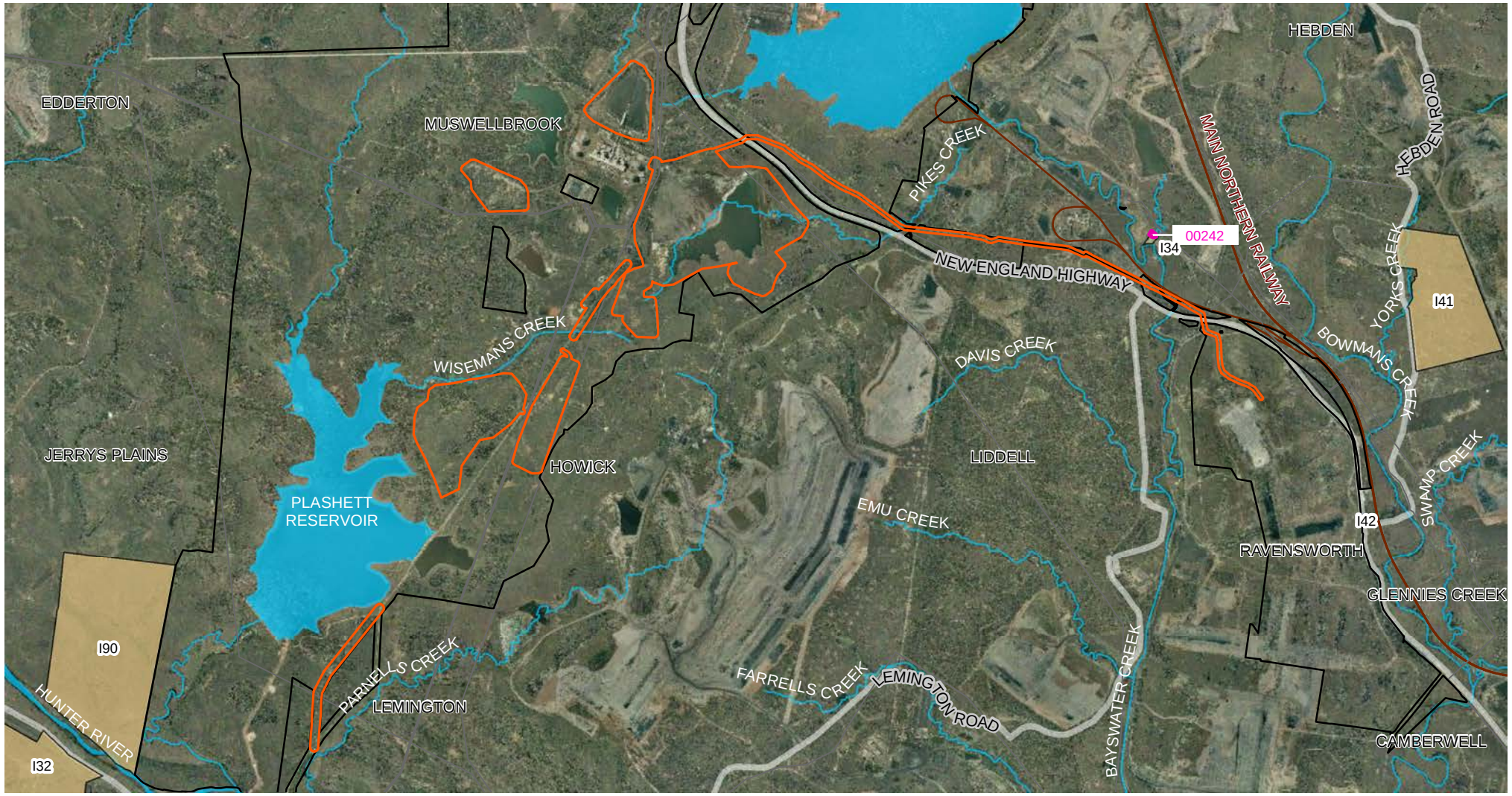
A search of the following heritage registers was undertaken in September 2019:

- NSW State Heritage Register (**SHR**)
- s170 State Agency Heritage and Conservation Registers
- Muswellbrook LEP 2009
- Singleton LEP 2013
- Commonwealth Heritage List
- National Heritage List
- World Heritage List and
- Register of the National Estate.

The following listed heritage items were identified as described in Table 17-1. The locations of these items are shown on Figure 17-1.

Table 17-1 Heritage register search results

Item name	Register	Number	Location
Inn & Outbuildings (former)	State heritage register	00242	Old New England Highway, Chain of Ponds
	Singleton LEP	I34	



Study area
AGL owned land
State Heritage Register item
Heritage (EPI):
Item - General

0 1 2 km

1:75,000 at A4

N

Data sources

Jacobs 2019, AGL 2019,
DPE 2019, OEH 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 17-1 Heritage items in proximity to the project area

The Project area is typical of a rural landscape within the Upper Hunter. 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 threshold at Local or State level of heritage significance.

17.2.1 Chain of Ponds Inn, Liddell (Inn & Outbuildings [former], SHR ID# 00242)

The Chain of Ponds Inn was constructed in the 1840s by Henry Rowland as a coaching inn for traffic on the main road from Morpeth to Tamworth (Umwelt, 2014) (Figure 17-2). The inn was convict built, and one of the structures was a stone lock-up to house convicts being transported to the north (Thorp, 1990).

The Inn has been known by several names since its construction including the Lady Mary Fitzroy, the Coach and Horses Inn, the Star of the North Inn, the Travellers Inn and the Liddell House when it was used as a private residence in the late 19th century. It also operated as a post office from 1890 until 1920 (EJE Heritage, 2013) .

The former Chain of Ponds Inn and its outbuildings, comprising a police lock-up and stables, were listed on the State Heritage Register in 1999. It is located approximately 500 metres outside of the study area, on the north-eastern side of Bayswater Creek. It is therefore unlikely to be impacted by the Project.

Figure 17-2: Chain of Ponds Inn, Liddell (Courtesy: EJE Heritage, 2013:1).

17.2.2 Trigonometric Station Glendower

Within the proposed Borrow Pit 2 project footprint, the highest elevation of the crest has a broken trigonometrical (trig) station (Figure 17-4), marked ‘T.S. Glendower’ (Figure 17-5), adjacent to a wooden post and wire fence.

It is a concrete pillar trig station of a common design which rose to prominence in the mid-1970s (Figure 17-3). It has a concrete pillar of approximately 1.3 metres tall with a metal mast and circular vane mounted using a P.V.C. flange (this flange is broken on TS Glendower, which has allowed the mast to be dislodged). The mast is designed to be removable in order to access a threaded spigot which provides a mount for a theodolite or prism.

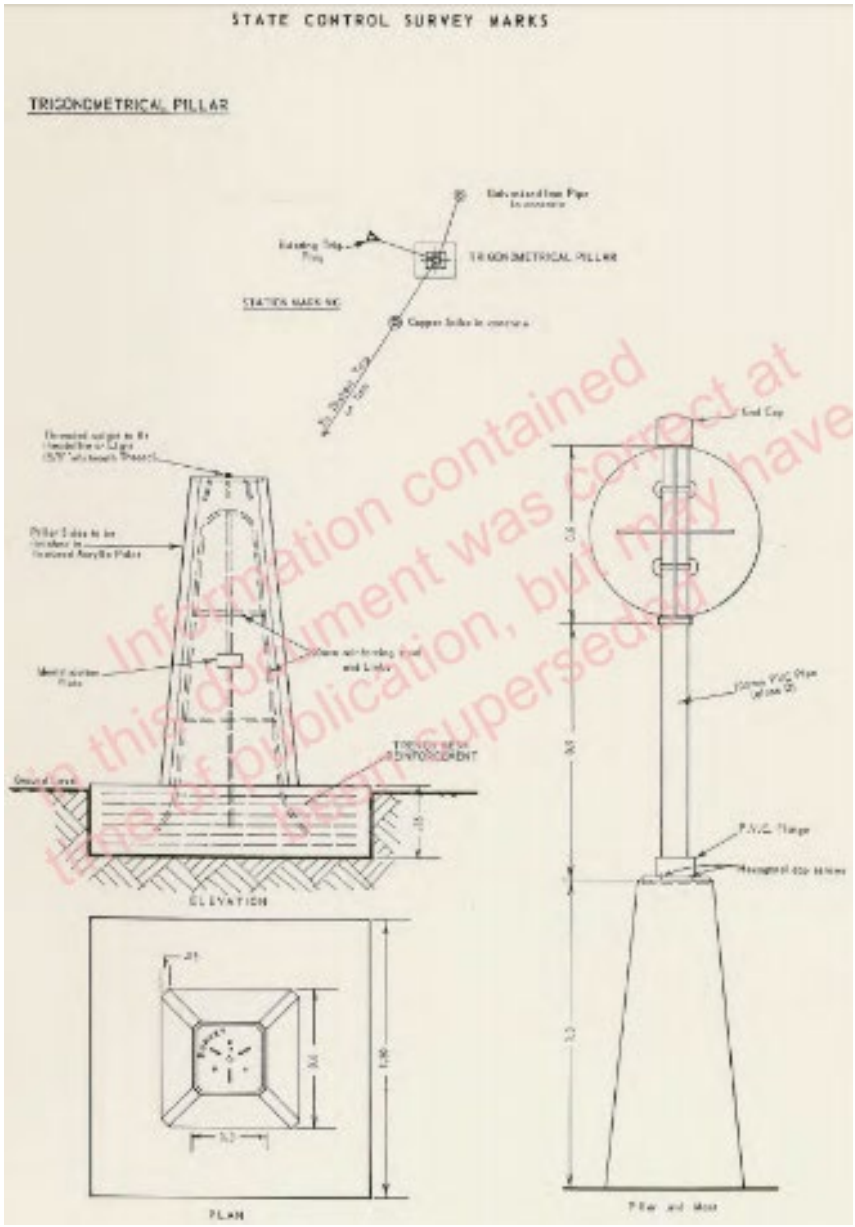


Figure 17-3: NSW trigonometrical pillar design (Department of Lands, 1975)

No other items of potential heritage significance were observed.

Figure 17-4: Derelict trig station

Figure 17-5: Survey marker plaque 'T.S

17.3 Assessment of impacts

17.3.1 Construction

Construction of the Project would require the removal of the permanent survey mark (TS Glendower). An assessment of significance was undertaken for this item. The item is of low aesthetic and historical significance and negligible research potential, and therefore does not threshold at Local or State level of heritage significance. As outlined in Section 3.1.3, an application for authorisation to remove or replace this survey mark would be sought in accordance with clause 90 of the *Surveying and Spatial Information Regulation 2017.*

There would be no impacts to known or potential non-Aboriginal heritage or archaeology during construction.

17.3.2 Operation

There would be no impacts to known or potential non-Aboriginal heritage or archaeology once the Project is operational.

17.4 Environmental management measures

Environmental management measures relating to non-Aboriginal heritage impacts are outlined in Table 17-2.

Table 17-2 Environmental management measures -non-Aboriginal heritage

Ref	Environmental management measure	Timing
NAH01	Should any historical archaeological remains be discovered during construction, all works would 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 of the *Heritage Act 1977* (NSW), a s146 form would be submitted to notify the Heritage Council of the discovery of relics. Further investigation may be required, and appropriate management would be agreed through consultation with Heritage NSW.	Construction
NAH02	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 AH7.	Construction

18.Waste

This chapter addresses the waste related elements of the SEARs, including an assessment of the likely impacts associated with the disposal of the additional waste generated by the Project and a description of the measures to be implemented to manage, reuse, recycle and safely disposal of waste generated by the Project:

- *an assessment of the likely impacts associated with disposal of the additional brine and sludge produced and whether existing infrastructure at the Bayswater Power Station has sufficient capacity to store the waste;*
- *a description of all reasonable and feasible measures that have been or would be implemented to maximise resource recovery from the waste stream and reduce the disposal of waste to landfill in line with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2014-2021 and other government policy;*
- *details of the landfill cell design and integrity in accordance with best practice industry standard guidelines such as the EPA's Environmental Guidelines: Solid Waste Landfills;*
- *a detailed description of how the landfill facility would be progressively capped and rehabilitated, and integrated into the surrounding landscape, including measures to ensure that the final landform is free draining;*
- *a detail of the procedures and practices that will be put in place to ensure that any recovered ash for reuse offsite meets the requirements of the Coal Ash Order and Exemption, as in force from time to time; and*
- *an assessment of available markets for recovered coal ash, whether existing markets will meet the reuse targets nominated and if not, actions and investments to be taken to expand these markets or create new markets.*

18.1 Assessment methodology

This chapter assesses the waste that would be generated through construction of the proposed works, and variations to the generation and disposal of operational wastes. It focusses on how this waste would be managed in accordance with the waste hierarchy (see Section 3.6) to reduce the impact of the waste generation. It assesses:

- Construction waste: generated from demolition activities, from wasted construction materials and details of the movement of cut and fill around the site, and how this will be managed
- Coal ash generation: the current and proposed future capacity for this material, recycling activities and how the product created will meet relevant legislation and
- Salt cake production: the production of salt cake from water treatment processes, and a proposed change in disposal method, including how this method (a new landfill) will meet legislative requirements.

In summary, the following materials are considered as part of this chapter:

Table 18-1: Assessment Boundary

Phase of operation	Material / Waste	Included?
Demolition	Demolition of a 1.3km long coal conveyer. Removal of any disused pipelines as required	Yes (Qualitatively)
Construction	Major construction waste generation estimates	Yes (Qualitatively)
	Movement of cut and fill (including any imports to or exports from site)	Yes
	Cleared vegetation estimates including proposed management measures	Yes
Operation	Fly ash	Yes

Phase of operation	Material / Waste	Included?
	Bottom ash	Yes
	Salt cake & Salt cake capping material	Yes
	Other operational wastes	No – where there is no proposed change from baseline operation.
Decommissioning	Rehabilitation of BWAD	Yes
	Rehabilitation of Salt cake landfill	Yes
	Rehabilitation of Borrow Pits	No

18.2 Construction Waste

18.2.1 Demolition Wastes

The abandoned coal conveyor that runs along the western perimeter of the BWAD is to be removed prior to commencing earthworks for the western levee raise. It is estimated that a total length of 1,300 metres is to be demolished. The conveyor would be removed using standard demolition practices. The majority of this material (steel) is expected to be recycled.

It is likely that once the belt is removed, the steel could be salvaged, offsetting the cost of demolition. Alternatively, 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. AGL 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.

The proposed Borrow Pits would require clearing of vegetation and stripping of topsoil. There will likely be vegetation clearing across the new ash pipeline proposed for connecting Bayswater to Ravensworth Void No. 3, although this will aim to be minimised through working in areas with existing clearing where possible. Some vegetation clearing may be required for site preparation of the proposed Salt cake landfill facility. Cleared vegetation would be either mulched for onsite reuse or used to created habitat piles (i.e. offsite disposal is not required). Topsoil would be stripped, separately stockpiled and reused for rehabilitation.

As part of the construction of the Ravensworth ash line, the removal of any disused pipeline may be required using an appropriately licensed contractor.

As part of the site clearing for the Salt cake landfill there would be removal of contractor facilities and materials. It is assumed that the facilities and materials would be relocated to other areas of AGL land, and therefore would not be required to be taken off site for disposal.

18.2.2 Waste construction materials

It is anticipated that there will be a small amount of waste generated during the construction process, which would include some material breakage, as well as offcuts and disposable items. These wastes would be made up of small amounts of the likely imported construction materials are shown in Table 18-2.

Table 18-2: Imported Construction Materials

Construction Element	Construction Materials Imported to Site
BWAD augmentation	Ash and effluent pipe
	Rockfill
	Concrete

Construction Element	Construction Materials Imported to Site
Ash recycling facility expansion	Weighbridges
	Fuel tanks
	Concrete
	Utility connections
	Ash silos
	Asphalt for access road
Salt cake landfill	N/A: Note clay likely sourced from Borrow Pits
	High density polyethylene liner (if clay liner is not deemed sufficient)
Ravensworth ash line	Pipeline material
	Concrete
Borrow Pits	Erosion and sediment controls Soil binding
CHP water and wastewater infrastructure upgrades	Concrete Processing equipment and housing

It is anticipated that additional workers will be on site for the duration of the Project's construction. This would likely generate minor volumes of general waste as part of the construction of the Project. Increased general waste would be incorporated into other waste streams generated through daily operation of Bayswater and disposed off-site by the existing licensed contractor.

18.2.3 Movement of cut and fill

The majority of fill material required for raising saddle dams and levees associated with the BWAD would be sourced from Borrow Pits on site. This excludes structural / rockfill materials. General fill material required associated with the BWAD augmentation (see Section 2.2.1 for details) and the Salt cake landfill (see Section 2.3 for details) is shown in Table 18-3.

Table 18-3: Project Fill Requirements

Project component	Total (m^3)
Western levee and saddle dam earthfill	**514,877**
Saddle dam drains and filters	**23,794**
South saddle 1 earthfill	**42,250**
Divider walls earthfill	**426,130**
Spillway raising earthfill	**720**
Spillway raising rockfill	**390**
South saddle 2 earthfill	**2,310**
Main dam raising	**2,800**
Salt cake landfill	**535,138**
Total	**1,548,409**

Material excavated for the Salt cake landfill would be stockpiled beside it, within the Project area (see Figure 2-1). It is anticipated that excavated materials would be beneficially reused within the Salt cake landfill or within other areas of AGL lands. Stockpile management procedures for segregating spoil, dust suppression, erosion and sediment control would be implemented.

18.3 Operational waste

No additional operational waste is anticipated as a result of the Project with the exception of general waste generated by increase employees working on site in association with the ash recycling operation expansion. Discussion of the changed management of operational wastes proposed as part of the Project is provided below.

18.3.1 BWAD augmentation

Ash generation forecasts

The quantity of ash generated at Bayswater would not change as a result of the Project and is dependent on:

- The generation requirements (and unit availability)
- Efficiency of the furnace (combustibles left in ash)
- Quality of coal provided and
- The bag house efficiency.

The future generation requirements and unit availability would be the largest factor influencing the overall ash production.

Forecasts for the generation of both Fly ash and Bottom ash from present day to 2034/35 are presented in Table 18-4 as reported by AGL.

Table 18-4: Fly Ash and Bottom Ash Generation Projections

Year	Coal Consumption (kT)	Total Ash Produced (kT)	Total Fly Ash Produced (kT)	Fly Ash Sales (kT)	Fly Ash Placed (kT)	Bottom Ash Production (kT)	Bottom Ash Sales (kT)	Bottom Ash Placed (kT)
2018 / 19	7,207	1,921	1,652	83	1,569	269	24	245
2019 / 20	7,954	2,227	1,915	96	1,820	312	61	251
2020 / 21	7,962	2,229	1,917	96	1,821	312	61	252
2021 / 22	7,797	2,183	1,878	94	1,784	306	61	245
2022 / 23	7,896	2,211	1,901	95	1,806	310	61	249
2023 / 24	7,949	2,226	1,914	96	1,818	312	61	251
2024 / 25	7,830	2,192	1,885	94	1,791	307	61	246
2025 / 26	7,947	2,225	1,914	96	1,818	312	61	251
2026 / 27	7,885	2,208	1,899	95	1,804	309	61	248
2027 / 28	7,965	2,230	1,918	96	1,822	312	61	252
2028 / 29	7,947	2,225	1,914	96	1,818	312	61	251
2029 / 30	7,946	2,225	1,913	96	1,818	311	61	251
2030 / 31	7,943	2,224	1,913	96	1,817	311	61	251
2031 / 32	7,942	2,224	1,912	96	1,817	311	61	251

Year	Coal Consumption (kT)	Total Ash Produced (kT)	Total Fly Ash Produced (kT)	Fly Ash Sales (kT)	Fly Ash Placed (kT)	Bottom Ash Production (kT)	Bottom Ash Sales (kT)	Bottom Ash Placed (kT)
2032 / 33	7,922	2,218	1,908	95	1,812	311	61	250
2033 / 34	7,994	2,238	1,925	96	1,829	313	61	253
2034 / 35	7,917	2,217	1,906	95	1,811	310	61	250
2035 / 36	4,000	1,120	963	48	915	157	61	96
Total	**138,002**	**38,544**	**33,148**	**1,658**	**31,490**	**5,396**	**1,055**	**4,342**

Ash dam fill rate

Ash forecasts shown in Table 18-4 are based on 2015 budget forecasts undertaken for Bayswater. The fill volumes within the Bayswater Ash Dam will be dependent on a number of key factors including:

- The ratio of bottom ash to fly ash
- The performance and availability of the Ravensworth Fly Ash Plant
- Coal Ash product sales
- Insitu densities, consolidation and beach slope

Using the forecasted ash generation rates above, it is estimated that an additional 12.5 million cubic metres storage capacity is required based on the following assumptions:

- An approximate 14:86% ratio of bottom ash-to-fly ash, as per above
- Ravensworth Plant availability of approximately 75%, as measured within the last 12 months
- Projected coal ash sales as shown above
- Placement densities of 1t/m3 and 1.1t/m3 for fly ash and bottom ash, respectively
- Approximate beach slope of less than 1%.

Ash Dam Capacity Requirements

Total ash production forecast to be sent to the BWAD is between 8,065,000 m^3 and 12,500,000 m^3 by 2035. The forecasts in the current deposition plan (as presented in the 2015 ash management plan) and using latest survey information, estimates that the BWAD has approximately between 1,271,000 m^3 and 4,736,000 m^3 capacity remaining (Aurecon, 2019). Using best-case ash generation estimates, this predicts the dam would reach full capacity between October 2020 and February 2026, falling short of the planned station closure in 2035. Thus, a new strategy is required, augmenting the dam to increase storage capacity.

The Project includes providing an additional 12.5 m^3 of storage capacity through the augmentation of the BWAD.

Ash dam decommissioning

The *Bayswater Ash Dam Augmentation Design Report* (Aurecon, 2019) provides a number of options and a recommended concept schematic for the rehabilitation of the site. This rehabilitation option is a basic rehabilitation that conforms with the industry standard approach of:

- Capping ash surfaces with an appropriately low permeability layer (minimum 500 mm thick)
- Provision of adequate cross fall over capped surfaces to avoid ponding above ash deposits
- Grading of the dam and storage to remove the dam walls ability to detain a ‘free’ water pond
- Upgrade of flood spillways to enable safe discharge of the Probable Maximum Flood event and
- Provision of a growth medium to allow for light vegetation that would assist in the prevention of erosion.

18.3.2 Fly ash use at Ravensworth Mine

As is currently the case, fly ash would continue to be transferred via pipeline (in slurry form) to Ravensworth Mine, where it is used to rehabilitate (fill) mine voids under separate approvals. This is the primary disposal mechanism for Fly ash. No change is proposed to the intended use of Fly ash at Ravensworth as part of the Project.

18.3.3 Fly Ash and Bottom Ash Disposal and Recycling

As indicated in Table 18-4, the majority of ash produced by Bayswater is fly ash. Whilst some of this ash is sold and transported off site, the majority is sent as a slurry (via pumps and pipes) to AGL's Ravensworth Mine where it is deposited within voids.

Historical Recycling Operations

Ash harvesting at the BWAD commenced in 2002-2003 by an ash harvesting contractor. In 2004-2005, average extraction rates were around 85,000 tonnes per annum as stated by AGL. Peak extraction rates of around 170,000 tonnes per annum were experienced when contracts were won to supply major road infrastructure projects (such as the Five Islands Road).

To date, extracted materials from the BWAD have been supplied for the following reuse opportunities:

- Redi-mixed concrete
- Masonry blocks
- Pipe backfilling and
- Bridging poor soils.

Current Operations

Bottom ash harvesting is currently on hold with AGL working with EPA to obtain an approval for a Bottom Ash Sampling Plan to ensure compliance with the CAOE. More recently, bottom ash for reuse offsite was harvested at a rate of approximately 70,000 tonnes per annum. This results in around 5 to 20 transport trucks accessing the site per day (i.e. 10 to 40 total daily movements). At this level of operation, the site employs the equivalent of four to six full time roles.

Fly ash recycling process

The recycling process involves dry Fly ash being pneumatically conveyed from Bayswater to two large run of station silos. From here it is either harvested directly as run of station ash or transferred to secondary silos where it is classified to separate into finer fractions for specific markets. The coarser fractions are returned to the run of station silos. The majority of Fly ash then is loaded into tankers for transfer to market with a small fraction of super fine ash bagged in 20kg bags. Trucks are weighed onsite prior to leaving site to ensure compliance with load restrictions. The trucks are also washed prior to leaving site to ensure no residual ash is left on the outside of the tankers.

Bottom ash recycling process

Bottom ash is either harvested via truck and shovel (excavator) and placed in a stockpile or dredged and placed into a stockpile. The bottom ash is either harvested directly from the discharge point into the BWAD or areas are pre-stripped using a dozer to remove any vegetation and organics and then the ash is harvested from below. Material from the stockpiles is then screened using a classifier/sieve or crushed into the various aggregate sizes required for market:

- 0.5 mm sand (~75 percent);
- 20 mm x 7 mm (~20 percent); and
- >20 mm (~5 percent).

Plant equipment such as front-end loaders are then used to stockpile the aggregate in specific stockpiles for market. These are loaded into truck and dogs and/or truck and pigs using excavators or front-end loaders. The stockpiles are managed for dust using sprinkler systems. Water carts are used to manage dust on haul roads. Trucks are weighed onsite prior to leaving site to ensure compliance with weight restrictions.

The Project seeks approval to expand the current operations to up to 400,000 tonnes per annum of fly ash and up to 600,000 tonnes per annum of Bottom ash.

In order to comply with the CAOE, AGL has developed both fly ash and bottom ash sampling plans. These documents:

- Outline the required sampling and sample collection locations
- Describe the procedures for sampling, sample preparation, sample storage and transport to the analytical laboratory and sample analysis, as well as the reporting requirements and
- Document compliance with the requirements of the Coal Ash Order.

The Bottom Ash Sampling Plan is currently being reviewed by the EPA and once approved would form the basis of the procedures and practices in place to ensure that any recovered ash for reuse offsite meets the requirements of the CAOE.

Uses for Fly ash and bottom ash include:

- Cement – use of fly ash as a partial replacement for cement in concrete mixtures. Fly ash improves the overall performance and quality of concrete. This includes improving workability and durability, alongside offsetting the need for cement production. As with concrete, fly ash can also replace cement in grout and mortar
- Bottom ash can replace fine aggregates in masonry blocks (which are otherwise typically quarried)
- Bottom ash can replace different grades of aggregate as a road base material, provided that the aggregates meets the same performance specification as the material it is replacing. Potential projects include Singleton and Muswellbrook bypasses and Golden Highway upgrades and
- Smaller scale use in rehabilitation and garden products, soils and soil amelioration.

AGL plans to expand recycling activity, and hence is expanding the capacity of its recycling operation (including storage, processing and dispatching facilities). This material is expected to be supplied to large road infrastructure projects on an ‘as required’ basis. Expansion is market driven. There is no specific reuse target for bottom ash, but it is noted that greater reuse of the Bottom ash would reduce the size of the ash dam augmentation required. AGL does not have any market guarantees for this offtake.

18.3.4 Salt management

Existing salt management

Salt requiring management is currently generated by the existing Bayswater water treatment plant which removes naturally occurring salts and solids through the process of cleaning feedwater for the cooling water system. To preserve the inner workings of the cooling system, the water must be free of impurities which are present in both the returned water and the natural water. The purification process generates the salt brine which comprises of calcium carbonate (limestone), calcium sulphate (gypsum), magnesium carbonate (dolomite), magnesium sulphate (epsom salts), silica (sand), sodium chloride (common salt), hydrated sodium sulphate (glauber salt), and smaller quantities of iron, manganese, fluorides, aluminium, and other substances.

Salt brine is currently stored in the brine concentrator decant basin with Lake Liddell discharge also used to discharge salt from the site under the Hunter River Salinity Trading Scheme. At present, Baywater discharges salt to the Hunter River are via Lake Liddell Dam Wall via Bayswater Creek. There is discharge point 8 on the Bayswater EPL 779 which is part of the HRSTS. Historical discharge volumes under the Trading Scheme are provided in Table 18-5.

Table 18-5 Annual discharge total from discharge point 8 under Bayswater EPL 779

Year	Discharge amount (ML)
2018	0
2017	0
2016	4,380
2015	1,357
2014	0
2013	6,260
2012	11,928
2011	21,049

A Salt caking plant has been approved and will be constructed as part of the water treatment plant upgrade (Project approval 06_0047, as modified), which would produce a Salt cake by-product. The commencement of operation of the salt caking plant is subject to a deferred commencement condition requiring the separate approval of an appropriate salt cake disposal method.

Salt cake landfill design

The Project includes the construction and operation of a Salt cake landfill facility on site to store the Salt cake produced from the approved caking plant. The Salt cake landfill facility is required to enable the approved caking plant to commence operation and complete the water treatment upgrades.

The facility would be designed to accommodate up to 50,000 tonnes of salt cake per year, with approximately 600,000 tonnes of salt cake being deposited over the operational life. 10 cells are proposed which would be constructed sequentially as shown in Figure 2-5. Once each cell is at capacity the next one would be constructed. Each cell would be able to hold more than three years of Salt cake if around 20,000 m^3 is generated per year.

Excavated materials would be stockpiled beside the Salt cake landfill, within the proposed disturbance footprint. It is anticipated that excavated materials would be beneficially reused within the Salt cake landfill or within other areas of Bayswater. Stockpile management procedures for segregating spoil, dust suppression, erosion and sediment control would be implemented.

The Salt cake would be trucked to the cells via existing internal access roads. Transfer and placement would occur as required. *EPA Environmental Guidelines: Solid Waste Landfills* (EPA, 2016) would be adhered to throughout operation of the Salt cake landfill facility, which would include provision of appropriate coverage of each active landfill cell to minimise dust and rainwater infiltration, as well as appropriate methodology for leachate management.

Landfill decommissioning and rehabilitation

Design, operation and capping of the cells would be as per *EPA Environmental Guidelines: Solid Waste Landfills* (EPA, 2016). All completed landfill cells would be capped and revegetated as soon as practicable, and would be designed to:

- Reduce rainwater infiltration into the waste and thus minimise the generation of leachate (infiltration from the base of the final cap to be less than 5% of the annual rainfall)
- Stabilise the surface of the completed part of the landfill
- Reduce suspended sediment and contaminated runoff
- Minimise odour emissions, dust, litter, the presence of scavengers and vermin, and the risk of fire and

- Prepare the site for its future use; this includes protecting people, fauna and flora on or near the site from exposure to pollutants still contained in, or escaping from, the landfill.

When constructing the final capping, consideration would be taken to grading the final surface in such a direction so as not to impede on future landfill cells. As more cells are constructed, filled and then capped, this final landform may be amended to suit the topography.

18.4 Environmental management measures

The following mitigation measures would be implemented to address the potential waste management impacts:

Table 18-6 Environmental management measures – waste

Reference	Environmental management measures	Timing
WR01	The existing Waste Management Plan would be updated to include the Project and would be implemented prior to each stage. The plans would be developed with the following criteria: • A hierarchical waste management approach would 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 would 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 would be segregated by type for collection and removal (for processing or disposal) by licensed contractors • All waste types would be separated at source for recycling and apply a system of colour-coded waste storage containers to ensure the segregation of waste is affected as far as possible • A licensed service provider would be appointed to collect general solid waste and hazardous waste during construction and operation • Each waste type would be classified for transport to ensure correct handling. Any waste that cannot be recovered or recycled would need to go to a licensed treatment or disposal facility where it would be treated and disposed of according to its classification	Construction
WR02	Cleared vegetation would be either mulched for onsite reuse or used to created habitat piles, noting that any weeds and pathogens would be managed according to requirements under the *NSW Biosecurity Act 2015.*	Construction
WR03	The Salt cake landfill would be designed, constructed and operated in accordance with *EPA Environmental Guidelines: Solid Waste Landfills* (EPA, 2016).	All
WR04	Ash recovery for off-site use would be undertaken in accordance with the coal ash order and exemption and approved sampling plans.	Operation
WR05	The onsite disposal or reuse of materials generated through construction and operation would be undertaken in accordance with the EPL 779, POEO Act and applicable waste orders and exemptions as in force at the time.	All

19. Hazards

This chapter considers the Hazards components of the SEARs, which require particular attention to public safety, including bushfires.

19.1 Dangerous goods and hazardous substances

The *Hazardous and Offensive Development Application Guidelines - Applying SEPP 33* (**SEPP 33 Guidelines**) identify that certain activities may involve handling, storing or processing a range of substances which in the absence of locational, technical or operational controls may create an off-site risk or offence to people, property or the environment. Such activities would be defined as potentially hazardous or potentially offensive. The SEPP 33 Guidelines aim to assist determining authorities and proponents to establish whether a development proposal would fit into such definitions and hence, come under the provisions of *State Environmental Planning Policy No 33—Hazardous and Offensive Development.*

The SEPP 33 Guidelines provides the following in relation to existing developments:

> *"SEPP 33 does not apply to existing developments unless a new development application (DA) is required for the site. Such a DA could involve the modification of the existing facilities, the construction of new facilities or the commencement of new uses.*
>
> *If the proposed use or modifications are considered potentially hazardous or potentially offensive in their own right, then SEPP 33 applies.*
>
> *For potentially hazardous developments, hazards relating to external causes as well as those from the development itself must be addressed. Any preliminary hazard analysis would therefore need to consider hazards from the existing facility.*
>
> *SEPP 33 would also apply if the proposed modifications are not potentially hazardous in themselves, but interact with the existing facility in such a way that cumulative hazards (or offence) from the existing facility may be significantly increased. This may in many cases be a matter for judgement by the consent authority".*

19.1.1 SEPP 33 Screening

The methodology used to address the hazard SEARs has responded to the SEPP 33 Guidelines and included:

- Confirmation that hazardous chemicals proposed to be used in association with the Project are not potentially hazardous in their own right
- Screening of hazardous chemicals associated with the existing operation of Bayswater to confirm that these exceed SEPP 33 Guideline screening levels
- Consideration of the potential for interaction between the Project and existing operations of Bayswater to lead to significant change in Bayswater's operational risk profile and
- Commentary of AGL's current approach to risk management at Bayswater to provide confidence that Bayswater would remain acceptable in its current location.

The SEPP 33 Guideline screening procedure is based on the quantity of dangerous goods involved in the Project and, in some cases, the distance of these materials from the site boundary. Key inputs to the screening exercise provided by AGL include:

- Confirmation that the Project does not seek approval for storage of hazardous substances above screening levels and only minor quantities of such substances would be handled in a manner typical of earthworks projects and
- Current Hazardous Chemicals manifest and plan of storage locations for the existing operations of Bayswater.

No review of hazardous chemicals handled and stored as part of existing ongoing operations at Bayswater was undertaken. However, it is understood that:

- Management of hazardous chemicals on site is governed through AGL Hazardous Chemical and Substances Procedure for storage, handling and transportation
- A Chemical management database, is available and accessible to all workers required to handle hazardous chemicals
- A Hazardous Chemical Manifest has been prepared and notified to WorkSafe NSW and emergency services of NSW
- AGL reported that Bayswater was audited by WorkCover NSW in December 2013 as part of the 2013-14 Major Hazard Facilities Hazardous Chemicals Verification Program and a number of Improvement Notices were issued, and have all subsequently been closed out to the satisfaction of WorkCover
- AGL business risks and associated controls are managed through a software package. The operational risk events including storage of hazardous chemicals which are identified in the risk register appear to be managed to an acceptable level
- An Emergency Response Plan is implemented in accordance with Work Health and Safety legislation to respond to any crisis and emergencies which occur in Bayswater and to workers working offsite and
- A Pollution Incident Response Management Plan is maintained for Bayswater for the environmental, human, and life safety aspects of pollution incidents under EPL 779.

The existing operation of Bayswater would be considered potentially hazardous when screened under the SEPP 33 Guideline in the absence of appropriate controls. As hazardous chemicals are not stored within the Project area and the Project does not alter how these chemicals are stored or handled, there is no potential for cumulative hazards or for Bayswater land-use safety risk profile to be significantly increased.

The existing separation between the Project and storage locations for hazardous chemicals means there is a low and manageable risk that the Project could interact with existing storage. Therefore, it can be concluded that the Project would not have any hazardous impact on the existing operation or contribute to the escalation of any event in a manner that could impact land inside the plant, within the buffer zone and most importantly to off-site receptors. The Project does not intensify the existing risk profile of the operation of Bayswater and is not considered potentially hazardous.

19.2 Dam Safety

The BWAD is currently prescribed under the DS Act. As a result, it has several conditions applied to ensure the safety of the structure and to minimise risk to the downstream population.

As part of the DSC's requirements, it is necessary to establish the Consequence Category for any prescribed dam. This is required by the DSC so that it could determine the design requirements for the facility, as well as set an appropriate level of ongoing surveillance.

The Consequence Category of the dam is reviewed at five-yearly intervals within comprehensive surveillance reports, which are submitted to the DSC. The last report concluded that BWAD remains within the Significant Consequence Category, under both sunny day and flood conditions.

With BWAD having been prescribed, the DSC requires that a dam safety management program be implemented, that includes regular surveillance inspections, monitoring and regular reporting to the DSC. Given the change in placement strategy, and the augmentation that has been proposed, this triggers the need to reassess the consequence category of the BWAD, based upon the revised final landform.

Bayswater Ash Dam Augmentation Design Report (Aurecon, 2019) incorporates a Consequence Category assessment of the preferred design option. Aurecon (2019) concludes that the augmented BWAD would remain in the Significant Consequence Category under both sunny day and flood conditions.

19.3 Bush fire prone land

Bush fire prone land (**BFPL**) is land that has been identified by local council which can support a bush fire or is subject to bush fire attack. Bush fire prone land maps are prepared by local council and certified by the Commissioner of the NSW RFS. A review of the NSW Rural Fire Service mapping was conducted to confirm

that the Project would be partly located within and near bushfire prone land. The location of bushfire prone land in relation to the Project is shown in Figure 19-1, and is located on the eastern portion of the augmented BWAD, the Salt cake landfill and within Borrow Pit 4.

The following bushfire risks are identified for the Project:

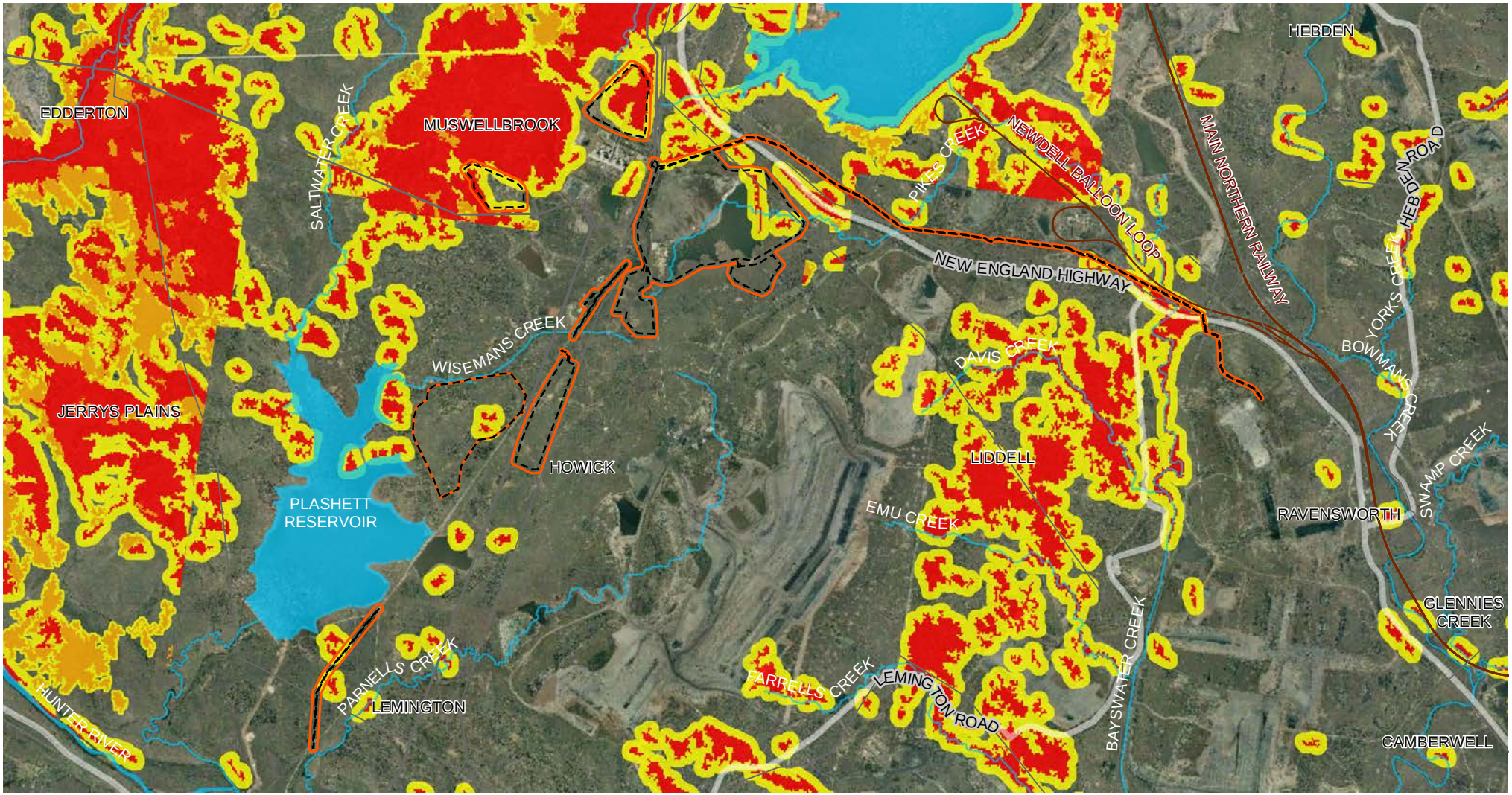
- Construction of the Project would introduce additional fire ignition risks associated with clearing and hot works such as welding igniting surrounding vegetation and causing a bushfire
- New activities not adequately considered in bushfire emergency response system resulting in serious injury or death to workers
- Insufficient training of construction workers dealing with bushfire risk and
- Protection of additional on site infrastructure from existing bushfire threats.

Potential impacts during construction would mainly involve the health and safety of construction workers, then impacts to construction materials and assets.

Post construction bushfire risks would remain consistent with the existing situation with only additional onsite infrastructure requiring protection being the Salt cake landfill. All other Project components are either located in areas with existing infrastructure with consistent bushfire impact risks.

AGL implements a bushfire management plan at Bayswater to meet the requirements of the Rural Fires Act 1997 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 updated to address identified risks.

Overall, the hazards and risks associated with construction, operation and decommissioning of the Project are considered low and do not introduce new bushfire risks to the site. Risks would be managed with the implementation of AGL's Health Safety and Environment Management Plan, which would be updated to include the Project.



Data sources

Jacobs 2019, AGL 2019
NSW Spatial Services 2019
Rural Fire Service 2019

GDA94 MGA56

Figure 19-1 Bush fire prone land

Date: 27/11/2019 Path: J:\IE\Projects\04_Eastern\IA215400\22_Spatial\GIS\Directory\Templates\Figures\WOAOW_EIS\IA215400_GIS_EIS_F008_r1v1_BushfireProneLand.mxd
Created by : XX | QA by : XX

19.4 Environmental management measures

Table 19-1 Environmental management measures – hazards and risk

Reference	Environmental management measures	Timing
HR1	Risks associated with the Project would be managed through a Management of Change process. AGL 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 AGL's Risk Management and Assessment Framework to assess the risks that may be introduced by the proposed change. This would be undertaken for all Project components and appropriate controls implemented to reduce the risk to an acceptable level.	Prior to construction
HR2	Completion of all actions arising out of the management of change process.	Prior to construction/ Construction / Post construction.
HR4	Temporary construction compounds would 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
HR5	Construction activities involving flammable materials and ignition sources (for example, welding) would 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 would be inducted into the requirement to safely dispose of cigarette butts.	Construction
HR6	Storage and management of dangerous goods and hazardous materials would occur in a safe, secure location consistent with the requirements of applicable Australian Standards.	Construction and Operation
HR7	Risks associated with the Project would be managed through a Management of Change process. AGL 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 AGL's Risk Management and Assessment Framework to assess the risks that may be introduced by the proposed change. This would be undertaken for all Project components and appropriate controls implemented to reduce the risk to an acceptable level.	Prior to construction

20. 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.

20.1 Existing Management Arrangements

Bayswater operates under an Environmental Management System 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 required under EPL 779, the Emergency Management Plan and Emergency Response Plan. EPL 779 stipulates the discharge points to air and water. It also stipulates 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
- Power Stations Standing Instruction No. HSE 40/1 Bushfire Risk Management Plan
- AGL Macquarie Bayswater Power Station – Water Treatment Plant Upgrades – Construction Environmental Management Plan
- Bayswater Power Station - Upgrade to Increase Water Extraction Capacity – Ecology Management Plan
- Bayswater Power Station - Operation Environmental Management Plan – Hunter River Pump Station Augmentation
- Bayswater Power Station Upgrade to Increase Water Extraction Capacity – Vegetation Management Plan
- Ravensworth Mining Operations Plan for Ravensworth Ash Disposal Area (Rehabilitation Management Plan)
- Bayswater Ash Dam Ash Management Plan.

These plans would be reviewed to incorporate the environmental management commitments and any conditions of approval for the Project.

20.2 Project environmental commitments

20.2.1 Ongoing design process

Full details of the design for the Project have 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 adopt 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. AGL will 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 eventuate. Where additional impacts are identified, any necessary modifications would be sought.

20.2.2 Construction Environmental Management Strategy

Due to the various Project components, it is likely that individual construction packages would be tendered and potentially delivered by different contractors. Each contractor is likely to implement construction works differently and in accordance with their own management systems and processes. As such AGL 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 Construction Environmental Management Plans (CEMP). As such the CEMS would document the required environmental performance outcomes for the Project and each CEMPs would document reasonable and feasible measures for the Project component to achieve these outcomes.

20.2.3 Operational Environmental Management Plan

The existing operational environmental management framework for Bayswater would be reviewed to incorporate commitments and approval conditions associated with the Project. In particular, the following Project components represent new or expanded operations that warrant new or revised management plans:

- Salt cake landfill operation
- Ash harvesting and recycling operations and
- Borrow Pits.

All other Project components are the subject of existing operational management plans which would be revised to accommodate any new commitments and procedures as necessary.

20.3 Consolidated summary of mitigation measures

A summary of the proposed environmental mitigation measures is provided in Table 20-1. These measures have been adapted from, and reflect the intent of, the recommended measures of the specialist assessments provided in Appendix C to K whilst adopting the overarching environmental management approach adopted for the Project by AGL.

Table 20-1: Summary of environmental management measures

Reference	Environmental management measures	Timing
Biodiversity		
BD01	Opportunities to limit the extent of vegetation (including hollow-bearing trees and stags) clearance required would be considered as part of detailed design and construction planning.	Pre-construction
BD02	A Biodiversity Management Plan would be prepared as part of the CEMS and include the following requirements: • Clearly delineate the boundaries of the Project area to prevent any unnecessary clearing beyond its extent • 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 Biodiversity 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.	Construction
BD03	Prior to the removal of hollow-bearing trees / habitat trees, a pre-clearing protocol would be implemented which would include the following requirements: • Pre-clearance surveys would be undertaken to determine if any inhabiting fauna are present • A suitably qualified and trained fauna handler would be present during hollow-bearing tree clearing to rescue and relocate displaced fauna • Appropriate exclusion fencing around trees and woodland that are to be retained within the Project area would be erected, considering allowance for Tree Protection Zones in accordance with the Standards Australia (2009).	Construction
BD04	Clearing would be avoided, where practicable, during breeding and through egg hatching periods for the Striped Legless Lizard, November to February. If clearing is to occur during this period (November to February): • Pre-clearing surveys within areas of Striped Legless Lizard habitat will be conducted • Any individuals captured during these pre-clearing surveys will be relocated into similar habitat outside the Development Site.	Construction
BD05	Weeds and pathogens would be managed in accordance with applicable legislative requirements including and not limited to the *Biosecurity Act 2015* (NSW). The following measures would be implemented to prevent the transfer of weeds and pathogens: • Plant and equipment would be required to arrive at site clean • Soil and seed material transfers would consider the risks of weeds and pathogens being present and the sensitivity of the	Construction

Reference	Environmental management measures	Timing
	receiving area. No transfers are to occur to relatively less disturbed areas of site unless material can be determined to be from a non-weed infested area and not contain pathogens • Weed infestations within the construction footprint are to be identified and mapped prior to construction. Methods to be implemented for the control of noxious weeds would be included in the CEMS and adopted as necessary in each CEMP. This is to include weed control works to be conducted throughout the construction phase of the Project, and follow-up weed control within the Development Site post construction.	
BD06	If it is identified there is a Salt cake landfill lining failure and an associated increase in salinity in the groundwater, above background levels, then monitoring of vegetation within the predicted impact area would occur. If during the monitoring of vegetation there is an identified impact on the vegetation due to the increased salinity from the Salt cake landfill, additional offsetting measures would be implemented where required. Credits retirement would be calculated based on the area of impact and the ratio of credits generated within the closest equivalent vegetation zone within the impact area.	Operation
BD07	Upon the completion of extraction works within each Borrow Pit location, these areas would be rehabilitated. A rehabilitation plan for each Borrow Pit would be prepared prior to completion. Where the areas are to be returned to native vegetation, locally endemic species will be used for rehabilitation of appropriate vegetation communities, using locally sourced seeds/plants where possible.	Decommissioning
BD08	Biodiversity offset credits would be retired in accordance with BC Act and EPBC Act requirements. The number and type of credits would be refined as part of further survey and detailed design. A clearing staging plan would be prepared prior to the commencement of works. From this plan the required biodiversity credits for each stage would be determined based on areas of impacts to each vegetation zone, and the retirement of biodiversity credits would occur prior to the commencement of each stage. This plan will be set out in a separate document to the BDAR and would be approved by DPIE prior to commencement of disturbance works.	Prior to clearing for each Project component.
Surface Water		
SW01	An overarching Construction Environmental Management Strategy **(**CEMS) would be prepared for the Project and would require the preparation of a Construction Environmental Management Plan (CEMP) for each Project component. The CEMS would outline measures to manage soil and water impacts associated with the construction works. The CEMS would require that each CEMP would provide: • Measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans for all progressive stages of construction	Pre-construction Construction

Reference	Environmental management measures	Timing
	• Measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation • Measures to manage groundwater dewatering and impacts • Processes for dewatering of water that has accumulated on site and from sediment basins, including relevant discharge criteria • Measures to manage accidental spills including the requirement to maintain materials such as spill kits • Measures to manage potential saline soils • Details of surface water and groundwater quality monitoring to be undertaken prior to, throughout, and following construction • Controls for receiving environments including: Designation of 'no go' zones for construction plant and equipment Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to ensure containment of sediment-laden runoff and diversion toward sediment sump treatment areas (not sediment basins) to prevent flow of runoff to nearby waterways.	
SW02	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 (Department of Environment, Climate Change and Water, 2008), commonly referred to as the "Blue Book". Additionally, any water collected from worksites would be treated and discharged (where able) to avoid any potential contamination or local storm water impacts. Measures would be designed in accordance with the relevant guideline where appropriate.	Construction
SW03	Alternative water supply options to potable water would be investigated, with the aim of using recycled water where feasible. Measures would be implemented to reduce reliance on potable water use for both construction and operational phases of the Project where possible noting that AGL obtains the majority of its water from the Hunter River under AGL's existing Macquarie Generation Water Licensing Package dated April 2011. No additional water is required for the Project outside of this Water Licensing Package. Water use requirements and sources would be reviewed during the detailed design and construction planning, documented in each CEMP and implemented throughout the Project. Any existing Water Management Plans would be updated to incorporate any altered water use requirements during operational stages of the Project.	Construction Operation
SW04	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 Operation

Reference	Environmental management measures	Timing
SW05	A construction water quality monitoring program would be developed where appropriate and included in each CEMP for the Project to, observe any changes in surface water and groundwater during construction, and inform appropriate management responses. The program would be based on the water quality monitoring methodology, water quality indicators and the monitoring locations outlined in the CEMS. Sampling locations and monitoring methodology to be undertaken during construction would be further developed in detailed design in accordance with the *ANZECC water quality guidelines* (ANZECC/ARMCANZ (2000). It may include collection of samples for analysis from key locations, visual monitoring of other points of release of construction waters and monitoring of downstream waterways where appropriate. The monitoring frequency during construction would be confirmed during detailed design however would include at least monthly construction monitoring at all monitoring sites which would be preferentially monitored following wet weather events. Should the results of monitoring identify that the water quality management measures are not effective in adequately mitigating water quality impacts, additional mitigation measures would be identified and implemented as required.	Prior to construction, and during construction and operation
SW06	The Bayswater site operational water quality monitoring program would be updated and implemented as required.	Prior to operation and during operation
SW07	The specific requirements for water quality controls would be confirmed as the detailed design develops and prior to commencement of construction of each Project element to ensure the objectives of the Project are achieved.	Prior to Construction
SW08	The following measures would be undertaken to manage activities in proximity to waterways: • Works within waterfront land would be managed in accordance with the relevant guideline as deemed appropriate • Implementing practices to minimise disturbance of banks and undertaken bank stabilization. Appropriate drainage features would be incorporated into the design of the Project elements by a suitably qualified and experienced professional. All Project elements would be designed and constructed in accordance with relevant guidelines.	Prior to construction and during construction
SW09	Borrow Pits would be designed to comply with design specifications to minimise interference and disruption of natural surface water flows and water quality, particularly impacts on turbidity.	All
SW10	Routine inspections and monitoring of the Ravensworth Ash line would be undertaken to ensure any leakages are promptly identified and fixed.	Operation
Flooding		
F01	Temporary works would consider flood risks during construction. Should construction staging require a temporary departure from the design (e.g. higher embankments for preloading, temporary diversions	Construction

Reference	Environmental management measures	Timing
	or temporary crossings of waterways), flood impacts would be assessed before finalising the approach.	
F02	Where stockpiles are to be located in the floodplain, they would be located and sized to ensure no adverse impacts on flood behaviour.	Construction Operation
F03	Flood management controls would be included as part of each CEMP. The controls would consider likelihood of flooding, flood evacuation routes, warning times and potential impacts from flooding from the Project. It would include, but not be limited to: • Any monitoring requirements to provide advance notice of a flood event • Procedures (e.g. dam safety emergency plan) to be implemented in the event of a flood Required training and staff inductions.	Prior to Construction Construction
F04	Temporary crossings on water courses would be designed with consideration of flooding during construction and removal and rehabilitation following completion of construction.	Prior to Construction Construction
F05	Dam break inundation maps would be prepared based on two-dimensional hydraulic modelling software based on the current relevant guidelines presented in Australian Rainfall and Runoff (Ball J et al, 2019), ANCOLD and guidelines acceptable to Dams Safety NSW. The inundation maps would be utilised to confirm the consequence category for the dam.	Prior to Construction
F06	A detailed assessment of the flood handling capacity for the BWAD would be undertaken for each of the augmentation stages based on the current guidelines presented in Australian Rainfall and Runoff (Ball J et al, 2019). The consequence categories for each of the augmentation stages would be reassessed and inundation maps prepared to inform the Dam Safety Emergency Plan.	Prior to Construction
F07	A flooding assessment based on current guidelines from the Australian Rainfall and Runoff and using a two-dimensional hydraulic modelling software would be undertaken for: • The proposed Borrow Pits, to consider possible re-distribution of flood flows due to diversion and which may impact on scouring and bank erosion • The Salt cake landfill, to demonstrate that the salt cake landfill facility would have no adverse impacts on flood behaviour up to and including the 1% AEP event.	Prior to Construction
F08	The design of the Ravensworth Ash line would confirm that the pipeline would have no adverse impacts on flood behaviour and the pipeline would be unlikely to be damaged or destroyed up to the designed storm event.	Prior to Construction
Groundwater		
GW01	Design Borrow Pit areas to avoid areas with shallow groundwater.	Prior to construction
GW02	If groundwater is unexpectantly intersected during Borrow Pit excavations, excavations should cease in that area and the date, location, level and depth of groundwater interception should be	Construction

Reference	Environmental management measures	Timing
	documented and conveyed to a hydrogeologist to determine an appropriate course of action.	
GW03	During detailed design, salt cake landfill design should ensure leachate and salt cakes would not geochemically compromise the elected liner type due to reactions. Since the salt is reported by the proponent to predominantly comprise gypsum, there may be a risk that this material (and leachate) could interact with clay liners and result in compromised liner integrity.	Prior to construction
GW04	If drilling fluids are required, where possible, freshwater would be used. Where this is not possible, environmentally friendly biodegradable drilling fluid would be used where possible.	Construction
GW05	The above-ground sections of the Ravensworth ash line would be routinely checked for leaks. Observed leaks would be rectified.	Construction and operation
GW06	To minimise the risk of spills/leaks of hazardous materials, the following would be undertaken: • Regular plant maintenance and checks • Onsite spill kits and established spill clean-up procedures, which would include: • Having adequate spill prevention and absorbent materials (including absorbent pads, absorbent booms, granular absorbent and disposal bags) onsite to manage spills and leaks of potential pollutants • Provision of appropriate equipment and materials to capture any drips and spills which occur during the transfer of potential pollutants, and when carrying out maintenance of hydrocarbon filled plant and equipment • Procedures which ensure that spills of potential pollutants are contained and cleaned up immediately. Such spillage must not be cleaned up by hosing, sweeping, or otherwise releasing contaminants to any watercourse, waterway or groundwater • Routine toolbox talks and safe work method statements which cover spill management protocols. Remediation of potential contamination sources and where possible removal of the contamination source (e.g. through offsite removal and disposal to an appropriately licensed waste facility).	Construction and operation
GW07	The BWAD seepage flow rate should be monitored during construction and operation, as well as the effectiveness of the two ash dam seepage collection dams. If monitoring indicates that after implementation of the proposed upgrades to the seepage collection dams that the dams are not effectively collecting seepage, then additional seepage collection dam upgrades should be made, or alternatively, the seepage collection system be re-designed and re-constructed.	Construction and operation
Air Quality		
AQ01	The CEMS would include requirements to monitor and manage potential air quality impacts associated with the construction of the Project.	Construction

Reference	Environmental management measures	Timing
	Each CEMP would identify project construction activities with the potential to have air quality impacts and the controls required to avoid, minimise and mitigate these impacts. The following measures would be implemented as required: • Where possible, limit the extent of exposed areas and quantity of stockpiled dispersible materials; • Minimise dust generation from stockpiles, haulage routes, work activities and exposed ground surfaces; • Minimise generator and vehicle emissions; • Apply suitable speed limits on site haulage routes to minimise dust emissions; • Undertake watering of all unsealed trafficked haulage routes to minimise visible dust emissions; • Apply watering to activities involving the loading and unloading, compaction and handling of soil materials as required; • Cover or minimise truck loads; • Modify or cease dust generating works during unfavourable weather conditions; and Inspect and address corrective actions.	
AQ02	During operation of the augmented BWAD, the following additional controls would be implemented: • Conduct routine inspections of the ash dam to identify whether cenospheres (floating ash) have accumulated in dry areas beyond the decant pond; • Where identified promptly bury, harvest or move dried cenospheres into the decant pond; • Where feasible, use less dispersive bottom ash to 'cap' fly ash deposits in the ash dam before they dry out; • As possible, restrict discharge from fly ash pipelines to one cell at a time, and utilise bottom ash to 'cap' before moving to the next cell; • Where feasible utilise temporary 'flooding' of individual ash dam cells prior to unfavourable meteorological conditions • As applicable make use of new access tracks to apply water or dust suppressing agents.	Operation
AQ03	Undertake revegetation of rehabilitation areas at decommissioning.	Decommissioning
Soil and contamination		
SC01	Appropriate demarcation and restriction of access to previously identified asbestos impacted areas in the CHP Coal storage area and along the pipelines with the BWAD augmentation area should be undertaken to reduce potential exposure to workers in the short term.	Construction
SC02	Each CEMP would identify appropriate control measures to mitigate the potential for pollution incidents occurring that could lead to contamination of study areas. Each CEMP would also be required to include an unexpected finds protocol to manage actual or potential contamination encountered during construction. The protocol would	Construction

Reference	Environmental management measures	Timing
	include measures for appropriate sampling, analysis and interpretation of results by a qualified environmental consultant.	
SC03	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
SC04	A rehabilitation plan would be developed covering all Project elements, which would include measures to remediate the land where required following decommissioning in accordance with State Environmental Planning Policy No 55—Remediation of Land.	Decommissioning
Aboriginal heritage		
AH1	The detailed design of the Project would seek to avoid impacts to Aboriginal sites and areas of PAD where possible.	Pre-construction
AH2	Establish 'no-go' areas, through fencing or other appropriate measures, to protect all sites and areas of PAD (or portions thereof) that have been assessed as subject to potential indirect (inadvertent) impact.	Pre-construction
AH3	Where direct impacts are proposed to occur to areas of PAD (including those areas of PAD associated with surface artefact scatters), the following process would be carried out prior to construction: • A program of detailed survey and test excavation would be carried out to assess the nature and significance of any subsurface archaeological material • Develop further proposed management measures for areas of subsurface archaeological material, based on the results of test excavations Management may include salvage excavation, or further design refinements to avoid impacts and establishment of no-go areas.	Pre-construction
AH4	Carry out collection of surface artefacts from all sites or portions of sites that would be impacted by the Project. Collection of surface artefacts and archaeological excavations would be undertaken by a qualitied archaeologist and Site Officers supplied by the RAPs.	Pre-construction
AH5	Cultural awareness induction for any personnel involved in ground breaking activities. This could include a Cultural Awareness Training Program.	Construction
AH6	A Cultural Heritage Management Plan including potential monitoring and salvage works procedures would be prepared and implemented for the Project construction.	Construction
AH7	A Chance Finds Procedure would be included in the Cultural Heritage Management Plan and be followed for any previously unidentified Aboriginal heritage objects found during the works. The Procedure would require that: • In the event that a previously unidentified Aboriginal heritage object is found, all activity in the immediate area must cease and an appropriately qualified heritage professional should be consulted. Heritage NSW and local Aboriginal stakeholder groups must be immediately contacted and informed of the Aboriginal heritage object found. The qualified heritage professional should	Construction

Reference	Environmental management measures	Timing
	record the location and the attributes of the site and determine its Aboriginal cultural significance • If Aboriginal remains (human skeletal material or suspected human skeletal material) are discovered during construction all activities in the immediate area must cease. The State Police and NSW Heritage must be contacted and any sand or soil removed from the near vicinity identified and set aside for investigation purposes.	
Traffic		
TT1	An oversized vehicle permit would be sought for all oversized vehicle movements. Oversized vehicles would be escorted by an appropriately qualified subcontractor and would endeavour to travel outside of peak traffic periods.	Pre-construction
TT2	The haulage contractor to prepare and implement a traffic management plan for oversize vehicle movements, which would 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.	Construction
TT3	The CEMS and general site induction would inform construction and operational personnel of the risk of collisions, particularly with animals during rain or periods of low light.	Construction / operation
Noise and Vibration		
NV01	Each CEMP would identify project construction activities with the potential to have noise impacts and the controls required to avoid, minimise and mitigate these impacts. Each CEMP would adopt the following measures where reasonable and feasible:: • Conduct construction activities during standard hours of construction, and noisy operational works during day time hours • Schedule deliveries during standard hours of construction • Ensure on-site and public speed limits are adhered to • Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site, such as by including drive-through for parking and deliveries • Use mains power supply rather than use generators; • Switch off generators when not in use • Wherever possible and practical, select low noise plant and equipment • Operate and maintain plant and equipment in an efficient and proper manner • Turn off plant and equipment when not in-use • Consider the application of alternative, low-impact construction techniques • Avoid dropping materials from a height	Construction

Reference	Environmental management measures	Timing
	• Avoid dragging equipment and materials • Dampen or line metal trays as necessary • Ensure that road plates are installed as per specifications • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.	
Socio-economic		
SE1	To manage the increase in construction traffic, including heavy and oversize vehicles, on the New England Highway: • Implementation of a traffic management plan for management of construction traffic, including oversized loads • Consider the timing of key tourist activities and events in the planning of major haulage tasks • Communication with key stakeholders and communities about potential changes in construction traffic and major haulage tasks.	Construction
SE2	Identify opportunities to maximise the use of local suppliers and businesses in the provision of goods and services for construction.	Pre-construction
Visual		
VI01	Visual impacts would be considered in the detailed design to minimise visual impacts where compatible with biodiversity and heritage management measures and Project requirements.	Design
VI02	A rehabilitation management plan would be developed and include prioritising screening vegetation in areas able to support larger vegetation around permanent, unnatural landforms.	Operation
Non-Aboriginal heritage		
NAH01	Should any historical archaeological remains be discovered during construction, all works would 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 of the *Heritage Act 1977* (NSW), a s146 form would be submitted to notify the Heritage Council of the discovery of relics. Further investigation may be required, and appropriate management would be agreed through consultation with Heritage NSW.	Construction
NAH02	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 AH7.	Construction
Waste		

Reference	Environmental management measures	Timing
WR01	The existing Waste Management Plan would be updated to include the Project and would be implemented prior to each stage. The plans would be developed with the following criteria: • A hierarchical waste management approach would 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 would 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 would be segregated by type for collection and removal (for processing or disposal) by licensed contractors • All waste types would be separated at source for recycling and apply a system of colour-coded waste storage containers to ensure the segregation of waste is affected as far as possible • A licensed service provider would be appointed to collect general solid waste and hazardous waste during construction and operation • Each waste type would be classified for transport to ensure correct handling. Any waste that cannot be recovered or recycled would need to go to a licensed treatment or disposal facility where it would be treated and disposed of according to its classification	Construction
WR02	Cleared vegetation would be either mulched for onsite reuse or used to created habitat piles, noting that any weeds and pathogens would be managed according to requirements under the *NSW Biosecurity Act 2015.*	Construction
WR03	The Salt cake landfill would be designed, constructed and operated in accordance with *EPA Environmental Guidelines: Solid Waste Landfills* (EPA, 2016).	All
WR04	Ash recovery for off-site use would be undertaken in accordance with the coal ash order and exemption and approved sampling plans.	Operation
WR05	The onsite disposal or reuse of materials generated through construction and operation would be undertaken in accordance with the EPL 779, POEO Act and applicable waste orders and exemptions as in force at the time.	All
Hazards		
HR1	Risks associated with the Project would be managed through a Management of Change process. AGL 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 AGL's Risk Management and Assessment Framework to assess the risks that may be introduced by the proposed change. This would be undertaken for all Project components and appropriate controls implemented to reduce the risk to an acceptable level.	Prior to construction

Reference	Environmental management measures	Timing
HR2	Completion of all actions arising out of the management of change process.	Prior to construction/ Construction / Post construction.
HR3	Bushfire risks would be considered in the detailed design of each Project component and the bushfire management plan updated to address identified risks.	Prior to construction
HR4	Temporary construction compounds would 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
HR5	Construction activities involving flammable materials and ignition sources (for example, welding) would 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 would be inducted into the requirement to safely dispose of cigarette butts.	Construction
HR6	Storage and management of dangerous goods and hazardous materials would occur in a safe, secure location consistent with the requirements of applicable Australian Standards.	Construction and Operation

21.Evaluation of Merits

This Chapter presents an evaluation of the Project as a whole, drawing conclusions on the overall merits of the Project.

21.1 Justification

The benefits of the Project, being the improved environmental performance and rehabilitation outcomes for the continued operation of Bayswater, are 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 mitigation measures.

21.1.1 The suitability of the site

As described in Sections 3.4.6 and 3.4.7, the Project is for the purpose of energy generation and the land is appropriately zoned for this purpose. The objectives of the SP2 zoning where the majority of the Project would be located 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
- To recognise existing land and to enable future development for utility undertakings and associated purposes.

The Project is wholly ancillary to the ongoing operation of Bayswater and located within the AGL owned buffer lands. The site is largely developed as a power station and the Project objective is to improve the environmental outcomes of this use. The Project is considered a compatible use of this buffer land and does not conflict with these ongoing operations or any other proposed land uses.

The Project is wholly consistent with these land use objectives.

21.1.2 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 but this would not 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.

21.1.3 Biophysical costs and benefits

The Project involves approximately 339.45 hectares of vegetation clearing. These impacts would be offset in accordance with the BC Act and EPBC Act in accordance with any approval conditions. Air quality impacts have been identified as localised during the operation of the Borrow Pits and construction of the Ash dam augmentation. The Project would facilitate the capping and rehabilitation of the ash dam leading to improved air quality outcomes post Bayswater's retirement in 2035.

21.1.4 Economic costs and benefits

The Project has an estimated capital investment value of $51.9 million. This would be spent on the engagement of labour, materials, project components, plant and equipment. Plant, materials and equipment would be procured locally to the extent possible. 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 the upgraded 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.

21.1.5 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 in improving the environmental and rehabilitation outcomes of Bayswater that 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 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.

21.2 Consideration of the Objectives of the EP&A Act

The objectives of the EP&A Act, and how these are addressed in relation to the Project, are presented in Table 21-1 below.

Table 21-1: Consideration of Objectives of the EP&A Act

Objective	Comment
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.	The Project planning, impacts, safeguards and management measures detailed in this EIS allow for the proper management, development and conservation of natural and artificial resources. The Project is aimed at providing long-term positive impacts through improved ash and salt management and rehabilitation outcomes and limited short-term environmental impacts. Some permanent impacts to biodiversity and Aboriginal heritage values are required but these would be avoided to the extent possible. The Project is necessary to facilitate the ongoing operation of Bayswater until its planned retirement in 2035.
To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Sections 21.3.1 to 21.3.4 below.
To promote the orderly and economic use and development of land.	This objective is largely achieved through landuse zoning. As described in Sections 3.4.6 and 3.4.7, the Project is for the purpose of energy generation and the land is appropriately zoned for this purpose.

Objective	Comment
	The Project is wholly ancillary to the ongoing operation of Bayswater and located predominantly within the AGL owned lands. The site is largely developed as a power station and the Project objective is to improve the environmental outcomes of this use. The Project is considered a compatible use of this and and does not conflict with these ongoing operations or any other proposed land uses. The Project is wholly consistent with zone land use objectives.
To promote the delivery and maintenance of affordable housing.	Not applicable.
To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	This object is obtained via the application of the BC Act. The Project impacts have been assessed in accordance with the BC Act and planned to avoid clearing to the extent possible. AGL are required to retire biodiversity credits as described in Section 7.5.
To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The Project has assessed the potential for impacts on built and cultural heritage. While some impacts to Aboriginal heritage items and values is necessary, management measures have been proposed and endorsed by RAPs.
To promote good design and amenity of the built environment.	Design would be completed in accordance with applicable standards applying to each Project component.
To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Design, construction and maintenance of Project components would be undertaken in accordance with applicable standards and AGL health and safety policy.
To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	The application has been made in accordance with relevant State and Local environmental planning instruments and has been prepared to respond to applicable environmental planning legislation.
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 exhibited and any submissions received would be responded to and considered by the Consent authority in determining the development application.

21.3 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 21-2 below in order to summarise the likely impacts of proposed works on the natural and built environment.

Table 21-2: EP&A Act Section 4.15 Consideration

Matter for consideration	Consideration
The provisions of any environmental planning instrument.	Environmental planning instruments applicable to the site and project include: • State Environmental Planning Policy (State and Regional Development) 2011 • State Environmental Planning Policy (Infrastructure) 2007 • State Environmental Planning Policy No 33 – Hazardous and Offensive Development • State Environmental Planning Policy No. 55 – Remediation of Land • State Environmental Planning Policy (Koala Habitat Protection) 2019 • Muswellbrook Local Environmental Plan 2009 • Singleton Local Environmental Plan 2013 The relevant provisions of applicable environmental planning instruments are considered in Section 3.4. The proposed works are considered permissible under these instruments.
The provisions of any proposed instrument.	No proposed environmental planning instruments have been identified as applying to the proposed works.
The provisions of any Development Control Plan.	The Muswellbrook and Singleton Development Control Plans were considered briefly and are not considered 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 *Environmental Planning and Assessment Regulation 2000* identifies matters prescribed for the purposes of section 4.15 (1) (a) (iv) of the Act, to be taken into consideration by a consent authority in determining a development application. 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 and economic impacts in the locality.	Environmental and socio-economic impacts are assessed in Chapters 7 to 19
The suitability of the site for the development	The site is appropriately zoned and within the AGL owned buffer lands of Bayswater. The Project design has focused on previously disturbed land to the extent this is sufficient and appropriate for the required purpose of each component.

Matter for consideration	Consideration
Any submissions made in accordance with this Act or the regulations.	To be considered by DPIE following exhibition.
The public interest.	The proposed works are considered to be in the public interest as described in Section 21.1.5.

21.3.1 The Precautionary Principle

This principle states: “if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

The Project planning has sought to take a precautionary approach to minimising environmental impact through the avoidance of impacts. The objective of the Project is to improve the environmental outcomes of ash and salt management and improve rehabilitation outcomes post Bayswater retirement. A range of environmental safeguards are proposed to address identified impacts. These safeguards would be implemented during the Project.

No safeguards 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.

AGL has a clearly articulated plan to achieve decarbonisation of generation by 2050 focussed on contributing to global efforts to limit human induced climate change. The ongoing operation of Bayswater as one of the more efficient coal fired power stations in the NEM is a key component of AGL’s plans to manage the transition to decarbonisation of its generation portfolio while responding to the requirements of the market in relation to reliable and affordable electricity.

21.3.2 Intergenerational Equity

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 is not considered to sterilise land to any significant extent with Project components located in previously disturbed areas to the extent possible.

21.3.3 Conservation of Biological Diversity and Ecological Integrity

This principle states: “the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival”.

The Project has an aim of delivering improved environmental outcomes for ash and salt management for the ongoing operation of Bayswater and improved rehabilitation outcomes post Bayswater closure. The Project would include securing biodiversity offsets with the objective of attaining a neutral or beneficial biodiversity outcome.

21.3.4 Improved Valuation, Pricing and Incentive Mechanisms

This principle is defined as:

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

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

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

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

The Project represents an estimated $51.9 million investment by AGL aimed at improving environmental outcomes of the of the ongoing operation of Bayswater. The Project would be designed and implemented to achieve the most viable manner from an economic and social perspective.

21.3.5 Summary and conclusion

This EIS provides a description of the Project, existing information on environmental context and potential for environmental impacts. This EIS has been prepared addressing the SEARs issued by the NSW DPIE on 30 November 2018 and addendum SEARs issued 20 April 2020 and focuses on key issues of biodiversity, heritage, water, traffic, noise and vibration, air and socio-economic impacts. Based on the findings of the EIS the Project is considered able to be approved by the consent authority. The overall Project benefits, including improved environmental outcomes for the ongoing operation of Bayswater, are considered to outweigh the environmental and limited social impacts.

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