Bayswater Power Station Turbine Efficiency Upgrade

AGL Macquarie Pty Ltd

Environmental Impact Statement

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11 July 2018

SSI 9234

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Revision	Date	Description	By	Review	Approved
01	29/06/2018	Final	Thomas Muddle	Aaron Bowden	Thomas Muddle
02	11/07/2018	Final 02	Peter Horn	Kim Collings	Peter Horn

Contents

Statement of Validity

Development Application Details	**Bayswater Power Station Turbine Efficiency Upgrade**
Applicant name	AGL Macquarie Pty Limited
Applicant address	Bayswater Power Station, New England Highway, Muswellbrook, New South Wales, 2333.
Land to be developed	The development is to be carried out on the site of the Bayswater Power Station (being Lot 2, DP 327372 and Lot 2, DP 1095515).
Proposed development	SSI 9234 – Development for the purposes of the Bayswater Power Station Turbine Efficiency Upgrade Project, being the replacement and upgrade of turbines on the 4 existing generating units at Bayswater Power Station, as described in Section 3 of this Environmental Impact Statement.
Prepared by	Jacobs Group (Australia) Pty Ltd
Name	Thomas Muddle
Qualifications	Bachelor of Environmental Science, University of Newcastle and Graduate Diploma of Urban and Regional Planning, University of New England.
Address	Level 2, 710 Hunter Street, Newcastle West NSW 2303
In respect of	State Significant Infrastructure - 9234
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 4 May 2018, and that, to the best of my knowledge the information contained in the Environmental Impact Statement is not false or misleading.
Signature	
Name	Thomas Muddle
Date	29 June 2018

Executive Summary

Project Overview

AGL Macquarie Pty Limited (**AGL Macquarie**) owns and operates the Bayswater Power Station (**Bayswater**).

The Bayswater Power Station Turbine Efficiency Upgrade project consists of the works required to replace the four turbines in each of the four generating units at Bayswater with modern, efficient and higher rated capacity turbines (the **Project**).

The turbine replacement will increase each generating unit's rated capacity by 25 megawatts (**MW**) from 660 MW to 685 MW. It will also increase the overall rated capacity of Bayswater from 2,640 MW to 2,740 MW. The increased rated capacity results from efficiency gains only, as the proposed replacement turbines are able to convert steam energy from the boilers into mechanical energy more efficiently as a result of the improved and optimised steam paths contained within the selected modern turbine technology.

By increasing the rated capacity and efficiency of Bayswater, the Project will increase energy reliability and security for NSW. This will allow Bayswater to better meet market demand at a more efficient level than would be the case in the absence of the Project and contribute to the replacement of the energy generation capacity that will be lost as ageing coal fired power stations, including Liddell Power Station (**Liddell**), are closed over the coming decades.

Subject to planning approval being obtained, the Project is scheduled to commence in February 2019 to coincide with planned generating unit outages and be completed over the course of a four-year program. This would involve turbines within one generating unit being replaced each year so that all new turbines will be installed and operational prior to the scheduled closure of Liddell in 2022.

Apart from the upgraded turbines, no changes are proposed to the existing approved operation of any other component of Bayswater as part of the Project. Once the turbines have been replaced, the upgraded turbines and 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, including environment protection licence no. 779 (**EPL**). In particular, coal consumption, air emissions, water consumption, noise emissions and ash generation will continue to be governed by existing approvals.

Although some temporary impacts have been identified and detailed in this Environmental Impact Statement (**EIS**), such as slightly elevated traffic volumes while the installation works component of the Project are being carried out, these impacts are considered minor and acceptable. The overall impact of the Project is considered to be positive as it will enable Bayswater to operate at a more efficient level to meet market demand than would have been able to in the absence of the Project.

More specifically, the Project would involve the following:

- Approximately 10 heavy load deliveries from the Port of Newcastle to Bayswater and approximately 27 standard shipping container deliveries from Port Botany to Bayswater in advance of each outage over a four-year period;
- All deliveries would be to the existing loading bay within the turbine hall at Bayswater using existing established access roads, with turbine components being lifted to the turbine floor by existing cranes located within the turbine hall;
- Turbine installation works undertaken over an expected 50 days per year within a scheduled 72-day maintenance outage period to avoid unnecessary loss of availability;
- Turbine installation works being limited to one generating unit per year to minimise loss of overall generating capacity at any one time;

- Approximately 70 additional workers would be required. These workers would be accommodated in Hunter and attend the site over the scheduled 50-day period within the outage period each year for four years;
- Removal of turbine casings, extraction of high pressure, intermediate pressure and low pressure turbines, replacement with new turbines and reinstatement of turbine casings; and
- Categorisation and management of waste including off-site recycling of 100% of steel within turbine components, reuse of packaging materials for off-site transport of old turbines and off-site disposal of other wastes in accordance with existing waste management processes.

A detailed description of the Project works is set out in Chapter 3.

Project Objectives

AGL Macquarie has confirmed that the objective of the Project is to replace the ageing turbines to ensure safe, reliable and cost-effective operations can continue at Bayswater and contribute to addressing the identified power generation shortfall following the scheduled closure of Liddell in 2022.

AGL Macquarie has identified that the Project meets these objectives by:

- Enabling Bayswater to continue to safely and reliably meet the market demand for baseload power until its scheduled closure in 2035; and
- Contributing to address the identified shortfall in power generation following the scheduled closure of Liddell in 2022.

Strategic Justification

The Project has been declared by the NSW Minister for Planning to be critical State significant infrastructure on the basis that it would increase the capacity, reliability and efficiency of Bayswater and deliver greater energy security for NSW. This will create and sustain flow-on economic and social benefits for NSW, by providing employment opportunities for the region as well as strong and solid investment into regional NSW.

AGL has a clearly articulated plan to achieve decarbonisation of its generation assets by 2050. The closure of Liddell in 2022 forms a key part of this plan which is aligned with the NSW Climate Change Policy Framework. The Project is a key component of AGL's interim plans to improve the greenhouse gas efficiency of existing operations and to manage the transition to decarbonisation, while responding to the requirements of the market in relation to reliable and affordable electricity.

The Project is also aligned with the Commonwealth Government's current policy suite to reduce emissions, including the Direct Action Plan and Emissions Reduction Fund aimed at sourcing low cost emissions reductions. The Project is also aligned with the Commonwealth Government's intended National Energy Guarantee which aims to provide a reliable, secure and affordable energy system that will also help meet Australia's international commitments to reduce emissions.

Environmental Assessment

Air Quality and greenhouse gas

The Secretary's Environmental Assessment Requirements (**EARs**) issued by the Department of Planning and Environment (**DP&E**) for the Project includes a requirement to assess any potential changes to the air emissions (including greenhouse gas emissions) at Bayswater as a result of the installation and operation of the Project.

The air quality assessment reported on in this EIS considers:

- Power station air emissions;
- Air quality criteria;

- A summary of the Hunter region ambient air quality; and
- Any expected changes in air quality associated with the Project.

The efficiency gains resulting from the Project will enable Bayswater to generate in accordance with the increased 685 MW rated capacity from each generating unit without increasing the level of coal consumption and consequent air emissions when compared with the continued operation of Bayswater in the absence of the Project. On the basis that no change is proposed to the current approved operations, it is expected that the Project will result in a margin decrease in overall air emissions from Bayswater.

The Project completion coincides with the announced Liddell closure in 2022. The Project will enable some of the generation capacity lost from Liddell to be generated at Bayswater and will not result in any additional air emissions entering the Upper Hunter airshed. As Liddell emissions will cease once it closes, it is estimated that the Upper Hunter airshed power station particulate emissions will reduce by 30-50 per cent, and NOx and SO_2 by approximately 30 per cent. This will result in an overall improvement in the Upper Hunter ambient air quality.

The greenhouse gas assessment compared a theoretical 'do minimum' scenario of continuing to operate the existing turbines with the Project to identify the potential change in greenhouse gas emissions. This comparison identified a reduction of 179,417 tonnes of Carbon Dioxide equivalent (CO_2e) over 15 years of operation or approximately 12,000 tonnes CO_2e per year (on average). The Project is modelled to result in an additional 500,000MWh electricity generation per year for no additional greenhouse gas emissions, an overall emissions reduction in absolute terms and an efficiency improvement in terms of greenhouse gas emissions per unit of generated electricity.

Traffic

The EARs for the Project require an assessment of Traffic and Transport including:

- Details of the number, frequency and type of installation related vehicles, key transport routes, and proposed site access and parking arrangements;
- An assessment of the likely traffic and transport impacts during the installation of the Project on the capacity, condition, safety and efficiency of the road network, including key intersections; and
- A description of the measures that would be implemented to manage and mitigate any impacts, including any proposed road or intersection upgrades developed in consultation with the relevant road authorities (if required).

The traffic generation over the shutdown period is estimated to be:

- 70 light vehicles arriving during the morning peak and departing during the afternoon peak;
- 27 shipping containers arriving in the period leading up to the shutdown;
- 10 over-sized and over-mass deliveries from the Port of Newcastle to Bayswater; and
- 10 over-size and over-mass dispatches from Bayswater to Muswellbrook for the removal of the exiting turbines for recycling.

The findings of the study were that the additional traffic volumes would have minimal impact on the road network and that there is additional spare capacity within the interchange between the New England Highway and the Bayswater access road.

Transportation of the oversized and over-mass loads between the Port of Newcastle and Bayswater will be via existing approved routes for oversized loads and accordingly, no road upgrades will be required to accommodate the Project. It is proposed that a traffic management plan for the movement of these oversized loads be prepared to identify risks and minimise impacts on the road network.

Noise

The EARs for the Project include a requirement to assess Noise and Vibration - including an assessment of any potential changes to the noise and vibration impacts of Bayswater during the installation and operation of the Project.

Noise measurements of turbine maintenance works during an outage, considered by AGL Macquarie to be representative of works anticipated associated with the Project, were carried out on 25 May 2018. These measurements were used to predict likely noise impacts associated with the installation works and indicated that, with the exception of short term noise from hand tools, $L_{Aeq\ (15\ minute)}$ noise levels during maintenance activities were 15dB(A) lower than the total noise of the operating turbines. External noise measurements were also taken at the site access road, located 500 metres north west of the turbine hall. At this location turbine maintenance works noise was inaudible. On the basis that the installation works for the Project would be very similar to the works undertaken at the time the noise measurements were undertaken, noise impacts associated with the installation works for the Project are considered to be highly unlikely.

The operation of the new turbines is not expected to change existing operational noise levels generated by Bayswater. This is because the new turbines will be:

- Positioned within the same location as existing turbines;
- Housed within the same casing and within the existing enclosed turbine hall;
- Rotating at the same speed (a requirement of the network); and
- Functioning essentially in the same manner as existing turbines.

The turbine manufacturer has confirmed that the maximum noise emitted from the new turbines would not be greater than the maximum noise levels generated by the current turbines based on its extensive turbine replacement experience. Due to separation distances to sensitive receptors, the operation of the new turbines is not anticipated to result in any operational noise impacts when compared to the continued operation of Bayswater.

Land-use safety

The EARs for the Project include a requirement to assess Land Use Safety – including a preliminary risk screening completed in accordance with *Hazardous and Offensive Development Application Guidelines - Applying SEPP 33.* Should the screening indicate that the Project is "potentially hazardous", then a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis*.

A preliminary risk screening was completed and is focussed on the quantity of dangerous goods involved in the Project and the distance of these materials from the site boundary. The Project will not involve the use of hazardous chemicals in excess of screening levels nor will it interact with existing operations of Bayswater in such a way that cumulative hazards from the existing facility would be increased. As such the Project is not potentially hazardous.

In addition to the preliminary risk screening, AGL Macquarie has initiated a management of change process as part of its standard operational risk management processes which included an assessment of the risks that may potentially arise as a result of the Project. No land use safety risks were identified for the Project through this process.

Waste

The EARs for the Project include a requirement to assess waste – including identification, quantification and classification of the likely waste stream to be generated during installation and operation of the Project in accordance with the EPA Waste Classification Guidelines, and a description of the measures to be implemented to manage, reuse, recycle and safely dispose of waste generated by the Project.

The Project is expected to generate two waste streams being turbine packaging and the old turbine components. The turbine manufacturer and installation contractor have confirmed that all steel turbine components will be recycled where possible. Packaging would be predominantly made up of wooden pallets, packing, dunnage and plastic wrapping material. Packaging would be reused for the dispatch of old turbine components for recycling. All waste would be appropriately recycled or disposed of off-site to licenced waste or recycling facilities. No special wastes would be generated by the Project and as no additional coal would be burnt to achieve the additional energy generation there would be no additional ash requiring disposal.

Water

The EARs include a requirement to assess any potential changes to the existing water supply arrangements for Bayswater as a result of the installation and operation of the Project, including any associated licensing requirements.

The Project does not involve a change in the source, storage, use or treatment of water at Bayswater. There is available capacity within existing infrastructure including pumping and storage and management systems to facilitate the continued operation of Bayswater. The Project does not affect the existing water taking or consuming infrastructure or processes at Bayswater. No new or revised water access licences or water management works approvals are required to facilitate the Project.

Social and Economic

The EARs include a requirement to assess the likely social and economic impacts and benefits of the Project for the Muswellbrook local government area (**LGA**) (including consideration of any increase in demand for local infrastructure and services), the Hunter Region and the State as a whole.

The installation works associated with the Project would have some localised social impacts. These would include minor volumes of additional traffic travelling from the Hunter region to Bayswater and additional demands on local services associated with accommodating approximately 70 additional workers over each outage period for four years. Similar numbers of workers frequently travel to the region to work on specific short-term work projects in the mines and power stations and are readily accommodated. Positive social impacts include the flow-on effects of these workers accessing goods and services in the region.

The long-term effect would be an overall social benefit, through the more efficient and reliable generation of energy and additional peak capacity which contributes to the replacement of energy generation lost as ageing coal power stations in NSW, including Liddell, reach their end of life.

The Project has a calculated capital investment value of $129 million. The vast majority of parts and supplies are to be sourced internationally, as they are not manufactured in Australia. Similarly, AGL Macquarie does not have discretion in the sourcing of labour due to the specialist nature of the installation works and requirements associated with performance guarantees. However, AGL Macquarie understands the sourcing of specialist contracting labour will be from the Hunter and Central Coast regions.

Regional and wider benefits are identified as the provision of access to more reliable and affordable electricity. Local benefits would be limited to these regional benefits and the spending by Project workers on accommodation, food and services.

Conclusion and justification

The Project has been declared to be critical State significant infrastructure and so is to be assessed under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**). This EIS has been prepared to address the EARs issued for the Project and reflects the form and content requirements of the *Environmental Planning and Assessment Regulations 2000*, including consideration of the objectives of the EP&A Act.

The Project as described in the EIS best meets the project objectives and would result in improvements to the environmental performance of the continued operation of Bayswater.

1. Introduction

This Chapter provides an overview of the Project including a summary of the strategic context for the Project with regard to its critical significance for NSW and relevant State and Commonwealth Government policy and an analysis of feasible alternatives to the Project, including the consequences of not carrying out the Project.

1.1 Background

AGL Macquarie owns and operates Bayswater.

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

Bayswater generates electricity using four generating units. AGL Macquarie proposes to replace the turbines within each of the generating units to best ensure the continued safe, reliable and efficient operation of Bayswater until its scheduled closure in 2035 and ensure that all new turbines are fully operational prior to the closure of Liddell in 2022.

1.2 Project Overview

The existing four generating units at Bayswater currently have a 660 MW continuous maximum rating (**CMR**) capacity.

The Project involves the replacement of the turbines in each of these four existing generating units over a four-year period – one generating unit per year. This will increase the CMR capacity from 660 MW to 685 MW for each generating unit. A full description of the Project is provided in Chapter 3.

The Project is essentially a like for like replacement of the ageing turbines with current turbine technology. Since Bayswater was commissioned, there have been improvements in turbine technology which increase the efficiency at which the steam produced in the Bayswater boilers can be converted to electricity. As a result, the Project will have the consequence of increasing the CMR capacity of each generating unit from 660 MW to 685 MW. The increased rated capacity results from efficiency gains only as the proposed replacement turbines are able to convert steam energy from the boilers into mechanical energy more efficiently as a result of the improved and optimised steam paths contained within the selected, modern turbine technology.

Approval is sought for the rated capacity increase as part of the Project.

Specifically, the Project will:

- Increase the CMR of each generating unit from 660 MW to 685 MW;
- Increase the rated output of Bayswater from 2,640 MW to 2,740 MW;
- Achieve additional efficiency improvements estimated at over 4 per cent through the recovery of lost efficiency due to wear and tear since commissioning and as a result of improved turbine technology, with an associated decrease in the greenhouse gas (**GHG**) intensity of Bayswater;
- Have an estimated capital investment value of approximately $129 million over a four-year period; and
- Provide employment for an estimated 70 additional workers over approximately 50 days per year for four years.

Subject to approval being obtained, the Project is proposed to be carried out during planned maintenance outages which are scheduled to commence in February 2019. It is essential that the Project be timed in line with these planned outages to minimise the risk of disruption to NSW's energy security.

All works proposed as part of the Project will be carried out within the existing turbine hall at Bayswater with no change required to the existing impact footprint.

The Project forms part of AGL's *NSW Generation Plan* (AGL, 2017a), which outlines AGL's proposed new investments aimed at replacing the 1,000 MW shortfall identified by the Australian Energy Market Operator (**AEMO**) as being required to supplement Liddell's generation capacity before its closure in 2022. Other investments identified in AGL's *NSW Generation Plan* include a mixture of large-scale renewables, firm gas-peaking power, battery storage and demand response.

The Project is limited in scope to only the replacement of existing turbines. Importantly, the Project does not include any changes to the existing operations at Bayswater which will continue to be managed in accordance with the existing authorisations, including the EPL, as described in Section 1.4.

1.3 Proponent

AGL Macquarie is the owner and operator of Bayswater and is the proponent for the Project. AGL Macquarie currently produces approximately 12 per cent of the electricity needed by consumers in eastern Australia. AGL Macquarie's assets include the 2,640 MW Bayswater Power Station, the 2,000 MW Liddell Power Station and the 50 MW Hunter Valley Gas Turbines. AGL Macquarie acquired these assets from the NSW Government in September 2014.

AGL Macquarie employs approximately 630 people, with most living in the Hunter region. The assets 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 Macquarie is owned by AGL Energy Limited (**AGL**) and forms a key component of the company's generation portfolio. AGL is an integrated energy business that has been operating for more than 180 years and is committed to helping shape a sustainable energy future for Australia. AGL operates the country's largest private electricity generation portfolio, its total capacity of 10,245 MW accounting for 25 per cent of total generation within the NEM in the financial half-year ended 31 December 2017. AGL is also the largest Australian Securities Exchange listed investor in renewable energy, an active participant in gas and electricity wholesale markets and has more than 3.6 million gas and electricity customer accounts.

1.3.1 AGL Policies

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

In the past five years, 12 coal fired power stations have closed in Australia, and whilst some have been mothballed, and their closure anticipated, none were closed with more than one year's notice.

In contrast, AGL has provided advanced notice of its intention to close its coal fired power stations with its strategic approach presented in its *Greenhouse Gas Policy* (AGL, 2015). This policy provides a public commitment that includes:

- Decarbonisation of generation by 2050;
- Improve the GHG 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 Liddell in 2022 and Bayswater in 2035;
- Renewable investment; and

- Constructive engagement on energy and climate policy.

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

In December 2017, AGL announced its *NSW Generation Plan*, which included plans for the retirement of Liddell in 2022, and the resulting changes to its portfolio to assist in meeting the loss of power generation that this would create. The upgrade of the Bayswater turbines to create an additional 100 MW generation capacity was identified in this document as part of the mechanism by which the power formerly generated by Liddell will be replaced.

1.4 Site History

Bayswater is located approximately 16 kilometres (km) south-east of Muswellbrook, 25 km north-west of Singleton, and approximately 165 km west north west of Sydney in NSW.

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

Bayswater includes both main plant areas and ancillary service facilities. The main plant areas and structures include the turbine hall, boilers, cooling towers, fly ash collection plant, chimneys, coal storage area, transformer yard and switchyard. The ancillary service facilities include a cooling water desalination plant, cooling water make-up reservoir, waste water treatment plant, oil storage tanks, workshops, stores, amenities and administration buildings.

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. Bayswater is scheduled for closure in 2035 in accordance with its planned 50 year life and AGL's sustainability policy.

Table 1.1 outlines the key approvals and authorisations which currently apply to Bayswater and outlines the likely interaction of the Project with each of these approvals. In summary, the Project will not impact on, or require any amendment to, any of the existing approvals and authorisations under which Bayswater operates.

Table 1.1 : Key Authorisations and Project Interaction

Authorisation	Likely Interaction with the Project
Bayswater Operations Bayswater was originally approved via development consent 47209 granted by Muswellbrook Shire Council in 1980 (**Bayswater Consent**). The Bayswater Consent authorised the 'development of the proposed Bayswater Power Station as described in the environmental impact statement and supplementary information volume dated June 1979' subject to conditions. The environmental impact statement referenced in the Bayswater Consent contemplate that Bayswater would comprise 'four 660 MW boiler-turbine generating units'.	The Project will, if approved, authorise an increase in the CMR of each generating unit from 660 MW to 685 MW. However, it will not impact on any of the conditions of the Bayswater Consent and no modification to the Bayswater Consent is required to accommodate the Project.
Other Bayswater Planning Approvals A number of other planning approvals have been granted over the life of Bayswater for specific aspects of its operations. The key such planning approvals are summarised below. Each of these planning	The Project will not impact on any of the works authorised under these planning approvals and no modification to any of these planning

Authorisation	Likely Interaction with the Project
approvals are subject to detailed conditions and a number of these planning approvals have been modified throughout the life of Bayswater. Ravensworth South Coal Mine Development consent 86/51 granted by the Minister for Planning for the Ravensworth South Coal Mine, including the rehabilitation of the mine void (now known as void 5). Ravensworth Ash Disposal Project Development consent DA 144/1993 granted by Singleton Council jointly with Muswellbrook Council on 8 December 1993 for the use of the Ravensworth No. 2 Mine Voids (now known as Voids 1 to 4) for the disposal of fly ash to be produced by Bayswater. Ravensworth Ash Disposal Project Development consent DA 138/93 granted on 16 December 1993 granted by Muswellbrook Shire Council for ash transfer and water return infrastructure components that occur within the Muswellbrook Shire Council Local Government Area. Water Treatment Plant Upgrade Part 3A project approval 06_0047 granted on 6 April 2006 by the Minister for Planning for the Bayswater upgrade to improve the water treatment plant performance. Water Pumping Station Upgrade Part 3A project approval 06_0259 granted on 23 May 2007 by the Minister for Planning for the Bayswater water pumping station upgrade to increase water extraction capacity. Pipeline replacement Development consent 2017-12 issued by Muswellbrook Shire Council on 7 April 2017 for pipeline replacement works. New Effluent Drain Sump Development consent 2017-89 issued by Muswellbrook Shire Council on 25 January 2018 for New Effluent Drain Sump.	approvals is required to accommodate the Project.
Shared Infrastructure Planning Approvals A number of further planning approvals have been granted over the life of Bayswater for specific infrastructure which is shared for Bayswater and Liddell. The key shared infrastructure planning approvals are summarised below. Each of these planning approvals are subject to detailed conditions and a number of these planning approvals have been modified throughout the life of Bayswater. Barnard River Water Supply Project Development consent DA 81/42 granted on 18 November 1981 by Scone Shire Council for the Barnard River Water Supply Project. Ravensworth Rail Coal Unloading Facility Development consent DA 20/98 granted on 10 June 1998 by Singleton Shire Council to develop a rail coal unloading facility. Coal/Rail Unloader Augmentation Development consent DA 401/2000 granted on 11 October 2000 by Singleton Shire Council for Coal/Rail Unloader Augmentation.	The Project will not impact on any of the works authorised under these planning approvals and no modification to any of these planning approvals is required to accommodate the Project.

Authorisation	Likely Interaction with the Project
Rail Unloader Upgrade Development consent DA 460/2001 granted on 21 October 2001 by Singleton Shire Council for the Ravensworth Rail Unloader Upgrade. Rail Sidings and Associated Facilities Development consent DA 223/2004 dated 9 August 2004 granted by Singleton Shire Council for the construction of 4 rail sidings and associated facilities. Antiene Coal Unloader Development consent DA 50-3-2005 granted on 7 November 2005 by the Minister for Planning for the construction and operation of a Rail Coal Unloader and associated infrastructure at Antiene. Subdivision Development consent DA 148/2011 dated 21 July 2011 for the consolidation and subdivision of 13 Lots in 2 Stages.	
Bayswater B Concept Approval In June 2009, Macquarie Generation submitted a concept plan application for a proposed development of Bayswater B Power Station, totalling a maximum generating capacity of 2,000 MW. A concept plan approval was subsequently granted in 2010. This concept plan approval authorises a concept only and a separate planning application would need to be made and approved prior to the development and operation of Bayswater B.	Nil. AGL Macquarie has no current plans to develop a coal or gas fired power station at this site. The concept plan approval will lapse on 12 January 2020.
EPL 779 Bayswater operates under EPL 799 issued by the Environment Protection Authority (**EPA**) under the *Protection of the Environment Operations Act 1997* (NSW) (**POEO Act**). The EPL was last varied by the EPA on 7 September 2017. The EPL authorises the carrying out of the 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 EPL contains detailed conditions which: • Limit and regulate discharges to air from Bayswater including imposing emission limits for key air emissions resulting from Bayswater's operations; • Limit and regulate discharges to water from Bayswater including imposing discharge limits; • Impose monitoring requirements (including for both air and water discharges); • Impose general operating conditions; • Impose reporting requirements; and • Require the carrying out of pollution studies and environmental improvement projects.	The Project will not result in any change being made to the scheduled activities authorised by the EPL. The Project will not require any changes to any of the conditions of the EPL, including any of the air or water discharge limits which apply under the EPL.
Mining Leases Mining lease 1484 and 1485 regulated under the *Mining Act 1992* (NSW) continue to apply to the former Ravensworth South Coal Mine	The Project will not impact on any of the activities authorised under these mining leases and no modification to

Authorisation	Likely Interaction with the Project
and the Ravensworth No 2 Mine sites which are currently being rehabilitated using ash from Bayswater.	these mining leases is required to accommodate the Project.
Water Access Licences and Water Management Work Approvals A number of water access licences and combined water supply and use approvals are held under the *Water Management Act 2000* (NSW) to authorise the extraction and use of the water required for Bayswater.	The Project will not result in any change to the volume or source of the water required for Bayswater and no modification is required to any of the water access licences or approvals to accommodate the Project.

AGL Macquarie acknowledges that Bayswater is regulated under a large number of planning approvals. Separately to this Project, AGL Macquarie is undertaking a detailed review of its existing planning approvals that takes into account potential future operational requirements and will seek to consolidate relevant approvals, where practicable as part of future approval applications made following this detailed review. In the meantime:

- Any State significant infrastructure planning approval granted for the Project under Part 5, Division 5.2 of the EP&A Act will regulate the carrying out of the Project only. The ongoing operation of Bayswater will continue to be regulated by the existing planning approvals and licenses described in Table 1.1 above.

- In particular, the EPL will continue to regulate operational impacts from Bayswater, including by setting limits on air and water emissions. The EPL is regularly reviewed and updated by the EPA, with the most recent amendments to the EPL having being made on by the EPA on 7 September 2017; and

- AGL recognises the increasing expectations of all levels of government and surrounding communities for appropriate site rehabilitation that successfully supports future land uses. Accordingly, AGL has committed to rehabilitating Bayswater following its planned end of life in 2035 in accordance with the *AGL Rehabilitation Report* (AGL, 2017c).

1.5 Project Need and Objectives

Bayswater was commissioned in 1985 and has a current technical life, established by Macquarie Generation prior to AGL Macquarie acquiring the site, up to 2035. AGL Macquarie's asset strategy and remnant life study has identified that the existing turbines require replacement to achieve this planned technical life as the turbines would otherwise need substantial ongoing maintenance and may ultimately degrade beyond repair. Replacement of the turbines would improve the safety, reliability and efficiency of operations and remove the risk of a turbine catastrophic failure occurring prior to planned operational closure in 2035.

AGL will close Liddell in 2022 in accordance with its planned operational end of life and provided public notice of this intention in April 2015 to avoid any volatility in the NEM. 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* to replace the generation capacity of Liddell. The Project forms a critical part of the *NSW Generation Plan* to ensure the ongoing security and reliability of energy supply.

AGL Macquarie has identified that there is a need to:

- Enable Bayswater to continue to safely and reliably meet the market demand for baseload power until its scheduled closure in 2035; and

- Contribute to addressing the identified shortfall in power generation following the scheduled closure of Liddell in 2022.

The Project will achieve these objectives by replacing the ageing turbines to ensure safe, reliable and cost-effective operations can continue at Bayswater and to contribute to addressing the identified power generation shortfall following the scheduled closure of Liddell in 2022.

The replacement of the ageing turbines within the existing generating units will increase the generation capacity at Bayswater and improve security of supply, through improved availability and reliability. This will help contribute to the continuity of energy supply to NSW during periods of maximum hourly and daily demand and will enable Bayswater to operate with reduced unplanned outages until its scheduled closure in 2035.

1.6 Strategic context

The Project has been declared by the Minister for Planning to be critical State significant infrastructure under Division 5.2 of the EP&A Act.

The Project will increase the capacity, reliability and efficiency of Bayswater, delivering greater energy security for NSW. This will create and sustain flow-on economic and social benefits for NSW by providing employment opportunities for the region as well as strong and solid investment into regional NSW.

The Project is considered to be essential to NSW for the following economic and social reasons:

- The Project would improve security of supply, and contribute to continuity of energy supply to the State during periods of maximum hourly and daily demand;
- The Project would reduce operating risk profile and improve reliability of Bayswater enabling it to continue operating with decreased unplanned outages until its scheduled closure in 2035;
- With energy security being a critical issue for the State and Australia, particularly post the closure of Liddell in 2022, the Project would create additional capacity of 100 MW; and
- The Project would sustain about 70 jobs during each outage period over four years with workers accommodated in the Project locality with flow-on effects to the local economy.

1.6.1 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; and
- Make provisions for financing the commitments beyond 2020.

In response to this challenge, Australia has committed to reduce emissions to 26-28 per cent of the 2005 levels by 2030.

1.6.2 Australian Government Policy

The Australian Government's current policy to reduce emissions is the Direct Action Plan, which aims to focus on sourcing low cost emission reductions. The Direct Action Plan includes an Emissions Reduction Fund (**ERF**). Legislation to implement the ERF came into effect on 13 December 2014. Emissions reduction and sequestration methodologies are available under the ERF which provide the opportunity to earn carbon credits as a result of emissions reduction activities. Whilst there is a method related to 'Industrial Electricity and Fuel Efficiency', this is not applicable to electricity generators over 30 MW.

1.6.3 National Electricity Market

The NEM is a wholesale energy market through which energy generators and retailers trade electricity. The NEM interconnects the six eastern and southern states and territories and delivers around 80 per cent of all electricity consumption in Australia. As recognised by the Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future, (Commonwealth of Australia, 2017):

> *"The NEM is being transformed from a 20th century grid dominated by large-scale, fossil fuel-fired synchronous generators into a 21st century grid. New and emerging generation, storage and demand management technologies are being connected into a system that was not designed for them. Older generators are reaching the end of their life, becoming less reliable and closing. These changes are placing pressure on the NEM".*

The Final report from the Energy Security Taskforce, prepared by the NSW Chief Scientist & Engineer and released on 19 December 2017, confirmed that "the electricity system is in a period of transition, innovation and reform" and "identified a series of risks and emerging issues for NSW" (Energy Security Taskforce, 2017). The Energy Security Taskforce (2017) identified that maintaining sufficient generation to meet demand at any given time, plus a margin for contingencies was one of the four key elements essential for reliable electricity supply. While instances of unserved energy have been rare, there are indicators that the supply and demand balance is tightening and new risks are emerging, particularly with the failure of large generation plant or extreme weather events.

As the Energy Security Taskforce (2017) recognises:

- No power station can operate at its maximum capacity all the time due to outages and maintenance, and their capacity to do so tends to degrade somewhat over time; and
- The Project, which the Energy Security Taskforce Final Report refers to as the "efficiency upgrade at Bayswater", will increase the capacity, reliability and efficiency of Bayswater, delivering greater energy security for NSW.

The AEMO identified in its *Electricity Statement of Opportunities* (2017) that there will be a 1,000 MW generation gap following the closure of Liddell in 2022. This is not only relevant for NSW, but due to limited interconnector capacity, the AEMO report recognised that it has NEM wide impacts.

On 16 March 2018, AEMO advised the Commonwealth Government that if all three stages of proposed investment outlined in AGL's *NSW Generation Plan* are completed, the generation gap will be eliminated.

The *NSW Generation Plan* also aligns with the national energy guarantee (NEG), which AEMO has agreed will encourage competitive markets and produce the best outcome for consumers.

1.6.4 Proposed National Energy Guarantee

In response to the Independent Review into the Future Security of the National Electricity Market (Commonwealth of Australia, 2017) the Energy Security Board (**ESB**) provided the Council of Australian Governments (**COAG**) Energy Council with advice on changes to the NEM and legislative framework as follows:

> *"The proposed national energy guarantee aims to support the provision of reliable, secure and affordable electricity with a focus on ensuring:*
>
> - *the reliability of the system is maintained*
> - *electricity sector emissions reductions needed to meet Australia's international commitments are achieved*
> - *the above objectives are met at the lowest overall costs.*

The NEG is a way to encourage new investment in clean and low emissions technologies while allowing the electricity system to continue to operate reliably" (ESB, 2017).

Details as to how the NEG will function are currently being determined but it is anticipated that retailers will be required to contract with or invest in generators or demand response to meet a minimum level of dispatchable 'on demand' electricity while also keeping their emissions below an agreed level.

Bayswater currently supplies dispatchable electricity into the NEM. The Project is focused on improving the reliability of Bayswater through to its scheduled closure in 2035. The Project has been determined by AGL Macquarie as being the best option to ensure Bayswater remains as reliable and efficient as possible while also contributing to the replacement of a portion of the generation capacity lost through the closure of Liddell while also reducing emissions intensity and total emissions. As such, the Project is consistent with the key proposed objectives of the NEG.

1.6.5 NSW Government Policy

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

In September 2013, the NSW Government released the *NSW Renewable Energy Action Plan* to guide NSW's renewable energy development and to support the former national target of 20 per cent renewable energy by 2020. The NSW Government's vision is for a secure, reliable, affordable and clean energy future for the State. The *NSW Renewable Energy Action Plan* positions the State to increase energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW.

The *NSW Renewable Energy Action Plan* strategy is to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in NSW. The plan details three goals and 24 actions to most efficiently grow renewable energy generation in NSW:

- Attract renewable energy investment and projects;
- Build community support for renewable energy; and
- Attract and grow expertise in renewable energy technology.

The *NSW Government Submission to the Review of the Renewable Energy Target* (NSW Government, 2014) confirmed the NSW Government's commitment to promoting energy security through diversity, particularly through increasing the supply of energy from renewable sources. It identifies that having a diversity of supply can help to protect energy customers from price sensitivity associated with fuel inputs, such as gas prices.

AGL has a clearly articulated plan to achieve decarbonisation of generation by 2050 (refer to Section 1.3.1), wholly aligned with the *NSW Climate Change Policy Framework*. The Project is a key component of AGL's plans to manage the transition to decarbonisation and net-zero emissions by 2035 while responding to the requirements of the market in relation to reliable and affordable electricity.

1.6.6 Hunter Regional Plan 2036

The *Hunter Regional Plan 2036* (NSW DP&E, 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.

The overall 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 for

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 scheduled closure of Liddell means significant local energy generation will be withdrawn from the area. The upgrade of Bayswater is one of AGL's responses aimed at off-setting this loss of generating capacity in the region by providing an additional 100 MW capacity.

1.6.7 Muswellbrook Shire Council

The *Muswellbrook Shire Council Community Strategic Plan 2017-2027* (Muswellbrook Shire Council, 2017) outlines the community's main priorities and visions 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 70 additional workers for approximately 50 days per year for four years and by facilitating the ongoing operation of Bayswater until 2035.

Supporting Commonwealth and State initiatives to reduce the human impact on climate change is a goal for the Strategic Plan. In particular, improved air quality was identified by the community as important. The Project is limited to the replacement of the turbines and does not include any other works to any other aspects of Bayswater. However, the Project would result in a slight reduction in emissions and would improve greenhouse gas emissions intensity of Bayswater.

1.6.8 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. Reduced emissions and improved greenhouse gas emissions intensity from the Project would support the achievement of this outcome.

1.7 Feasible Alternatives

AGL Macquarie has reviewed options regarding the existing turbines to ensure they best ensure the continued safe, reliable and efficient operation of Bayswater until its planned closure. Five options, as well as their risks, benefits and costs, were assessed. These options are discussed below.

1.7.1 Do Nothing

AGL Macquarie has undertaken a remnant life study which found that the existing turbines would need significant ongoing maintenance, and it was identified as almost certain that one or more of the turbines would need replacing prior to 2035. This was the case even if a further overhaul of all turbines were to occur prior to 2022 and a subsequent major overhaul in a further 12 years. "Do Nothing" is therefore not considered a viable option as it risks almost certain failure of some turbine components prior to 2035, resulting in decreased reliability, lost generation, lost capacity, and significant repair costs.

It is also understood that the existing turbines have decreased in efficiency overtime due to wear and tear since they were commissioned in the 1980's. As such, the "Do Nothing" option would also represent a continuation of

less efficient use of coal at Bayswater resulting in greater emissions and ash generation at any operating capacity than would be the case if such efficiency degradations were restored by replacing the turbines.

In order to identify the change requiring assessment in the EIS, a “Do Nothing” scenario has been modelled as including a major overhaul of all turbines prior to 2020 and a subsequent major overhaul in a further 12 years in accordance with the experience of the wider NSW Power Stations experience with continued degradation and partial recovery post overhaul out to 2035.

1.7.2 Capacity 685 (the Project)

The Project, which is assessed in this EIS, was originally considered by AGL as "Capacity 685". The Project would increase capacity and deliver improved efficiency resulting in less coal consumed to generate 685 MW when compared to the modelled do nothing scenario. It would also virtually eliminate the risk that a turbine failure would occur before 2035.

This option would replace the high pressure (**HP**), intermediate pressure (**IP**), and low pressure (**LP**) turbines within each of the four generating units. This option was identified as allowing the generating units to run at 660 MW on reduced coal consumption, or at up to the 685 MW rated capacity at the same coal consumption as the current turbines under the do nothing scenario.

Key benefits include:

- Increased capacity to respond to identified generation shortfalls post 2022;
- Improved efficiency;
- Improved reliability of the turbine plant;
- Avoidance of unplanned outages as a result of turbine issues; and
- Reduced operating risk through replacing life-limited components.

Modelling undertaken as part of the EIS has identified that the Project is estimated to result in an overall 4 per cent efficiency improvement at Bayswater immediately following commissioning of the new turbines. Over time, this is expected to reduce to a 3.5 per cent improvement towards the end of operations in 2035 as the new turbines degrade. Based on assumed operation of Bayswater until 2035, this option would result in an additional 500,000 MWh of electricity generation per year with no additional greenhouse gas or air emissions.

1.7.3 Base Case 660

The Base Case 660 option would virtually eliminate the risk that a turbine failure will occur before 2035 by replacing only life limited components of each generating unit but would not increase the overall capacity of the units, or deliver the same efficiency gains as the Capacity 685 option. While this option would cost less than the Capacity 685 option (being the Project) and result in improved reliability, it would involve similar installation works and not contribute to addressing the identified generation shortfall after the closure of Liddell. Accordingly, it was not considered suitable.

1.7.4 Efficiency 660

This option would not increase capacity but it would deliver improved efficiency resulting in less coal consumed for the same rated output. It would also virtually eliminate the risk of a turbine failure occurring before 2035.

This option would replace the same components as the preferred Capacity 685 option (being the Project). The turbine blade design would be optimised for 660 MW output which would slightly improve efficiency and total emission profile over the Capacity 685 option, however the maximum output would be compromised. Given one of the key objectives of the Project is aimed at addressing identified generation shortfall post 2022, the

increased capacity with no additional coal consumption provided by the Capacity 685 option is preferred to the small additional efficiency gain that this Efficiency 660 option could achieve.

1.7.5 Upgrade 750

This option would replace and upgrade the HP, IP, and LP turbines. This option would increase capacity to 750 MW per generating unit. Substantial works would be required to much of the non-turbine plant to match it with the new capability of the turbines. This additional scope of works would introduce a risk that items designed and built for a 660 MW unit would fail or require additional maintenance under the stress of running at 750 MW. Given this risk the Upgrade 750 option was not considered any further.

1.7.6 Preferred option

The Capacity 685 option, the Project, is the preferred option as it meets the key objectives with minimal environmental impacts and delivers the key benefits to NSW outlined in this EIS.

1.8 Environmental Assessment Requirements

The EIS has been prepared to respond to the EARs issued for the Project by the DP&E. The table below identifies each of the EARs along with cross reference to the location in the EIS where each requirement has been addressed. The EARs and agency input letters are provided as Appendix A.

Requirement	Location
General Requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000. In particular, the EIS must include, but not necessarily be limited to, the following:	This EIS
• an executive summary;	Executive Summary
• a full description of the development, including: - all components, materials activities and processes required to construct and operate the proposed upgrade - any ancillary development or changes to the existing operations at the Bayswater Power Station;	Section 3
• a summary of the strategic context for the Project with regard to its critical significance for NSW and relevant State and Commonwealth Government policy;	Section 1.6
• an analysis of feasible alternatives to the Project (and its key components), including the consequences of not carrying out the project;	Section 1.7
• the likely interactions between the Project and any other existing, approved or proposed development on the site or in the vicinity of the site;	Chapter 2
• 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 all relevant environmental planning instruments;	Chapter 4

Requirement	Location
- 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;	
• an assessment of the likely impacts of the Project on the biophysical and socio-economic environment, focusing on the specific issues identified below, including: - a description of the existing environment likely to be affected by the project; - an assessment of the potential impacts of the Project, including any cumulative impacts associated with existing, approved and proposed developments in the region; and - a description of how the Project has been designed to avoid and minimise impacts;	Chapters 6 to 10
• 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 the Bayswater Power Station;	Chapter 12
• an evaluation of the Project having regard to: - relevant matters for consideration under the EP&A Act including ecologically sustainable development; - the strategic need for the Project having regard to energy security and reliability in NSW and the broader National Electricity Market; and - the biophysical, economic and social costs and benefits of the project;	Chapter 13
• relevant Project plans, maps, and diagrams in an appropriate electronic format.	Figure 2.1, Figure 2.2, Figure 2.3, and Figure 2.4.
While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the assessment of this Project.	Noted
Key Issues	
The level of assessment of likely impacts should be commensurate with the significance or degree or extent of impact within the context of the proposed location and surrounding environment, and having regard to applicable NSW Government policies and guidelines. In particular, the EIS must address the following matters:	Noted

Requirement	Location
Air quality – including an assessment of any potential changes to the air emissions (including greenhouse gas emissions) at the Bayswater Power Station as a result of the construction and operation of the Project;	Chapter 7 for Greenhouse Gas Chapter 8 for Air Quality
Noise and Vibration– including an assessment of any potential changes to the noise and vibration impacts of the Bayswater Power Station during the construction and operation of the Project;	Section 10.1
Traffic and Transport – including - details of the number, frequency and type of construction related vehicles, key transport routes, and proposed site access and parking arrangements; - an assessment of the likely traffic and transport impacts during the construction of the project on the capacity, condition, safety and efficiency of the road network, including key intersections; and - a description of the measures that would be implemented to manage and mitigate any impacts, including any proposed road or intersection upgrades developed in consultation with the relevant road authorities (if required);	Chapter 9
Land Use Safety – including a preliminary risk screening completed in accordance with Hazardous and Offensive Development Application Guidelines - Applying SEPP 33. Should the screening indicate that the Project is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis;	Section 10.2
Waste – including identification, quantification and classification of the likely waste stream to be generated during construction and operation of the project in accordance with the EPA Waste Classification Guidelines, and a description of the measures to be implemented to manage, reuse, recycle and safely dispose of waste generated by the Project;	Section 10.3
Water – including an assessment of any potential changes to the existing water supply arrangements for the Bayswater Power Station as a result of the construction and operation of the Project, including any associated licensing requirements; and	Section 10.4
Social and Economic – including an assessment of any potential changes to the existing water supply arrangements for the Bayswater Power Station as a result of the construction and operation of the Project, including any associated licensing requirements; and	Chapter 11
Consultation	
During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. The EIS must describe the consultation process and the issues raised, and identify how these issues have been considered and addressed.	Chapter 5
If you do not lodge the EIS for the Project within 2 years of the issue date of these assessment requirements, you must consult further with the Secretary in relation to the preparation of the EIS.	Noted

2. Project setting

This Chapter describes the likely interactions between the Project and any other existing, approved or proposed development on the site or in the vicinity of the site.

2.1 Site Description

Bayswater is located approximately 16 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 Macquarie landholding is approximately 10,000 hectares, including Liddell, the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands.

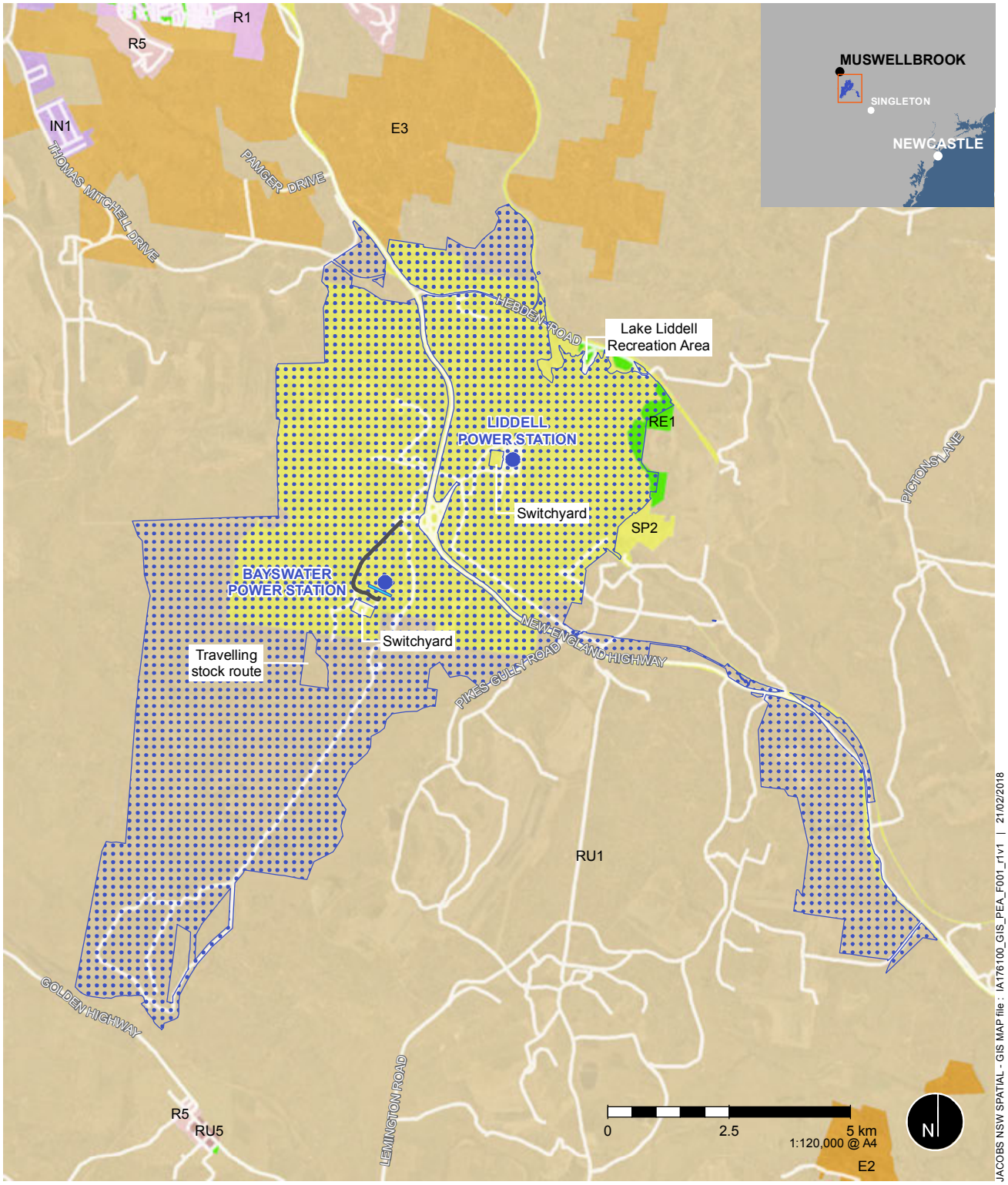
Bayswater's operational area occupies approximately 300 hectares, which includes the Pikes Gully Ash Dam. The location of Bayswater is shown in Figure 2.1.

The Project will be carried out within the existing turbine hall located at Bayswater. The turbine hall, houses the four generating units containing the existing turbines proposed to be replaced. The turbine hall is a 38-metre-high, enclosed structure covering approximately 1.3 hectares. The turbine hall is located on Lot 2 DP327372 and Lot 2 DP1095515 within the Muswellbrook Local Government Area (LGA) to the west of the New England Highway as illustrated in Figure 2.2.

Bayswater includes both main plant areas and ancillary service facilities. The main plant areas and structures include the turbine hall, boilers, cooling towers, fly ash collection plant, chimneys, coal storage area, transformer yard and switchyard. The ancillary service facilities include a cooling water desalination plant, cooling water make-up reservoir, waste water treatment plant, oil storage tanks, workshops, stores, amenities and administration buildings. The location of the key existing infrastructure at Bayswater is set out in Figure 2.3.

Bayswater was built to utility standards of the time and has a current technical life up to 2035. Bayswater is now over 30 years old and as part of the mid-life refurbishment program, AGL Macquarie has identified that the Project is required to ensure that the continued safe, reliable and efficient operation of Bayswater until its planned closure.

Coal consumption and emissions at Bayswater vary in response to demand for energy. Operations are carried out in accordance with existing authorisations outlined in section 1.4 including the EPL. No changes to the existing approved operations at Bayswater are proposed other than the increase in capacity as described in Chapter 3. Specifically, no other upgrades or changes to Bayswater are required or proposed as part of the Project.



Legend

Turbine hall / upgrade works area — Upgrade works access — Power station — AGL owned land

LEP land zoning (DPE)

E2	Environmental Conservation	R1	General Residential	RU1	Primary Production
E3	Environmental Management	R5	Large Lot Residential	RU5	Village
IN1	General Industrial	RE1	Public Recreation	SP2	Infrastructure

Figure 2.1 | Land tenure and land use context

Figure 2.2 | Upgrade works area

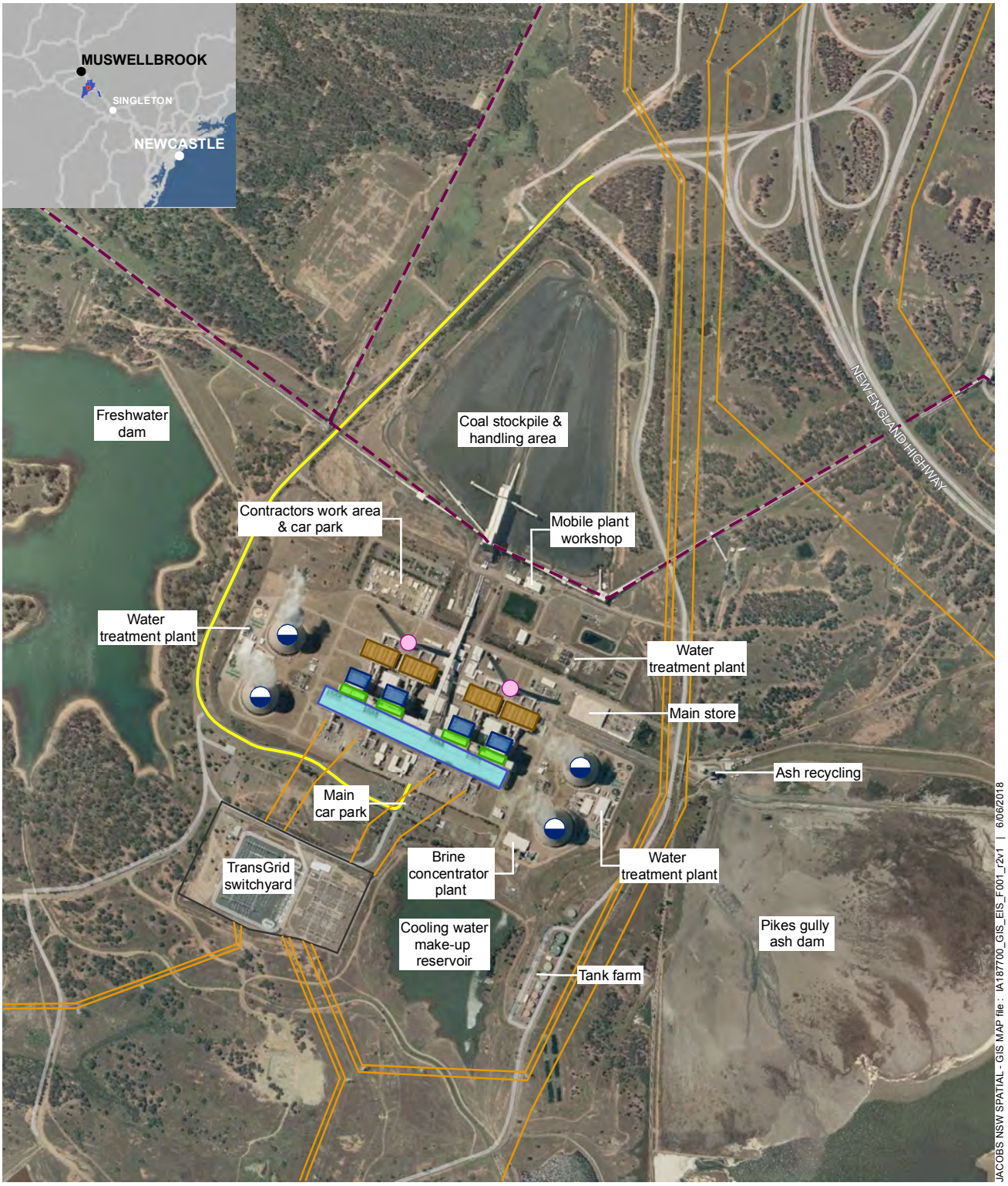


Figure 2.3 | Existing Bayswater infrastructure

2.2 Existing Operations

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

- Coal is received and stored on site;
- Coal is transferred from the storage area to the coal bunker by conveyor and is finely ground before being burned in the boiler furnace producing:
  - Heat for the boiler;
  - Incombustible coal residue, in the form of furnace ash and fly ash, which is collected and transported to ash disposal areas; and
  - Hot gases generated from the combustion of the coal in the furnace, discharged via the fly ash collection plant through tall stacks which are continuously monitored.
- 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;
- Each of the generating units consists of four turbines arranged in tandem that drives a generator. The four turbines consist of one single flow HP turbine, one dual-flow IP turbine and two dual-flow LP turbines;
- Once within the generating units, the high pressure steam is expanded through stages of fixed and rotating blades within the HP turbine before being reheated and expanded through the IP and LP turbines. The turbines drive the generator rotor which produces electricity;
- Steam exiting the turbine train is condensed to water and returned to the boiler with the addition of any purified water necessary to make up for losses;
- Heat rejected in the condenser is carried away by the circulating water system and dissipated in the natural draught cooling towers; and
- The electricity produced by the generator is transformed to system voltage and fed to the interconnected transmission system via the station switchyard.

2.3 Other Bayswater Activities

As part of the ongoing operation of Bayswater, AGL Macquarie has also recently obtained modification to the Part 3A project approval for the water treatment plant so as to authorise further upgrades. In addition, it has identified other necessary maintenance works and opportunities to improve environmental performance, reliability, efficiency and safety of Bayswater (**Other Bayswater Activities**).

In addition, work has been commenced to identify the opportunities which will arise once Liddell reaches its planned end of life in 2022 and the Liddell site is repurposed (**Liddell Closure and Re-Purposing**).

The Other Bayswater Activities and the Liddell Closure and Re-Purposing do not form part of the Project, which has been declared to be a critical State significant infrastructure project under Part 5, Division 5.2 of the EP&A Act.

Where further planning approvals are required to authorise any of the current Other Bayswater Activities and the Liddell Closure and Re-Purposing then separate planning applications will be made which will fully assess these activities and all required planning approvals will be obtained prior to any activities commencing. In addition to the current Other Bayswater Activities and the Liddell Closure and Re-Purposing, AGL is also undertaking a broader review of its existing planning approvals with the aim, where practicable, of consolidating these.

Table 2.1 outlines the currently proposed Other Bayswater Activities and the work being undertaken as part of the Liddell Closure and Re-Purposing and confirms that these are proposed separately to, and outlines the extent of interaction with the carrying out of the Project.

Table 2.1 : Other Bayswater Activities, and Liddell Closure and Re-Purposing

Works	Likely Interaction
Other Bayswater Activities Bayswater will continue to operate during the Project with the exception of the outage for one generating unit. During this outage, other maintenance works will be undertaken including: • Cooling tower re-packing; • Generator Stator rewind; and • Installation of a Distributed Control System (**DCS**). These works are being undertaken as part of AGL Macquarie's ongoing mid-life refurbishment of Bayswater which commenced in 2017. <u>Cooling Tower</u> The concrete natural draught cooling towers provide cooling for the condensers of the turbo-generator units at Bayswater. The towers were commissioned in 1985. The cooling tower re-packing was initiated in FY17 to deliver the following key objectives: • To ensure the serviceable life of the respective cooling tower pack and sprayer systems to provide reliable cooling operation until 2035; • To recover performance degradation caused by defects and fouling and return the thermal capability of the cooling tower to meet or exceed the original design conditions; and • Improve safe access to inspect and maintain Cooling Tower packing and water spraying systems. <u>Generator Stator Rewind</u> The Generator stator has been operated for over 30 years and is exhibiting signs of degradation of the stator bar insulation as well as other defects. These works involve in-situ rewinding of the stator to improve efficiency and ensure ongoing reliability of the Generator. <u>Distributed Control System</u> AGL Macquarie has commenced works to install a DCS at Bayswater. A DCS is a semi-automated system that monitors, controls and instructs the various parts of a power station, to help manage efficient performance and operation. Installation of the DCS started in September 2017 and is being completed during successive planned unit outages until late 2019.	Works to cooling towers, boiler air heater and Distributed Control System (DCS) upgrade would be undertaken during shut-downs and coincide with the Project installation works. AGL anticipate that these works would result in minor efficiency gains resulting in improved coal to energy generation ratio. This improvement would not be quantifiable until post upgrade. Traffic associated with these mid-life refurbishment works has been included in the traffic model for the Project as it is planned to be consistent with the outage works being undertaken during traffic counts for the Project. Typical noise impacts from these proposed shut-down works have also been considered as part of the noise assessment for the Project.
Water Treatment Plant Modification 2 Modification 2 was recently approved to Part 3A project approval 06_0047. This modification authorises further upgrades to the existing Bayswater Power Station Water	A maximum workforce of up to 30 personnel would be required during construction for this proposed modification. It is anticipated the proposed

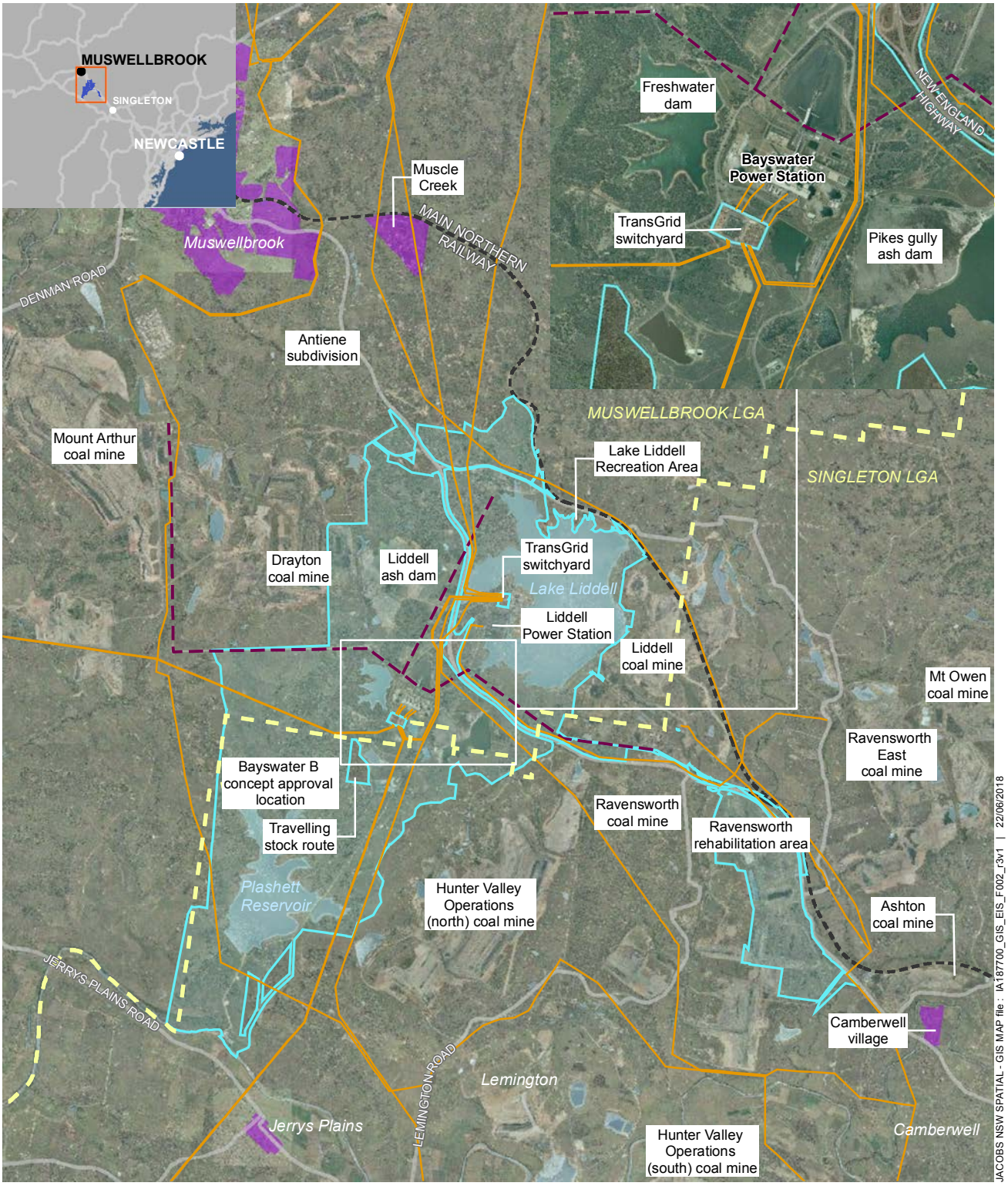
Treatment Plant (**WTP**). The objective of the upgrade is to improve the capacity of the WTP to remove salts from cooling water, and provide for a more efficient process to dispose of salt wastes generated by this process. The approved modification includes the following key components: • Construction 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 BCDB, with an overflow into the main Brine Concentrator Decant Basin cell; and • Construction of a salt caking plant and temporary storage area for conversion of concentrated brine from the Brine Concentrator into a solid waste cake.	modification would take approximately 18 months to construct. Some works may coincide with the Project and as such traffic and noise interactions may eventuate. Noise from the modification was identified as not being likely to be noticeable as separate to the ongoing operation of Bayswater. The traffic impact assessment for the Project identifies that the intersection is capable of accommodating the overlap in traffic.
Liddell Closure and Repurposing AGL has announced the closure of Liddell in 2022 in accordance with its operational end of life-cycle and provided public notice of this intention in April 2015 to avoid any volatility in the NEM. Following the receipt and thorough assessment of an unsolicited offer to purchase Liddell, AGL has reaffirmed its decision to close Liddell in December 2022 and will continue progressing its NSW Generation Plan, which includes repurposing Liddell. The closure of Liddell would result in a significant reduction in emissions (air and noise) in the Hunter region, improved air quality, significantly reducing AGL's generation portfolio greenhouse gas intensity and reducing greenhouse gas emissions generally.	Any demolition or repurposing of Liddell would be subject to assessment and approval requirements under the EP&A Act. As these works would not commence prior to completion of the Project there are no interactions in relation to traffic or noise impacts.

2.4 Surrounding Land-Uses

Existing development neighbouring Bayswater includes Liddell, the Drayton and Liddell 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 station. Agricultural clearing for the purposes of grazing is also present within and surrounding the AGL Macquarie landholding. The closest residential area is the Antiene subdivision, which is located behind a ridge line approximately 5 kilometres north of the Project. A single dwelling is located 2.8 kilometres from the turbine hall to the north west and behind a ridge line. The surrounding land-use context is illustrated in Figure 2.4.

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.

A review of the DP&E Major Projects website indicates that there are no third party projects in the surrounding lands that would interact with the Project in a manner likely to lead to any cumulative impacts.



Legend

- AGL owned land
- LGA
- Coal supply conveyor
- Residential zoned land
- Transmission line
- Railway
- Road

0 2.5 5 km
1:150,000 @ A4

N

Data sources

Imagery © Department of Finance, Services & Innovation 2017
NSW Dep. of Planning and Environment

Figure 2.4 | Surrounding land-use context

3. Project Description

This Chapter provides the full description of the Project, including all components, materials activities and processes required to construct and operate the proposed upgrade, including any ancillary development or changes to the existing operations at the Bayswater Power Station;

3.1 Project Summary

The Project consists of the works to replace the four turbines in each of the four generating units, with modern, efficient and higher rated capacity turbines. This will result in each generating unit's rated capacity increasing by 25 MW to 685 MW and the overall rated capacity of Bayswater increasing from 2,640 MW to 2,740 MW.

The increased rated capacity results from the more efficient conversion of steam energy into mechanical energy provided by the improved and optimised steam paths within the selected, modern turbine technology. Improved technology includes:

- **Improved turbine blading and seal design** - New rotating and fixed blades using advanced blade design to minimise frictional losses on the blade profiles. The newer blade designs are able to extract additional energy out of the steam, thereby improving the turbine efficiency;

- **Extra turbine stages** - The steam in a turbine is expanded in mutiple stages, with each stage consisting of a fixed set of blades, and a rotating set of blades. The new turbines include additional stages which will improve the expansion efficiency allowing more more work to be done by steam in each turbine; and

- **Replacement of liners and seals to reduce steam leakage** - Steam which leaks around the blades, does not complete useful work on the blades. Newer seal designs which minimise this leakage, and guide the steam to expand through the blades, allow for an increase in the efficiency of the turbine.

Once replaced, the turbines will continue to be operated and maintained as required. It is noted that coal input is not expected to increase from current throughput under current assumptions of how Bayswater will be operated until closure. The new turbines at year of opening are expected to need less steam power from the boilers to generate at the 685 MW rated capacity per unit than the pre-upgrade turbines require to generate at the 660 MW rated capacity. Therefore, coal consumption will decrease. As the performance of turbines degrades, steam requirements are expected to increase over time to continue to achieve the rated capacity. This is the case both under existing operations and with the completion of the Project. Under current assumptions as to how Bayswater will operate in the future, total coal consumption and emissions will decrease slightly as a result of the Project, with the boilers required to produce less steam than under existing operations and the 'do nothing' future operations scenario as described in Section 1.7.1.

The Project is scheduled to commence in February 2019 to coincide with the first planned major outage in a four-year major outage program that would see one turbine replaced each year, prior to the closure of Liddell in 2022. It is critical that the Project be timed in line with these planned outages to minimise the risk of disruption to NSW's energy security.

No changes are proposed to the existing approved operation of any other component of Bayswater as part of the Project. In particular, coal consumption, air and noise emissions, water consumption and ash generation will not increase as a result of the Project and will continue to vary as the operation of Bayswater responds to market demand. The Project will enable this continued variation in the overall operating level of Bayswater to occur at a more efficient level than possible in absence of the Project.

3.2 Turbines Installation Works

Turbine components within each of the four generating units are currently maintained on a 12-yearly basis. This involves the removal of turbine casing, inspection and maintenance of turbine components and reassembly. The Project involves the replacement of the HP, IP and LP turbines instead of the scheduled turbine inspection and maintenance activities. The Project would be completed during current planned maintenance outages of each

generator unit, with replacement of turbines in one generating unit occurring each year over a four-year period, commencing in February 2019.

The Project would involve the following:

- Approximately 10 heavy load deliveries from the Port of Newcastle to Bayswater and an expected 27 standard shipping container deliveries from Port Botany to Bayswater in advance of each shut-down over a four-year period;
- All deliveries would be to the existing loading bay within the Bayswater turbine hall using existing established access roads, with turbine components being lifted to the turbine floor by existing cranes located within the turbine hall;
- Turbine installation works would be undertaken over an expected 50 days per year within each scheduled 72-day maintenance shutdown period to avoid any unnecessary loss of availability;
- Turbine installation works would be limited to one generating unit per year to minimise loss of overall generating capacity at any one time;
- Approximately 70 additional workers to be accommodated in the Hunter region and attending site over the scheduled 50-day period within the shutdown period;
- The turbine replacement works would require the removal of the turbine casings, the extraction of HP, IP and LP turbines, the replacement of these with new HP, IP and LP turbines and reinstatement of the existing turbine casings; and
- Categorisation and management of waste, including off-site recycling of steel components of old turbines, reuse of packaging materials for offsite-transport of old turbines where practicable and off-site disposal of other wastes in accordance with existing waste management processes.

Other planned maintenance works, consistent with the existing approved operations at Bayswater will also be undertaken during the outages as described in Section 2.3. These maintenance works do not form part of the Project. However, where necessary to ensure full assessment of cumulative impacts, these maintenance activities have been considered and assessed.

With the exception of the turbine deliveries and the dispatch of waste, all installation activities associated with the Project would be contained within the fully enclosed turbine hall. No additional laydown areas, access upgrades, parking areas, temporary or permanent structures or clearing would be required to facilitate the Project.

3.2.1 Installation Works Hours

The Project is scheduled to commence in February 2019 to coincide with the first planned major outage in a four-year major outage program that would see one turbine replaced each year, prior to the closure of Liddell in 2022. Works will commence with the delivery of turbine components to Bayswater during February each year in advance of the shut-down scheduled to commence in March each year (2019 to 2022).

Due to the tight timeframes associated with shuts-downs, the works would be undertaken consistent with current shut-down shift patterns which are regulated based on health and safety requirements. Shifts for the Project would commence at 6:30 am, including on Saturdays, Sundays and Public Holidays, and be of a 10-hour duration.

3.2.2 Workforce

The Project would provide employment for an estimated 70 workers over approximately 50 days per year for four years. This specialist workforce would be engaged by the turbine provider, Toshiba, who anticipate drawing

on resources from NSW (approximately 35 workers), interstate (approximately 20 workers) and overseas (approximately 15 managers and supervisors). All staff would be accommodated in the Hunter region.

AGL Macquarie and Toshiba anticipate that these workers would be a subset of the number of workers who have undertaken annual shut-down maintenance of turbines over prior years. However, to be conservative, these workers have been modelled as generating additional vehicle movements.

3.2.3 Equipment

Transport vehicles, including overweight and over mass vehicles, will be used to deliver large turbine components to Bayswater.

In addition, the following plant and equipment would be used within the turbine hall during installation of the new turbines:

- Existing overhead heavy lift cranes;
- Small cranes and elevated work platforms; and
- Hand tools including grinders, welders, drills and pneumatic ratchets.

3.2.4 Access

Deliveries associated with the Project are expected to include 10 oversize and overweight deliveries to Bayswater from the Port of Newcastle and 27 standard shipping containers containing smaller components to Bayswater from Port Botany or Port Kembla. These deliveries are scheduled to arrive prior to the commencement of the shut-down period and would not coincide with the increased small vehicle movements associated with the Project and wider shut-down works as described in Section 2.3.

Access to and from Bayswater is provided by slip-lanes from the New England Highway. The access was established to accommodate the construction of Bayswater and ongoing operation of Bayswater and Liddell. All deliveries would be to the existing loading bay within the turbine hall using existing established access roads, with turbine components being lifted to the turbine floor by existing cranes located within the turbine hall.

As staff undertaking the installation works will be accommodated in the Hunter region, they would travel to site each day in small vehicles or by private bus. Contractor parking is provided on site capable of accommodating the standard shut-down workforce.

3.2.5 Installation Works Waste Management

The Project would generate waste in the form of turbine packaging and the old turbine components. Waste resulting from the Project and the intended waste management are summarised as follows:

- It is anticipated that a total of 344 tonnes of steel turbine components will be recycled after/during each upgrade outage. Toshiba have advised that 100 per cent of the metal turbine components will be recyclable;
- The wooden packaging material for new components arriving at site will be re-used, where practicable, to pack the old components for transport to a local recyclable company located either in Muswellbrook or Newcastle; and
- All other outage generated wastes will be classified and separated into waste streams to be removed by an on-site waste disposal contractor in accordance with existing waste management plans for Bayswater.

3.3 Operational Implications

3.3.1 Summary of change

The Project involves the replacement of the ageing existing turbines with new, more efficient and higher rated capacity turbines. The turbines operate to convert the steam generated from the boiler to electricity, which occurs towards the end of the electricity generating process. No changes to the existing infrastructure or operations, including boiler or water management, ash disposal or coal receipt, handling and milling are required to facilitate the operation of the Project. As such the Project would have limited operational implications. A minor decrease in total coal combustion and resulting emissions (ash, air impurities and greenhouse gases) is modelled to occur as a result of the Project under current assumptions for future operations of Bayswater.

Based on available data and specifications, the Project would provide a net improvement in overall cycle efficiency of over 2 per cent compared to the original design and over 4 per cent compared to current operations reducing Bayswater's GHG intensity (CO_2e emissions per MWh) by 4 per cent compared with the 'do nothing' scenario (refer to Chapter 7). This is a direct result of installing newer design and technology improved turbines which provide greater heat rate efficiencies.

The new turbines with increased rated capacity will require reduced coal consumption to generate at the 685 MW per unit rated capacity compared with that required to generate 660 MW per unit under the modelled 'do nothing' scenario.

3.3.2 Waste Management

The modelled decrease in coal consumption to achieve the additional energy generation over the remaining life of Bayswater would, if realised, result in no additional ash requiring disposal. This minor modelled decrease is negligible in the context of fluctuating coal quality and the Project will not require any change in ash disposal methods.

3.3.3 Water Supply

The Project does not involve a change in the source, storage, use or treatment of water at Bayswater. Water would continue to be sourced and used in accordance with the existing water access licence package described in Section 10.4.

4. 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.*

4.1 Environmental Planning and Assessment Act 1979

The Project has been declared to be critical State significant infrastructure and accordingly requires assessment in accordance with Part 5, Division 5.2 of the EP&A Act. This EIS has been prepared to address the specific EARs issued for the Project. The Minister for Planning is the consent authority for critical State significant infrastructure under the EP&A Act.

4.2 Environmental Planning and Assessment Regulation 2000

Schedule 2 of the EP&A Regulation stipulates the process to obtain SEARs to be addressed in the preparation of the EIS and the general form and content requirements of the EIS. Table 4-1 identifies how this EIS addresses these form and content requirements. The environmental assessment requirements for the Project are provided in full in Section 1.8.

Table 4-1 General Form and Content Requirements for the EIS

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 Chapter 6
(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, and (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	EIS Certification Page

EIS Requirement	Where addressed
(iii) that the information contained in the statement is neither false nor misleading.	
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 1.5
(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 1.7
(d) an analysis of the development, activity or infrastructure, including:	
(i) a full description of the development, activity or infrastructure, and	Chapter 3
(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, and	Chapter 2
(iii) the likely impact on the environment of the development, activity or infrastructure, and	Chapters 6 to 10
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Chapter 12
(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,	Chapter 4
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Chapter 12
(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 13

4.3 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 licence.

Bayswater is operated under the EPL which is held by AGL Macquarie and issued by the EPA under the POEO Act for Bayswater. The EPL contains detailed conditions which:

- limit and regulate discharges to air from Bayswater including imposing emission limits for key air emissions resulting from Bayswater's operations;
- limit and regulate discharges to water from Bayswater including imposing discharge limits;
- impose monitoring requirements (including for both air and water discharges);
- impose general operating conditions;

- impose reporting requirements; and
- require the carrying out of pollution studies and environmental improvement projects.

The Project is limited to the replacement of the existing turbines located at Bayswater, providing a net improvement in overall cycle efficiency of 4 per cent compared to the modelled 'do nothing' scenario with associated and similar percentage reduction of GHG intensity ($kgCO_2e/MWh$).

The Project will not:

- result in any change being made to the scheduled activities authorised by the EPL; or.
- require any changes to any of the conditions of the EPL, including any of the air or water discharge limits which apply under the EPL.

Accordingly, Bayswater would continue to operate under the existing conditions currently imposed under the EPL regardless of whether the Project is approved and implemented.

4.4 Biodiversity Conservation Act 2016

Part 7 of the *Biodiversity Conservation Act 2016* (NSW) requires that an application for State significant infrastructure 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 *Biodiversity Conservation Act 2016* defines "biodiversity values" as follows:

> *"biodiversity values" are the following biodiversity values:*
>
> *(a) vegetation integrity--being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state,*
>
> *(b) habitat suitability--being the degree to which the habitat needs of threatened species are present at a particular site,*
>
> *(c) biodiversity values, or biodiversity-related values, prescribed by the regulations.*

The regulations made under the *Biodiversity Conservation Act 2016* relevantly prescribe the following as additional biodiversity values:

> *(a) threatened species abundance--being the occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site,*
>
> *(b) vegetation abundance--being the occurrence and abundance of vegetation at a particular site,*
>
> *(c) habitat connectivity--being the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range,*
>
> *(d) threatened species movement--being the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle,*
>
> *(e) flight path integrity--being the degree to which the flight paths of protected animals over a particular site are free from interference,*
>
> *(f) water sustainability--being the degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.*

This EIS confirms that:

- The Project does not involve any clearing or ground disturbance and no impacts to threatened fauna or flora species or endangered ecological communities will result from the Project. The Project does not involve any changes that would increase pressure on any coal handling, ash disposal or water management infrastructure. As such the Project does not directly impact terrestrial or aquatic environments.

- The continued operation of Bayswater would continue to impact atmospheric environment through the emission of air impurities and GHG in accordance with EPL limits and existing practice. However, the Project would result in more efficient operations and as such less atmospheric impacts on a total and per megawatt hour basis. When considering the future operating scenario after completion of the Project as compared to the 'do nothing' continued operation base case, a decrease in coal consumption and resulting emissions is anticipated.

Given these conclusions, it is considered that the Project will not have any impact on biodiversity values. Accordingly, the Secretary of the Department of Planning and the Chief Executive of the Office of Environment and Heritage have been requested to confirm that they have formally determined, for the purpose of Section 7.9 of the *Biodiversity Conservation Act 2016*, that the Project "is not likely to have any significant impact on biodiversity values".

4.5 Roads Act 1993

Under section 138 of the *Roads Act 1993* (NSW) the consent of the roads authority is required to:

- Erect a structure or carry out a work in, on or over a public road, or

- Dig up or disturb the surface of a public road, or

- Remove or interfere with a structure, work or tree on a public road, or

- Pump water into a public road from any land adjoining the road, or

- Connect a road (whether public or private) to a classified road.

The Project would not require any works or activities of this type. Access to and from Bayswater is provided by slip-lanes from the New England Highway. All deliveries would be to the existing loading bay within the turbine hall using existing established access roads, with turbine components being lifted to the turbine floor by existing cranes located within the turbine hall. Therefore, consent from the roads authority would not be required.

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

Clause 16 of the *State Environmental Planning Policy (State and Regional Development) 2011* (**SRP SEPP**) provides that:

> *Development specified in Schedule 5:*
>
> *a) may be carried out without development consent under Part 4 of the Act, and*
>
> *b) is declared to be State significant infrastructure for the purposes of the Act if it is not otherwise so declared, and*
>
> *c) is declared to be critical State significant infrastructure for the purposes of the Act.*

Schedule 5 of the SRD SEPP lists:

Development for the purposes of the Bayswater Power Station Turbine Efficiency Upgrade project, being the replacement and upgrade of turbines on the 4 existing generating units. The development is to be carried out on the site of the Bayswater Power Station (being Lot 2, DP 327372 and Lot 2, DP 1095515).

Accordingly, the Project is Critical State significant infrastructure which requires approval under Division 5.2 of the EP&A Act.

4.7 State Environmental Planning Policy (Infrastructure 2007)

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.

Clause 16 of the SRD SEPP operates to override both the *Muswellbrook Local Environmental Plan 2009* (**Muswellbrook LEP**) and ISEPP and provides that the Project may be carried out without development consent under Part 4 of the EP&A Act. Rather, as the Project is Critical State significant infrastructure, it instead requires approval under Part 5, Division 5.2 of the EP&A Act.

4.8 State Environmental Planning Policy 33

Under *State Environmental Planning Policy 33 - Hazardous and Offensive Development* (**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 DP&E 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 does not exceed the screening thresholds so as to be considered a potentially hazardous development within the meaning of SEPP 33.

The Project will be undertaken in the existing turbine hall which is separated from all hazardous chemical storage locations. No interaction between the Project and existing hazardous chemicals storage locations at Bayswater has been identified through AGL's management of change process and as such no potential for increased hazard and risk profile for Bayswater has been identified.

Consideration has been given to land use safety reflecting the requirements of SEPP 33 as outlined in Section 10.2. The extensive buffer lands established as part of the existing operation are owned by AGL Macquarie and are appropriately zoned to prevent encroachment of development incompatible with the ongoing operation of Bayswater.

4.9 Muswellbrook Local Environmental Plan 2009

The site is within the application area of the Muswellbrook LEP. The site is zoned SP2 – Infrastructure: Power Station under the Muswellbrook LEP.

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 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.

4.10 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (**WARR Act**) promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs.

In addition, the Waste Avoidance and Resource Recovery Strategy 2014-21 (EPA, 2014) sets out six Key Result Areas (KRA). KRA 2 includes a recycling target for Construction and Demolition waste of 80% by 2021/22. Increasing the amount of material that is recycled and put back into the productive economy helps to reduce the waste going to landfill and can potentially save energy, water and other resources.

It is proposed that the waste generated from the Project will be recycled where practicable.

4.11 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.

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.

However, the EPBC Act contains exemptions for actions that were commenced prior to the commencement of the EPBC Act providing that the action:

- was authorised by a specific environmental authorisation, which includes an authorisation under NSW law; or
- is a lawful continuation of the use of land that was occurring immediately before the commencement of the EPBC Act.

The existing operation of Bayswater falls within these exemptions.

A search of the Australian Government Department of Environment and Energy's EP&BC Act Protected Matters Search Tool was undertaken for the project with a 1 km radius on 7 June 2018. The searches found:

- No World Heritage Properties;
- No National Heritage Places;
- One Wetland of International Importance;
- No Commonwealth Marine Areas;
- Three listed Threatened Ecological Communities;
- 24 listed Threatened Species;
- 14 listed Migratory Species;
- No Commonwealth Listed Heritage places; and
- No Commonwealth Land.

Given the limited scope of the Project and the results of the assessments reported on in this EIS, the Project is not likely to have a significant impact on any MNES protected by the EPBC Act and, as such, a referral to the Commonwealth Department of Environment and Energy is not required.

4.12 Conclusions

The Project is consistent with the current land-use zoning and may be carried out without development consent under the EP&A Act as declared Critical State significant infrastructure. The Project requires approval under Part 5, Division 5.2 of the EP&A Act and would continue to rely on and comply with existing authorisations and approvals as described in Section 1.4. With the exception of approval under the EP&A Act, the Project does not require new approvals and authorisations or any amendment to any of the existing approvals and authorisations under which Bayswater operates.

5. Engagement

This Chapter provides a summary of consultation undertaken by AGL with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.

5.1 Consultation Summary

AGL Macquarie publicly announced its plan for the Project on 28 February 2018. AGL Macquarie understands that interest in the Project and AGL's operations does not come only from immediate neighbours but extends to the broader community. The State Significant Infrastructure Application Report identified key stakeholders for the project as including:

- Commonwealth, State and local government representatives and agencies;
- Muswellbrook and Singleton residents, neighbours, businesses and business chambers, traditional owners, environment interest groups; and
- Other - community organisations, road users, tourism operators and emergency services.

The State Significant Infrastructure Application Report also committed to the development of an engagement plan to ensure ongoing and effective communication with key stakeholders and the community and that the outcomes of this consultation would be summarised in the EIS. Details of consultation undertaken are summarised in Table 5.1.

Table 5.1 : Stakeholder consultation to date

Date	Stakeholder	Engagement Type	Issues Raised	EIS Reference
11 April 2018	NSW DP&E, Muswellbrook Council and EPA planning focus meeting.	Project briefing and site tour.	DP&E acknowledged tight assessment timeframe and indicated quality and timely delivery of EIS would be necessary. EPA identified that a clear description and assessment of the likely change would be required. Muswellbrook Council expressed concerns with overall regulation of Bayswater and need for planning for end of life rehabilitation.	Noted Chapters 7 and 8 Section 1.4
1 May 2018	AGL Macquarie Community Dialogue Group	Regular Community Dialogue Group Meeting	Local procurement/employment opportunities.	Chapter 11
7 June 2018	Hunter Police - Local Area Commander	Face to face briefing	Traffic and oversized vehicle movements. AGL to work with RMS and NSW Police when	Chapter 9

			scheduling escort for oversized vehicles	
19 June 2018	AGL Macquarie Community Dialogue Group	Regular Community Dialogue Group Meeting	Local employment opportunities.	Chapter 11
24 June 2018	Muswellbrook Shire Council	Email	Proposal for meeting to discuss any additional items regarding the Project.	Section 5.4.5
27 June 2018	RMS Hunter	Face to Face briefing	Planning for oversize and overmass vehicles movements	Chapter 9

5.2 Anticipated Stakeholder Issues

As the Project relates to the upgrade of an existing operational coal fired power station, AGL Macquarie anticipated that key stakeholder issues would include:

- Air quality impacts including greenhouse gas emissions;
- Noise impacts;
- General objection to the use of coal;
- General objections to AGL's decarbonisation policy; and
- Potential implications for power prices.

These anticipated concerns, and expectations on how they are to be assessed, have been confirmed in the EARs for the Project along with additional concerns regarding traffic, relationship to existing, approved and proposed projects and social and economic impacts. Further details of the consultation undertaken is provided in the following sections.

5.3 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 Macquarie maintains a community reference group known as the AGL Macquarie Community Dialogue Group which meets bimonthly. 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 1 May 2018, as part of AGL's *NSW Generation Plan*. With the exception of local employment, economic stimulus potential and welcomed additional electricity capacity, no stakeholder issues were raised. A second Community Dialogue Group meeting was held on 19 June 2018 at which the Project was further discussed. No additional issues were raised at this meeting.

In the absence of specific issues beyond local employment being raised by the local community, broader, likely community concerns were identified through reference to various articles in the media associated both with AGL Macquarie specifically, coal fired power stations in general and wider discussions around power prices and reliability.

AGL Macquarie acknowledges these issues and addresses them in Chapters 7 to 11 of the EIS.

The Project does not involve clearing or new ground disturbance and as such no potential for impacts to Aboriginal heritage were identified as likely and no specific consultation with Aboriginal parties was undertaken.

5.4 Agency Consultation

Following the declaration of the project as Critical State significant infrastructure, a State Significant Infrastructure Application Report was prepared and submitted to DP&E for the purpose of facilitating the preparation of the Secretary's environmental assessment requirements under section 5.16 of the EP&A Act. The DP&E provided copies of the State Significant Infrastructure Application Report for the Project and draft environmental assessment requirements to various NSW Government Agencies and received responses from:

- The Department of Primary Industries - NSW Department of Industry Crown Lands and Water Division (DPI);
- Environment Protection Authority (EPA);
- Department of Transport - Roads and Maritime Services (Roads and Maritime);
- NSW Rural Fire Service (RFS); and
- Muswellbrook Shire Council.

These responses document each authority's key concerns and assessment requirements. Additional consultation during the preparation of the EIS was also undertaken as required and has also been detailed below. The agency input into the environmental assessment requirements was provided to DP&E and incorporated at DP&E's discretion. The agency inputs can be found attached to the environmental assessment requirements in Appendix A.

5.4.1 Department of Primary Industries

DPI provided input into the environmental assessment requirements including a requirement for:

- An assessment of impacts to surface and groundwater sources including water use, impacts on water users, waterfront land and aquifers, as well as compliance with relevant policies;
- Provide details on water licencing arrangements, including:
- Whether any additional take of water or water licence(s) is required as a result of the proposed works.
- Whether there is any need for alterations to any water supply works.
- Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project); and
- Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy 2012.

No surface water or ground water impacts and no change in how water is sourced, stored, used or discharged are anticipated with the Project (refer to Section 10.4). No further consultation was undertaken with DPI during the preparation of the EIS.

5.4.2 Environment Protection Authority

AGL Macquarie are in ongoing contact with the EPA in relation to the Bayswater scheduled activity. The EPA also provided input into the preparation of the environmental assessment requirements and noted that the Project would not alter coal consumption or air emissions or include any changes to existing pollution control equipment.

Chapter 7 and 8 address air quality and GHG impacts. No further consultation with the EPA was undertaken in relation to the project.

5.4.3 Roads and Maritime Services

Roads and Maritime Services (RMS) provided input into the preparation of the environmental assessment requirements describing Transport for NSW and Roads and Maritime's primary interests as the efficiency and safety of the classified road network, the security of property assets and the integration of land use and transport. Roads and Maritime also described their expectations for the traffic impact assessment. AGL Macquarie subsequently contacted RMS via email on 25 May 2018 seeking a meeting to provide clarity to Roads and Maritime as to the nature of the project and specific traffic impact assessment proposed. This meeting was not deemed necessary. AGL Macquarie subsequently met with Roads and Maritime on 27 June 2018 to discuss planning for oversize and overmass vehicles movements with a specific focus on bridge load limits. A traffic impact assessment addressing the environmental assessment requirements and concerns of Roads and Maritime is provided as Chapter 9.

5.4.4 NSW Rural Fire Service

NSW RFS had no specific recommendations in relation to bush fire protection and no further consultation with NSW RFS was undertaken.

5.4.5 Muswellbrook Shire Council

Muswellbrook Shire Council provided a response to the request for input into the environmental assessment requirements noting that it would appear the development will not have any detrimental outcome to the surrounding environment and will not create any additional liabilities on closure. No specific assessment expectations were provided.

Council did express concern regarding the broader regulation of Bayswater and in particular that, in Council's opinion, the Original "approval" letter issued by Muswellbrook Council does not constitute an approval under the EP&A Act and asking that that as a part of the conditions for the approval of the Project a consent condition be included to require AGL Macquarie to apply to DP&E for a replacement of the existing Council "Approval" for the site in a reasonable and feasible timeframe.

AGL Macquarie is currently undertaking a detailed review of its potential future operational requirements and where practicable, will consider opportunities to consolidate the existing planning approvals described in Section 1.4 as part of this process. AGL Macquarie emailed Muswellbrook Shire Council on 24 June 2018 asking if they had any further issues in addition to their submission made on 20 April 2018 regarding the Project and offering an opportunity to meet to hear any additional items regarding the Project. A meeting with Muswellbrook Shire Council is scheduled for 28 June 2018. Any further inputs from Council arising from this meeting would be considered as part of a Response to Submissions Report, where required.

6. Environmental Impact Identification

This chapter identifies how the likely environmental, social and economic impacts of the Project were identified.

The likely environmental consequences of the Project requiring assessment were identified through the preliminary environmental assessment process and consultation associated with obtaining SEARs. The SEARs require an assessment of the likely impacts of the Project on the biophysical and socio-economic environment, focusing on the specific issues identified below, including:

- A description of the existing environment likely to be affected by the Project;
- An assessment of the potential impacts of the Project, including any cumulative impacts associated with existing, approved and proposed developments in the region; and
- A description of how the Project has been designed to avoid and minimise impacts.

The SEARs specify the following specific issues for consideration:

- Greenhouse gas;
- Air Quality;
- Traffic and Transport;
- Noise and Vibration;
- Land-use Safety;
- Waste;
- Water; and
- Social and Economic.

Based on the findings of each assessment, Greenhouse Gas (Chapter 7), Air Quality (Chapter 8) and Traffic (Chapter 9) are considered key environmental issues requiring more detailed consideration and are presented in separate chapters. Noise (Section 10.1), Land-use Safety (Section 10.2), Waste (Section 10.3) and Water (Section 10.4) impacts are considered in less detail and are presented in a single chapter. The social and economic impact assessment relies on the findings of the environmental impact assessments provided in Chapters 7 to 10 and is presented separately in Chapter 11.

Separate technical assessment reports are not provided. Where necessary, technical details associated with assessments are provided in a single appendix for each topic for cross reference purposes.

7. Greenhouse gas

*This chapter addresses the air quality component of the EARs for the Project which requires an assessment of any potential changes to the air emissions (**including greenhouse gas emissions**) at the Bayswater Power Station as a result of the construction and operation of the Project.*

7.1 Introduction

The installation and operation of the Project may result in a change to the emission of greenhouse gases to the atmosphere compared with that which would have occurred under the 'do nothing' continued operations scenario. This chapter identifies the magnitude of these emissions, and demonstrates how the Project results in an overall emissions reduction in absolute terms and an efficiency improvement in terms of greenhouse gas emissions per unit of generated electricity.

7.1.1 Greenhouse Gases and Climate Change

Greenhouse gases (**GHG**) is a collective term for a range of gases that are known to trap thermal radiation in the upper atmosphere, where they have the potential to contribute to the greenhouse effect (global warming). Creating an inventory of the likely GHG emissions associated with a project has the benefit of determining the scale of the emissions and providing a baseline from which to develop and deliver GHG reduction options. Greenhouse gases include:

- Carbon Dioxide **CO_2**– by far the most abundant, primarily released during fuel combustion;
- Methane (**CH_4**) – from the anaerobic decomposition of carbon based material (including enteric fermentation and waste disposal in landfills);
- Nitrous oxide (**N_2O**)– from industrial activity, fertiliser use and production;
- Hydrofluorocarbons (**HFCs**) – commonly used as refrigerant gases in cooling systems;
- Perfluorocarbons (**PFCs**) – used in a range of applications including solvents, medical treatments and insulators; and
- Sulphur hexafluoride (**SF_6**) – used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

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

The GHG inventory in this document is calculated in accordance with the principles of the Greenhouse Gas Protocol (**GHG Protocol**)[1]. The GHG emissions that form the inventory can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the GHG Protocol are shown in Figure 7.1 and can be summarised as follows:

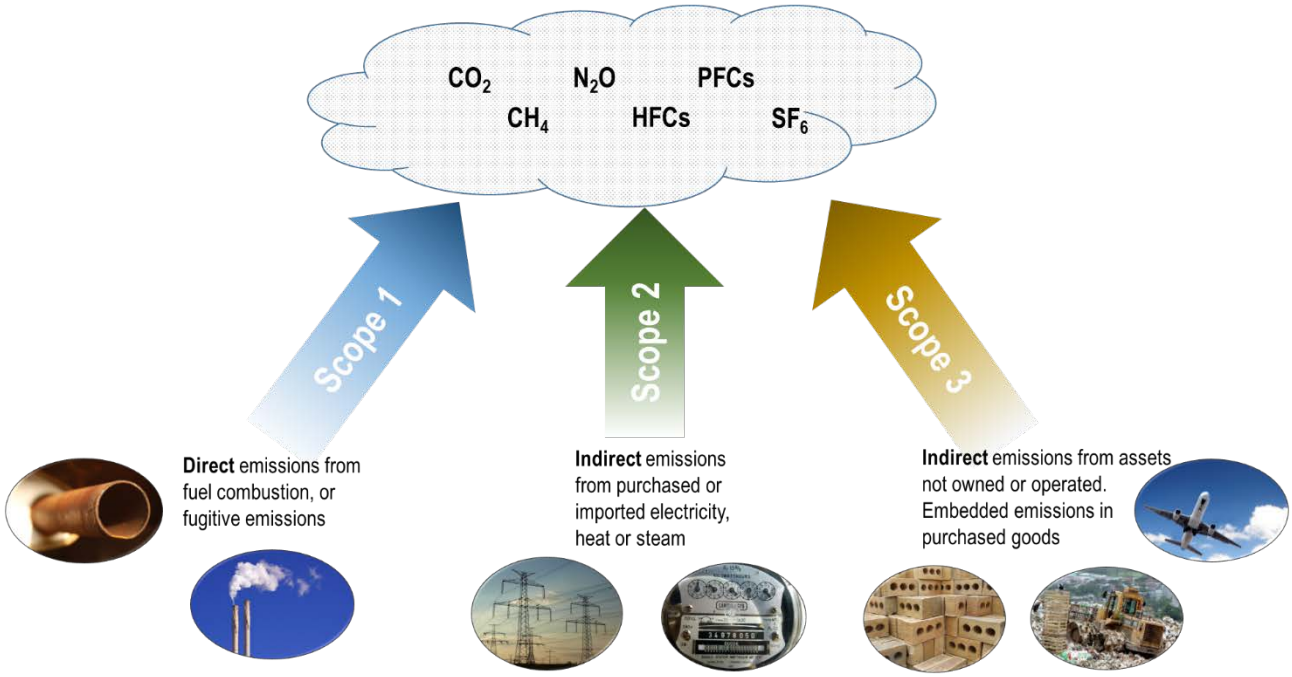
Scope 1 – Direct emissions from sources that are owned or operated by a reporting organisation (*examples – combustion of coal in onsite generation units or combustion of diesel in company owned cars*)

Scope 2 – Indirect emissions associated with the import of energy from another source (*examples – import of electricity or heat*)

[1] The Greenhouse Gas Protocol is collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides guidance on the calculation and reporting of carbon footprints.

Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (*examples include emissions from activities used to make construction materials, or upstream emissions associated with raw material (e.g. coal) extraction.*)

The initial action for a greenhouse gas inventory is to determine the sources of greenhouse gas emissions, assess their likely significance, and set a provisional boundary for the study.



Adapted from: World Business Council for Sustainable Development – Greenhouse Gas Protocol

Figure 7.1 : Sources of greenhouse gases

The results of this study are presented in terms of the above-listed 'Scopes' to help understand the direct and indirect impacts of the project.

The GHG Protocol (and many other reporting schemes) dictates that reporting Scope 1 and 2 sources is mandatory, whilst reporting Scope 3 sources is optional. Reporting *significant* Scope 3 sources is recommended. Within this inventory, assessment has been made of all (Scopes 1, 2 and 3) sources of GHG deemed significant to the implementation of the Project.

7.1.2 Current energy generation and GHG emissions

During years where there are no significant planned outages or downtime, Bayswater dispatches about 16,000,000 MWh energy per annum to the NEM (2016/17 data, based on a 69% capacity factor). Dispatched or sent out generation to the network is the difference between the gross generation less the in-house or auxiliary energy required to operate the plant. Typically, the in-house energy requirements for the station are around 5.5% of the gross output.

Annually Bayswater consumes approximately 7,100,000 tonnes of coal with equivalent of approximately 14,500,000 tCO_2e per annum (from all sources including coal combustion). The current greenhouse intensity of Bayswater varies between approximately 0.93-0.95 tCO_2e/MWh on a sent out basis (approximately 0.89 tCO_2e/MWh on a 'total generated' basis). GHG intensity varies due to changes in generating profile, seasonal conditions, plant performance and availability and fuel quality.

7.2 Methodology

7.2.1 Scope and Boundary

The scope of this study is a GHG assessment of the four generating units at Bayswater, including all material sources of emissions. Bayswater is currently in operation, so the GHG assessment makes a comparison of the proposed future operation after completion of the Project with a current baseline of operation. The scope of the assessment includes all material emissions within the plant boundary.

The assessment boundary defines the scope of GHG emissions and the activities to be included in the assessment. Table 7.1 and Table 7.2 summarise the emissions sources and activities considered within the Project's assessment boundary for installation and operation respectively, according to scope. Note that some emissions sources are split into more than one scope. This is typically the case where there are direct emissions (e.g. combustion of fuel in a boiler operated as part of the Project) as well as indirect emissions (such as the extraction and processing of fuel before it is used). The assessment boundary will include all material source (and sinks) of emissions within the installation and operation (over approximately 15 years), based on commencement of operation in 2020.

Table 7.1 : Emission sources included in the installation GHG assessment

Emission source	Scope 1	Scope 2	Scope 3
Material purchases (embedded GHGs in turbine componentry)			✓
Material transport (haulage of materials from manufacture to site)			✓

Table 7.2 Emission sources included in the operational GHG assessment

Emission source	Scope 1	Scope 2	Scope 3
Coal combustion	✓		✓
Diesel combustion (auxiliary fuel for start-up)	✓		✓
Electricity consumption (from NSW grid using as required		✓	✓

7.2.2 Other Emission Sources

Sources of GHG emissions which are excluded from the assessment (as presented in Table 7.1 and Table 7.2) are discussed below:

Installation sources

The following sources of installation GHG emissions are excluded on the basis that they are not expected to form a significant source given the limited nature of the Project:

- Diesel consumption during commissioning. Diesel will be used to performance test and commission the new turbines once installed. However, this activity is required as part of the separate DSC installation project which would occur equally under the do nothing scenario and is therefore not included in this assessment;
- Employee travel;
- Light installation vehicles (utility vehicles);
- Other installation equipment. The installation process, once materials are delivered to site, will involve internal cranes (already installed at site), platform lifts and welding / power tools. The energy consumption of this equipment is not forecast to be significant in the context of the other emissions;

- Packaging materials used for turbine upgrade components; and
- Vegetation clearing (as no clearing will be undertaken).

Other operational sources

The following sources are reported by AGL Macquarie in its annual NGER reporting process, but not included in this assessment as they are deemed to be incidental in nature, and not expected to change as part of the Project:

- Fuel used by contractors working on site;
- Energy / emissions associated with the use of hydrocarbon greases and oils;
- Emissions associated with water treatment processes on site; and
- Emissions calculated as being fugitive releases of fluorinated gases from switchgear.

It should also be noted that during installation each generating unit will not be operational. The impact of this (in terms of changes to the carbon intensity of the State or National grid) has not been included in the assessment.

7.2.3 Installation Input Data

This section presents the methodology used to estimate GHG emissions associated with installation of the Project.

7.2.3.1 Installation materials purchases

Greenhouse gas emissions associated with installation materials have been determined using the emission factors provided by the Infrastructure Sustainability Materials Calculator (**ISMC**), developed by the ISCA (2016). This calculator evaluates environmental impacts in relation to the use of materials on infrastructure projects and assets. To determine the GHG emissions from installation materials; material quantity estimates were determined from information provided by turbine manufacturer Toshiba, in terms of its packing list for shipping of turbine components.

The quantities of installation materials determined for the Project are shown in Table 7.3. These quantities were multiplied against corresponding emission factors as provided in the ISMC for individual materials to determine the resulting Scope 3 greenhouse gas emissions. It should be noted for this part of the assessment that:

- All turbine componentry was assumed to be steel;
- An emissions factor for ‘Steel Round and Square Sections’ was used to represent the manufactured turbines given the absence of an emissions factor. This will be an underestimate for the turbine installation; however, given that the magnitude of these emissions are not expected to be significant in the context of annual plant emissions it is deemed appropriate;
- An emissions factor for ‘paint – solvent based’ was used to represent polyester resin, hardener and varnish, in the absence of a bespoke emissions factor. Again, given the magnitude of these emissions are not expected to be significant in the context of annual plant emissions it is deemed appropriate; and
- An emissions factor for ‘ethanol’ was used to represent thinner.

Table 7.3 : Installation materials input volumes and emissions factors

Material	Quantity (t)	Emissions Factor Used	Emissions Factor (tCO_2e / t)
Steel	2,026	Steel Round and Square Sections	2.34
Polyester Resin	0.288	Paint – Solvent based	2.57
Varnish	0.044	Paint – Solvent based	2.57
Thinner	1.420	Ethanol	1.17
Hardener	0.004	Paint – Solvent based	2.57

7.2.3.2 Fuel combustion from the transport of materials to site

All of the componentry and associated materials identified in Table 7.3 will be transported to site from Japan where it is manufactured by Toshiba. It is assumed that all materials are shipped out of Tokyo. The materials delivery will be split between Newcastle and Sydney, with the main turbine rotors and casings arriving in Newcastle, and the remainder landing in Sydney, with both options then using road transport to Bayswater.

The expected gross weight of the materials (i.e. including packaging) being transported by each route is:

- 825t through Sydney
- 1,451t through Newcastle

The emissions factors used to represent sea and road logistics were derived from the UK Department for Business, Energy and Industrial Strategy, Greenhouse gas reporting: conversion factors 2017 (DBEIS, 2017). These provide the GHG emissions from transport of freight per tonne kilometre (i.e. the transport of one tonne by one kilometre) which can be multiplied by both the distance travelled and the weight transported to determine the total impact. These are shown in Table 7.4.

Table 7.4 : DBEIS 2017 Emissions Factor (per tonne.km)

	kg CO_2e	kg CO_2	kg CH_4	kg N_2O
Transport Road Artic (>33t – average loading)	0.05835	0.05769	0.00001	0.00065

7.2.4 Operation Input Data

This section identifies the operational input data and methodology used to calculate operational emissions.

7.2.4.1 Coal combustion

Coal input and energy output from the new turbines has been determined based on historical performance information of Bayswater, as well as performance specifications for the new turbines from the manufacturer Toshiba.

Coal input is not expected to change markedly from current throughput. As the new turbines at year of opening are expected to need less steam power from the boilers (1,526MWth to generate at the 685 MW per unit rated capacity as opposed to approximately 1,544MWth to generate at the 660 MW rated capacity) it is expected that coal consumption will decrease slightly in year 1. As the performance of the turbines degrades, both these power outputs (as well as coal consumption) would be expected to increase over time, with slightly greater performance turbines in the initial years than later years. The level of coal consumption for the degraded newer turbines is not expected to exceed current levels for the existing turbines.

Performance testing for the current turbines was not available, and as such had to be derived from degradation curves in Section 3.7 of ASME, 1985 (with extrapolation of the degradation made post four years modelled in the report). The starting degradation for existing turbines was based on performance testing in 2005 after the last turbine overhaul (assumed to have been completed in 2004) which showed input steam power of 1,533MWth required. This figure, one-year post overhaul, was used as a reference to determine the new (overhauled) state of the existing turbines (1,528MWth), as well as the 2016/17 degraded state (1,544MWth).

Coal throughput for year 1 of the upgraded turbines (assumed to be 2020 for the purposes of this assessment) was derived from the 2016-2017 financial year coal consumption for Bayswater as reported for the National Greenhouse gas and Energy Reporting (NGER) scheme. Variation to this was made using the proportional step change in boiler output advised as per Table 7.5.

Table 7.5 : Projected Year 1 Coal Consumption

Scenario	Coal Consumption (tonnes per year)
Current turbines (660MW). Boiler output required = 1544MWth.	7,123,125
Upgraded turbines (685MW). Boiler output required = 1526MWth.	7,040,943

Variation in coal consumption over time is subject to a number of factors. Those that have the largest influence are discussed in Table 7.6, together with an explanation of how this has been addressed in the modelling for this assessment.

Table 7.6 : Coal Consumption Variables

Variable	Model Treatment
Market Requirements (capacity factor)	During the 2016-17 financial year, Bayswater had a capacity factor of 69%. This essentially means that of the potential electrical energy output that could have been achieved from operating 4 x 660 MW turbines 24 hours per day and 365 days per year, it generated 69% of this value. The 31% of remaining capacity is time when: • Turbines are turned off or down to meet market demand; • Boilers / turbines are being turned on (but not yet generating electricity); • Turbines are taken offline during failures, for service / testing / repair and due to plant issues. For the market demand, there are a range of competing factors that will alter it, including: • With newer turbines; Bayswater may be more reliable (with fewer outages) and therefore be able to compete more efficiently in the electricity market, allowing it to run more often and generate more electricity; • As renewable energy projects come online across Australia, generation from larger (and typically more expensive) coal fired generation will become less attractive (financially and environmentally), meaning the capacity will likely decrease (especially towards the projected end of life at 2035). In terms of outages, the current turbines were not overhauled in 2016-17 and as such this year should be representative of being typical of a maintenance schedule. This part of the capacity factor is therefore not likely to change over the life of the new turbines (where no major overhauls will be scheduled for their 15 year lifespan).

Variable	Model Treatment
	Within the model it has been assumed that there will be no other change to the capacity factor. Whilst there will likely be fluctuations in this number over the 15 years of operation, this approach is likely to lead to an overestimate of emissions (i.e. a conservative approach), especially in the later years of the turbine lifespan where the station will be less competitive against newer renewable sources of energy (such as solar and wind).
Coal Quality	For coal with less calorific value, a larger volume has to be combusted in order to generate the same volume of electricity, and vice versa for better quality coal. Bayswater undertakes detailed analysis of coal quality, the data from which is used (amongst other things) to report NGER emissions annually. Weighted average coal quality from the 2016-17 financial year was used in this assessment, and as future coal quality forecasts were not available, it was assumed that this would remain constant over the life of the upgraded turbines. Assumptions about coal quality apply the same to both the existing turbines if they were to continue to operate into the future and the new turbines. As the SEARs require an assessment of change in GHGs associated with the Project, there are no changes with respect to assumptions made about coal quality.
Turbine degradation	Turbine performance degrades over time due to factors including: • Build-up of deposits in internal and typically inaccessible (during routine operation) parts; • Damage to turbine blades (especially in the final turbine stages); • Steam leaks in medium and high pressure equipment. Turbines at Bayswater would typically be overhauled every 12 years in order to address these issues and return the turbine close to its original performance specification. This involves taking the turbine offline for an extended period and accessing the inner workings to clean and repair it. The degradation of steam turbines over time is well studied, and as their performance degrades, a greater amount of steam power is required to ensure that they can generate the same amount of electrical power output. The current turbines have degraded from their original condition (with a step change from 1509MWth input required per turbine at year of commissioning in 1985 to at least 1533MWth at the last (2005) review period and the assumed 1,544MWth for 2016/17. As they are reaching end of life they may also fail and so must be replaced. The upgraded turbines are modelled to degrade over their lifespan based on a performance degradation curve derived from Section 3.7 of ASME, 1985 (with extrapolation of the degradation made post 4 years modelled in the report). This sees the upgraded turbines degrade over their 15 year intended lifetime, requiring the boilers to increase output (to maintain the same level of energy generation) from 1526MWth in year 1 to 1542MWth in year 15.

Based on the above variables, the coal consumption forecast over 15 years of operation is shown in Table 7.7. This is shown alongside the forecast coal consumption in a theoretical 'do nothing' scenario, in which the current 660 MW turbines are not replaced, and continue to be overhauled every twelve years. The 'do nothing' scenario is theoretical because the turbines need to be replaced due to their age. However, it assumes:

- The turbines are overhauled ready for 2020 and regain 90% of the performance from the 2004 overhaul;
- The turbines are overhauled every 12 years (so once more within the lifespan of Bayswater); and
- Following overhaul, they can only regain 90% of the previous overhaul performance.

Table 7.7 : Annual Coal Consumption

Year	Coal Consumption (Actual and Forecast (kt)) – Upgraded 685 MW turbines	Coal Consumption (Actual and Forecast (kt)) – Current 660 MW turbines
Current (based on 2016/17 financial year)	7,123.13	7,123.13
1	7,040.94	7,055.90
2	7,065.63	7,080.65
3	7,079.38	7,094.43
4	7,088.77	7,103.84
5	7,095.73	7,110.81
6	7,101.07	7,116.16
7	7,105.21	7,120.31
8	7,108.44	7,123.55
9	7,110.93	7,126.04
10	7,112.80	7,127.92
11	7,114.15	7,129.27
12	7,115.05	7,130.17
13	7,115.55	7,063.38
14	7,115.71	7,088.15
15	7,115.55	7,101.94
Total	106,484.93	106,572.51

Table 7.7 shows the new turbines are forecast to use slightly less coal over the life of Bayswater. With an overhaul in year 13 for the 'do nothing' scenario some performance improvement over the upgraded turbines is made, but in reality, this overhaul, so close to the proposed end of life for the plant, is unlikely to happen. Compared to the 'do nothing' scenario, 88,000 t of coal combustion will be reduced over the 15 years of operation.

Based on testing carried out for input coal over the 2016/17 financial years, as well as NGER data (NGA, 2017), Table 7.8 shows the energy content and emissions factors used to determine carbon dioxide equivalent emissions from coal combustion.

Table 7.8 : Coal energy content and emissions factors

Scope	Factor	Source
Scope 1		
Energy Content	21.67 GJ / t	Bayswater measured and reported (2016/17 NGER data)
Emissions – CO_2	91.31 kgCO_2e / GJ	Bayswater measured and reported (2016/17 NGER data)
Emissions – CH_4	0.03 kgCO_2e / GJ	NGA, 2107
Emissions – N_2O	0.2 kgCO_2e / GJ	NGA, 2107
Scope 3		
Upstream emissions associated with coal extraction	3.0 kgCO_2e / GJ	NGA, 2107

7.2.4.2 Diesel combustion

Diesel fuel is used for start-up of the boilers. Consumption of diesel throughout the year is dependent on the variability in usage required (to start up / shut down turbines) as well as planned or unplanned outages.

Diesel fuel has not been forecast to change over the lifetime of the project (15 years) and as such the 2016-17 year is taken as representative of likely ongoing consumption (assuming that the capacity factor for operations remains constant as noted in Table 7.6 – i.e. the same number of start-ups / shut-downs).

Diesel consumption during the 2016-17 financial year was 6,981 kL. This value is converted to CO_2e emissions using the factor presented in Table 7.9 (which presents the energy content factors (ECF) and the emission factors from NGA (2017) which apply to calculation of emissions from diesel consumption).

Table 7.9 : Diesel Fuel Emissions Factors

Fuel	Energy content factor (GJ per kL)	Scope 1 emission factor (kg CO_2e/GJ)			Scope 3 emission factor (kg CO_2e/GJ)	Emissions per unit quantity (t CO_2e per kL	
		CO_2	CH_4	N_2O		Scope 1	Scope 3
Diesel (stationary fuel use)	38.6	69.9	0.1	0.2	3.6	2.7097	0.1390

7.2.4.3 Grid Electricity Consumption

Grid electricity is used by Bayswater during outages (when the power station itself cannot supply the power). As for diesel fuel, this figure is not projected to change due to the Project.

Electricity consumption during the 2016-17 financial year was 15,146,786 kWh. This is converted to CO_2e emissions using the factors presented in Table 7.10.

Table 7.10 : NSW Electricity Emissions Factor

Factor	Intensity
NSW Electricity (current (2018) factor) – Scope 1	0.83 tCO_2e / MWh
NSW Electricity (current (2018) factor) – Scope 3	0.12 tCO_2e / MWh

It is noted that these factors are likely to decrease in carbon intensity over the life of the Project, as coal fired generation is displaced by renewables. However, this decrease has not been modelled for this study and as such the presented emissions from this source are a likely (conservative) over-estimate.

7.2.4.4 Energy Output

The turbines will have the ability to generate (at maximum continuous rating – MCR) an additional 25 MW each of electricity (with rated capacity of 685 MW each as opposed to 660 MW). This means that Bayswater will be able to generate an additional 100 MW of electricity once all turbines are upgraded for a similar level of coal combustion to the current (degraded) turbines.

At any point in time, the four generating units could be generating variable levels of electricity in response to market demand. This variability is difficult to project, but as per the calculations of coal combustion in Section 7.2.4.1, for this assessment we have based the output electrical energy projection on the current plant capacity factor (which for the 2016-17 financial year was 69%).

Based on this factor, the upgraded turbines would be expected to generate approximately 16,526GWh of electricity per year (noting that this value will fluctuate year on year according to market demand and operational performance factors).

7.3 Estimated Emissions

This section presents the estimated emissions associated with the installation and operation of the Project.

7.3.1 Installation

The greenhouse gas emissions associated with installation, based on the methodology presented in Section 7.2, are presented in Table 7.11.

Table 7.11 : Projected installation GHG emissions

Source	Quantity	Greenhouse gas emissions (t CO_2e)		
		Scope 1	Scope 3	Total
Installation Material Purchases	2,027 tonnes		4,735	4,735
Fuel Combustion from the transport of materials to site	18,146,856 t.km Sea 367,076 t.km Road		85	85
Total			**4,820**	**4,820**

As shown in Table 7.11, the emissions are dominated by those relating to the manufacture of the turbine components themselves (which as noted in Section 7.2.3.1 as likely to be an underestimate). The transport of the components to site is relatively small in comparison, and the installation process itself is not an energy intensive process.

7.3.2 Operation

The greenhouse gas emissions associated with operation of the upgraded turbines are presented in the following sections. All emissions sources are presented together in a summary in Section 7.3.2.4.

7.3.2.1 Coal combustion

Projected greenhouse gas emissions associated with coal combustion are presented in Table 7.12.

Table 7.12 : Projected Emissions from Coal Combustion

Year	Total Scope 1 CO_2 emissions (tCO_2e)	Total Scope 1 CH_4 emissions (tCO_2e)	Total Scope 1 N_2O emissions (tCO_2e)	Total Scope 1 Emissions (tCO_2e)	Total Scope 3 Emissions (tCO_2e)	Total Emissions (All Scopes) (tCO_2e)
1	13,930,898	4,577	30,515	13,965,990	457,719	14,423,709
2	13,979,752	4,593	30,622	14,014,967	459,324	14,474,291
3	14,006,955	4,602	30,681	14,042,239	460,218	14,502,457
4	14,025,531	4,608	30,722	14,060,861	460,829	14,521,689
5	14,039,297	4,613	30,752	14,074,662	461,281	14,535,943
6	14,049,855	4,616	30,775	14,085,246	461,628	14,546,874
7	14,058,064	4,619	30,793	14,093,476	461,897	14,555,373
8	14,064,452	4,621	30,807	14,099,880	462,107	14,561,987
9	14,069,372	4,623	30,818	14,104,812	462,269	14,567,081
10	14,073,073	4,624	30,826	14,108,523	462,391	14,570,914
11	14,075,742	4,625	30,832	14,111,199	462,478	14,573,677
12	14,077,520	4,625	30,836	14,112,981	462,537	14,575,518
13	14,078,518	4,626	30,838	14,113,982	462,570	14,576,551
14	14,078,826	4,626	30,839	14,114,291	462,580	14,576,870
15	14,078,518	4,626	30,838	14,113,982	462,570	14,576,551

7.3.2.2 Diesel combustion

Based on the methodology outlined in Section 7.2.4.2, emissions from diesel are expected to continue to be:

- 18,916 tCO_2e / year (Scope 1); and
- 970 tCO_2e / year (Scope 3).

7.3.2.3 Grid Electricity Consumption

Based on the methodology outlined in Section 7.2.4.3; emissions from electricity consumption are expected to continue to be:

- 12,572 tCO2e / year (Scope 2); and
- 1,818 tCO2e / year (Scope 3).

7.3.2.4 Operational Emissions Summary

An operational emissions summary is shown in Table 7.13 and Figure 7.2. Table 7.13 shows current performance (2016/17) as well as the projected future performance on an absolute basis (i.e. not per unit of generation).

Table 7.13 : Operational Emissions Summary

Year	Coal Scope 1 Emissions (tCO_2e)	Coal Scope 3 Emissions (tCO_2e)	Diesel Scope 1 Emissions (tCO_2e)	Diesel Scope 3 Emissions (tCO_2e)	Electricity Scope 2 Emissions (tCO_2e)	Electricity Scope 3 Emissions (tCO_2e)	Total Emissions (All Scopes) (tCO_2e)
Current - 2016/17	14,129,001	463,062	18,916	970	12,572	1,818	14,626,339
1	13,965,990	457,719	18,916	970	12,572	1,818	14,457,984
2	14,014,967	459,324	18,916	970	12,572	1,818	14,508,566
3	14,042,239	460,218	18,916	970	12,572	1,818	14,536,732
4	14,060,861	460,829	18,916	970	12,572	1,818	14,555,965
5	14,074,662	461,281	18,916	970	12,572	1,818	14,570,218
6	14,085,246	461,628	18,916	970	12,572	1,818	14,581,149
7	14,093,476	461,897	18,916	970	12,572	1,818	14,589,649
8	14,099,880	462,107	18,916	970	12,572	1,818	14,596,263
9	14,104,812	462,269	18,916	970	12,572	1,818	14,601,357
10	14,108,523	462,391	18,916	970	12,572	1,818	14,605,189
11	14,111,199	462,478	18,916	970	12,572	1,818	14,607,953
12	14,112,981	462,537	18,916	970	12,572	1,818	14,609,793
13	14,113,982	462,570	18,916	970	12,572	1,818	14,610,827
14	14,114,291	462,580	18,916	970	12,572	1,818	14,611,146
15	14,113,982	462,570	18,916	970	12,572	1,818	14,610,827

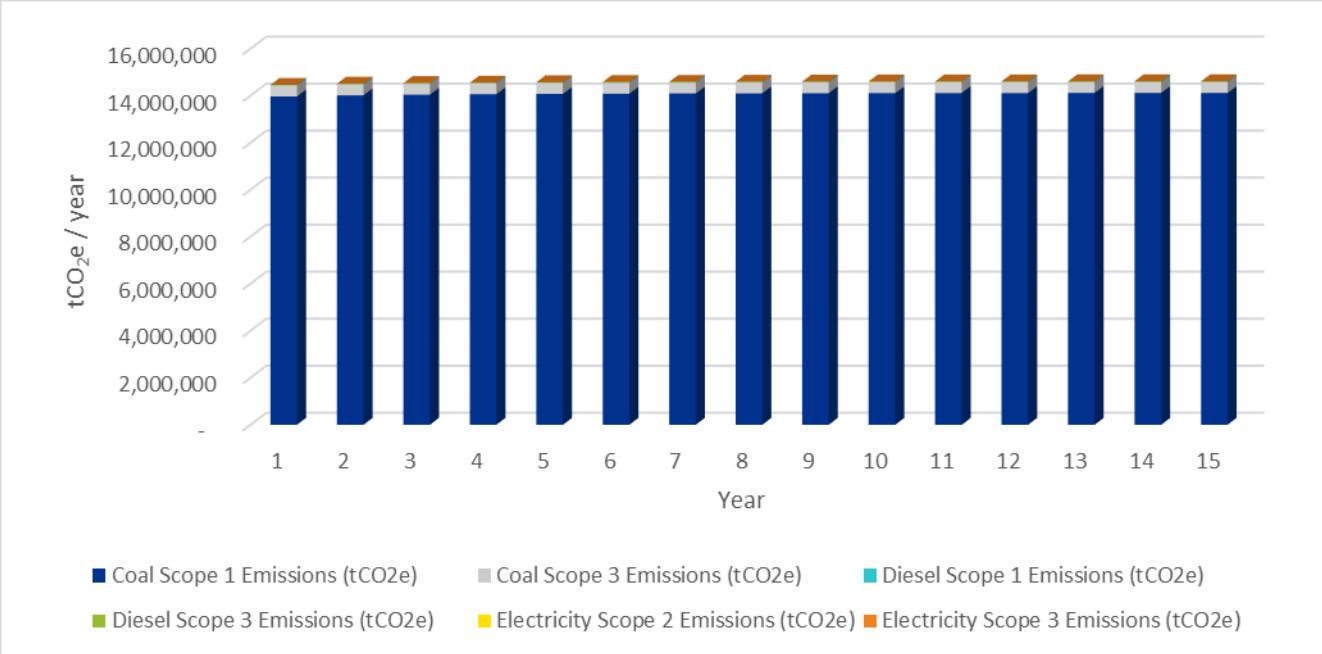


Figure 7.2 : Operational Emissions Summary

Figure 7.2 shows that the emissions profile is dominated by coal combustion (as expected). Given the forecast degradation rate of the new turbine, this shows a small increase post commissioning relating to additional boiler output needed to maintain the same level of electricity generation, however the increase is minimal.

7.3.3 Cumulative

Figure 7.3 shows the cumulative emissions profile of the Project, focussing on the difference between the Project and the 'do nothing' scenario.

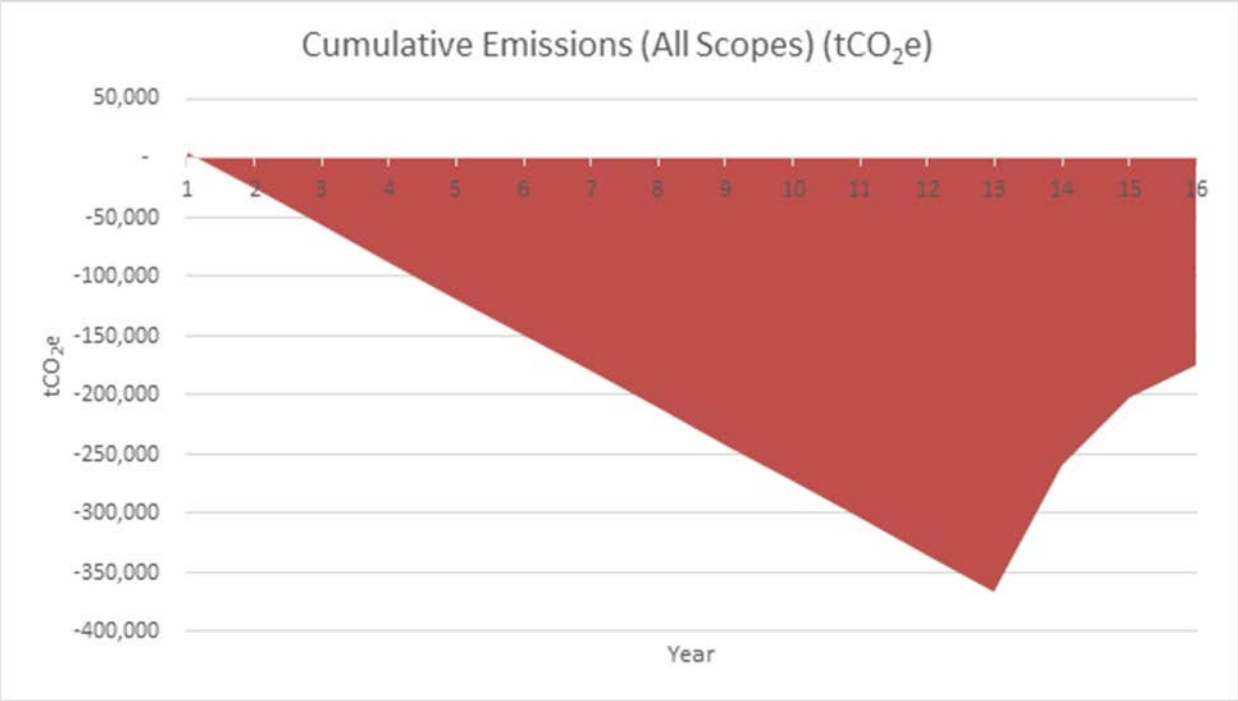


Figure 7.3 : Cumulative Emissions Difference

Figure 7.3 highlights:

- The magnitude of the installation emissions (the small positive increase at the start of the timeline);
- The projected year on year savings associated with combusting less coal using the upgraded turbines; and
- The loss of savings in year 13 assuming for the 'Do Nothing' scenario that the turbines are overhauled.

Under the 'Do Nothing' scenario (i.e. the theoretical continued operation of the current turbines (including one 12 year overhaul)) Bayswater would contribute 218.8 $MtCO_2e$ over a 15 year lifetime, meaning the Project will likely result in a reduction in emissions of 179,417 tCO2e (over 15 years) or approximately 12$ktCO_2e$ per year (on average). This means an additional 500,000MWh electricity generation per year for no additional greenhouse gas emissions.

7.3.4 GHG Intensity

The Project will improve the GHG emissions intensity of Bayswater as a direct result of a more efficient turbine design.

7.3.4.1 Intensity Pre-upgrade

Pre-retrofit, Bayswater consumes approximately 7,100,000 tonnes of coal with equivalent of approximately 14,500,000 tCO_2e per annum (from all sources including coal combustion), generating approximately 16,000,000MWh (gross output). The current greenhouse intensity of Bayswater varies between approximately

0.93-0.95 tCO_2e/MWh on a sent out basis (approximately 0.89 tCO_2e/MWh on a 'total generated' basis). This is likely to degrade further over time under a 'do nothing' scenario.

7.3.4.2 Intensity Post-upgrade

Should the total increase in annual generation be achieved post-retrofit, Bayswater is projected to generate an average of 16,500,000 MWh sent out and GHG emissions from major emissions sources over this period are projected to be an average of 14,700,000 tCO_2e per annum.

The forecast greenhouse gas intensity post-upgrade (including other material emissions sources) is:

- On a 'sent out' basis (i.e. not including that energy used on site to power equipment)
    - Year 1 = 0.89 tCO_2e/MWh
    - Year 15 = 0.90 tCO_2e/MWh
- On a 'generated' basis (i.e. total emissions divided by total electricity produced regardless of whether used on site or not):
    - Year 1 = 0.85 tCO_2e/MWh
    - Year 15 = 0.85 tCO_2e/MWh (no change due to rounding)

This demonstrates an improvement in GHG intensity of the turbine upgrade of approximately 4% at year 1, which will decrease slightly to 3.5% improvement by the end of their life (15 years).

7.3.5 Benchmarking Greenhouse Gas Intensity

7.3.5.1 Comparison with State and National Emissions

The Bayswater turbines are nearing their end of life and require replacement, hence the need for this Project. Whilst it is a requirement for this Project to assess the difference in emissions, this is difficult to do on an absolute basis, since the existing turbines (even with overhauls) could not be operated to 2035. Their continued operation would not therefore be a valid 'Do Nothing' case.

Likewise, it would not be a valid base case to replace the turbines with similar rated equivalents given the efficiency improvements available with the 685 MW rated capacity units.

The theoretical 'Do Nothing' scenario of continuing to operate the existing turbines (with one overhaul) has been used to represent potential change in emissions. As identified in Section 7.3.3, this is identified to be a 179,417 tCO2e (over 15 years) or approximately 12ktCO_2e per year (on average) reduction. This represents the following reduction in NSW State and National emissions inventories (derived from the Australian Greenhouse Emissions Information System):

- NSW (130,273.52 ktCO_2e / year (2016)) = 0.01% reduction
- Australia (532,971.15 ktCO_2e / year (2016)) = 0.002%

Comparison with other generators

The GHG emissions intensity of Bayswater before the Project is about 0.940 tCO_2e / MWh sent out, and following projected to be about 0.894 tCO_2e / MWh sent out. Table 7.14 provides details of other coal fired power projects in Australia based on most recent, publicly available information (Acil Allen Consulting, 2013), highlighting where Bayswater would sit pre and post the Project. GHG emissions intensity is implicitly linked to:

- The boiler and turbine design;
- The fuel type; and
- The generating profile.

On this basis, comparisons of Bayswater (before and after the Project) can only be made with other coal fired power stations. Typically, older power stations will have lower efficiencies due to original design and material considerations. Upon completion of the Project, Bayswater will be amongst the lowest GHG emissions black coal fired power stations operating in Australia.

Table 7.14 : Estimation of the greenhouse gas intensity and efficiencies of other coal fired power projects

State / System	Station	Scope 1 emission intensity (tonnes CO2-e/MWh sent-out)	Capacity (gross MW)	Commissioned
QLD	Tarong North	0.846	443	2002
NSW	Mt Piper	0.850	1,340	1993
QLD	Stanwell	0.894	1,440	1995
NSW	Bayswater (post-upgrade)	0.894	2,740	1983
QLD	Millmerran	0.898	851	2002
QLD	Kogan Creek	0.902	750	2007
NSW	Eraring	0.910	2,880	1983
NSW	Vales Point B	0.913	1,320	1978
QLD	Tarong	0.916	1,400	1985
QLD	Callide B	0.927	700	1989
SWIS	Bluewaters	0.928	441	2009
SWIS	Collie	0.931	333	1999
QLD	Callide C	0.937	810	2001
SA	Northern	0.939	530	1985
NSW	Bayswater (pre upgrade, 2016/17)	0.940	2,640	1983
QLD	Gladstone	0.942	1,680	1980
SWIS	Muja D	0.942	454	1986
SWIS	Muja C	0.970	398	1981

State / System	Station	Scope 1 emission intensity (tonnes CO2-e/MWh sent-out)	Capacity (gross MW)	Commissioned
NSW	Liddell	0.988	2,100	1972
VIC	Loy Yang B (Post Retrofit)	1.165	1,140	1995
SWIS	Worsley	1.197	0	1990
VIC	Loy Yang A	1.211	2,180	1986
SWIS	Muja A&B	1.216	220	1968
VIC	Yallourn	1.417	1,538	1980
VIC	Hazelwood	1.522	1,640	1968

7.4 Conclusion

At the core of this Project is the improvement of the efficiency of the Bayswater turbines, such that per unit of electrical energy output there is reduced GHG emissions from 0.94 tCO_2e / MWh to 0.89 tCO_2e / MWh. The upgrade will include replacement of turbine components to improve efficiency, as well as, during the necessary installation period, routine maintenance work (such as reduction in steam leakage) which will assist with the performance improvement. As noted in Table 7.14, this will put Bayswater amongst the most efficient of the black coal fired power stations. Based on this, no additional mitigation measures to those already used are proposed as part of this Project.

In line with AGL policy, as identified in Section 1.3.1, AGL Macquarie will continue to improve the carbon intensity of its operations, and seek to close all coal fired generation in its portfolio by 2050.

8. Air Quality

This chapter addresses the air quality component of the EARs for the Project which requires an assessment of any potential changes to the air emissions at the Bayswater Power Station as a result of the construction and operation of the Project.

8.1 Overview

As outlined in Chapter 3, the Project involves the replacement and upgrade of the HP, IP and LP turbines on the four generating units, increasing the rated capacity in each generating unit by 25 MW to 685 MW. This constitutes a total increase of 100 MW without requiring changes to the existing operation of other components of Bayswater, which are approved under the existing planning approvals.

At a coal fired power station, air emissions result from the combustion of coal in the boiler furnace. As outlined in Section 2.2, the burning of coal in the boiler furnace produces:

- Heat for the boiler which is used to produce steam;
- Incombustible coal residue, in the form of furnace ash and fly ash, which is collected and transported to ash disposal areas; and
- Hot gases generated from the combustion of the coal in the furnace discharged via the fly ash collection plant through tall stacks which are continuously monitored.

High pressure steam from the boiler enters the turbine trains within the generating units. Once within the generating units the high pressure steam is expanded through stages of fixed and rotating blades within the HP turbine before being reheated and expanded through the IP and LP turbines. The turbines drive the rotor which produces electricity.

The Project is limited to the replacement of the HP, IP and LP turbines with new, more efficient modern turbines on the four generating units, increasing the rated capacity in each generating unit by 25 MW to 685 MW via increased efficiency. The Project does not include any other changes to the existing approved operations at Bayswater.

In particular, the Project does not include any works on the boiler furnace which generates the air emissions at Bayswater and will result in a marginal decrease in coal consumption to generate at the 685 MW per unit rated capacity as a result of efficiency improvements.

This air quality assessment considers:

- Excising Bayswater air emissions (8.2);
- Air quality criteria (Section 8.3.1);
- A summary of the Hunter region ambient air quality (Section 8.3.2); and
- Any expected changes in air quality associated with the Project (Section 8.4).

8.2 Air Emissions at Bayswater

The main air emission sources from the existing approved operations of Bayswater are emitted from boiler stack and include sulphur oxides (SO_X), nitrogen oxides (NO_X), particulate matter (PM), carbon monoxide (CO), chlorine (Cl_2), various metals and fluorides.

Stack emissions from Bayswater are subject to regulation under the EPL and the *Protection of the Environment Operations (Clean Air) Regulation 2010*. The EPL requires monitoring of stack emissions and sets emission limits for the key pollutants outlined above. In addition, sulphur dioxide (SO_2) is also regulated under the EPL by restricting the sulphur content of the coals combusted in the power station.

8.2.1 Existing EPL Air Emissions Conditions

Bayswater has emission limit regulations for key air pollutants emitted from each of the four boiler stacks (points 10, 11, 12 and 13). The limits are as follows:

- Condition L3 - Concentration limits – Points 10, 11, 12 and 13
    - Cadmium: 100th percentile, 1 mg/m^3
    - Chlorine: 100th percentile, 200 mg/m^3
    - Sulfuric acid mist and sulfur trioxide: 100th percentile, 100 mg/m^3
    - Hydrogen chloride: 100th percentile, 100 mg/m^3
    - Nitrogen oxides: 100th percentile, 1500 mg/m^3
    - Hazardous substances: 100th percentile, 5 mg/m^3
    - Total fluoride: 100th percentile, 50 mg/m^3
    - Mercury: 100th percentile, 1 mg/m^3
    - Solid Particles: 100th percentile, 100 mg/m^3
- Condition L3.5 – All start-up fuel used at the premises must conform with the Australian Standard for Automotive Diesel Fuel (AS 3570 - 1998) and as updated from time to time
- Condition M2.2 - Detailed air monitoring requirements including requirements for continuous emissions monitoring of certain air emissions. AGL Macquarie provides monthly summary reports on its monitoring data on its website as required by the POEO Act.
- Condition R1.9 The Annual Return must include the following information:
    - **Air emission reporting limit -** The licensee must produce an air emission exceedance report if the concentration of Sulphur Dioxide at any time exceeds 600 ppm (vol). The air emission exceedance report must include the following:
        a) details of the date and time of the exceedance;
        b) the duration of the exceedance; and
        c) the reason(s) for the exceedance.
    - **Ambient air exceedances -** The licensee must produce an EPA air quality assessment criteria exceedance report containing an interpretation of any exceedances of the above criteria and details of plant operation at the time of any exceedance.
    - **Acid deposition monitoring -** The licensee must produce a report detailing the results of acid deposition monitoring. The data must be presented as long-term month-by-month time series.
    - **Grape leaf monitoring -** The licensee must produce a report that contains the results of the grape leaf fluoride monitoring required by this license. The data must be presented in time series that allows year-to-year comparisons.

Under the EPA's Load Based Licensing (**LBL**) Scheme, AGL Macquarie is required to pay license fees associated with the amount of annual air emissions.

8.2.2 Existing Air Emissions

Table 8.1 sets out the current LBL reportable emissions for Bayswater. Also shown is the pollutant emission intensity (kg/MWh) and other key existing power station operating parameters.

Table 8.1 : Bayswater LBL Reported Air Emissions (Feb 2016 – Jan 2017)

Pollutant	Load (kg/annum)	Load Intensity (kg/MWh)	Load Intensity (kg/tCoal)
Coarse Particulates	9436	0.000567126	0.001284372
Fluorides	609196	0.036614152	0.082920148
Benzo(a)pyrene	0.433	0.000000026	5.89374E-08
Lead	36	0.000002164	4.90011E-06
Arsenic	24	0.000001442	3.26674E-06
Sulphur Oxides	59597849	3.581974768	8.112105863
Nitrogen Oxides	39838245	2.394374810	5.422545717
Fine Particulates	526616	0.031650894	0.071679848
Mercury	77	0.000004628	0.000010481
Power Station Parameter	**Value**	**Units**	
Capacity	2640	MW	
Available Output	23126400	MWh/annum	
Actual Output (Feb 2016 – Jan 2017)	16638266	MWh/annum	
Capacity Factor	71.9	%	

8.3 Air Quality Impact Assessment

The efficiency gains generated by the Project will enable Bayswater to generate at the 685 MW rated capacity from each generating unit with a marginal decrease in coal consumption and air emissions when compared with the modelled do nothing scenario.

In NSW, air quality is regulated by the EPA and air quality impacts associated with industrial projects are to be assessed in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016).

Key elements of an air quality assessment include:

- Review of air emissions;
- Specification of emission limits and ambient air quality criteria;
- Review of ambient air quality;
- Impact assessment including prediction of air quality impacts and consideration of emissions control; and
- Conclusions and recommendation.

8.3.1 Air Quality Criteria

Ambient air quality criteria relevant to Bayswater as set out in EPA, 2016 are reproduced in Table 8.2.

Table 8.2 : NSW Ambient Air Quality Criteria

Pollutant	Averaging time	Criterion (µg/m^3)	Criterion (ppm)	Reference
Nitrogen Dioxide (NO_2)	1 hour	246	12	NEPC (1998)
	Annual	62	3	NEPC (1998)
Sulphur Dioxide (SO_2)	10 minutes	712	25	NHMRC (1996)
	1 hour	570	20	NEPC (1998)
	24 hours	228	8	NEPC (1998)
	Annual	60	2	NEPC (1998)
Carbon Monoxide (CO)	15 minutes	100 mg/m^3	87	WHO (2000)
	1 hour	30 mg/m^3	25	WHO (2000)
	8 hours	10 mg/m^3	9	NEPC (1998)
Ozone (O_3)	1 hour	214	10	NEPC (1998)
	4 hour	171	8	NEPC (1998)
Hydrogen Fluoride (HF)	24 hours	1.5	2.9	ANZECC (1990)
	7 days	0.8	1.7	ANZECC (1990)
	30 days	0.4	0.84	ANZECC (1990)
	90 days	0.25	0.5	ANZECC (1990)
Particulate matter (PM_{10})	24-hour	50	-	DoE (2016)
	Annual	25	-	DoE (2016)
	24-hour	25	-	DoE (2016)

Pollutant	Averaging time	Criterion (µg/m^3)	Criterion (ppm)	Reference
Particulate matter ($PM_{2.5}$)	Annual	8	-	DoE (2016)
Particulate matter (TSP)	Annual	90 µg/m^3	-	NHMRC (1996)
Deposited dust	Annual (maximum increase)	2 g/m^2/month	-	NERDDC (1998)

The EPA air quality assessment criteria relates to the total concentration of air pollutant in the air (that is, cumulative from all sources) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts.

8.3.2 Measured Ambient Air Quality

The Office of Environment and Heritage (**OEH**) operates the Upper Hunter Air Quality Monitoring Network (**UHAQMN**) as a regional air quality monitoring network of fourteen stations operated in partnership between the NSW Government and the Hunter region coal and power industries.

Air quality monitoring in the vicinity of Bayswater is conducted at Muswellbrook to the north-west, Jerrys Plains to the south-west and Camberwell and Singleton to the south-east. The network continuously measures:

- PM_{10}, wind speed and direction, temperature and humidity at all locations;
- $PM_{2.5}$ at Singleton, Muswellbrook and Camberwell; and
- SO_2 and NO_2 at Singleton and Muswellbrook.

Data from the past five years (2013 – 2017) from each of the four nearest locations was reviewed against the relevant air quality criteria. Annual average, 24-hour average and 1-hour average concentrations are presented for each pollutant as follows:

- PM_{10} annual averages (Table 8.3) and 24-hour averages (Figure 8.1);
- $PM_{2.5}$ annual averages (Table 8.4) and 24-hour averages (Figure 8.2);
- SO_2 annual averages (Table 8.5), 24-hour averages (Figure 8.3) and 1-hour averages (Figure 8.4); and
- NO_2 annual averages (Table 8.6) and 1-hour averages (Figure 8.5).

Any exceedances of the annual criteria have been highlighted. It is important to note that these are exceedances of ambient air quality criteria which reflect contributions from all sources in the region including other industries and natural sources.

Table 8.3 : Annual average PM10 monitoring data from Muswellbrook, Singleton, Camberwell and Jerrys Plains, 2013 – 2017:

Year	Muswellbrook	Singleton	Camberwell	Jerrys Plains	Annual Criterion
2013	22.6	23.3	27.8*	18.6	25*
2014	21.4	21.0	24.6	18.2	
2015	19.1	19.3	22.0	15.5	
2016	19.2	19.3	24.5	16.8	
2017	21.7	20.8	27.4	18.0	

* In 2015 the annual criteria for PM_{10} was reduced from 30 µg/m^3 to 25 µg/m^3

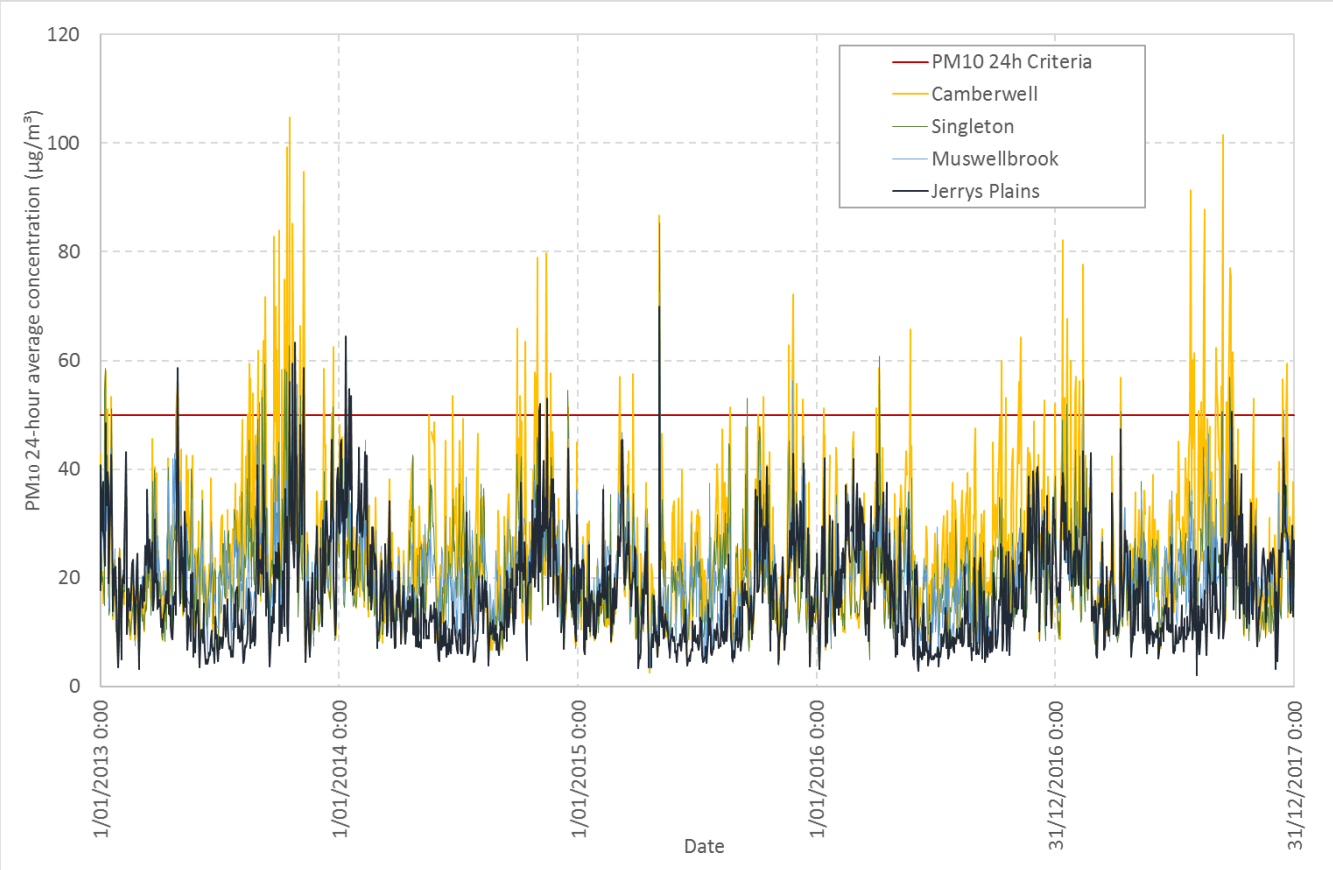


Figure 8.1 : Average 24-hour PM10 (µg/m³) measured at Muswellbrook, Singleton, Camberwell and Jerrys Plains, 2013 – 2017

Table 8.4 : Annual average PM2.5 monitoring data from Muswellbrook, Singleton, Camberwell and Jerrys Plains, 2013 – 2017

Year	Muswellbrook	Singleton	Camberwell	Annual Criterion
2013	9.4*	7.9	8.2*	8*
2014	9.7*	7.8	7.8	
2015	8.7	7.6	7.2	
2016	8.4	7.9	7.5	
2017	9.4	8.2	7.4	

** In 2015 the annual criterion for $PM_{2.5}$ was reduced from 30 µg/m³ to 25 µg/m³ and the 24-hour average from 10 µg/m³ to 8 µg/m³*

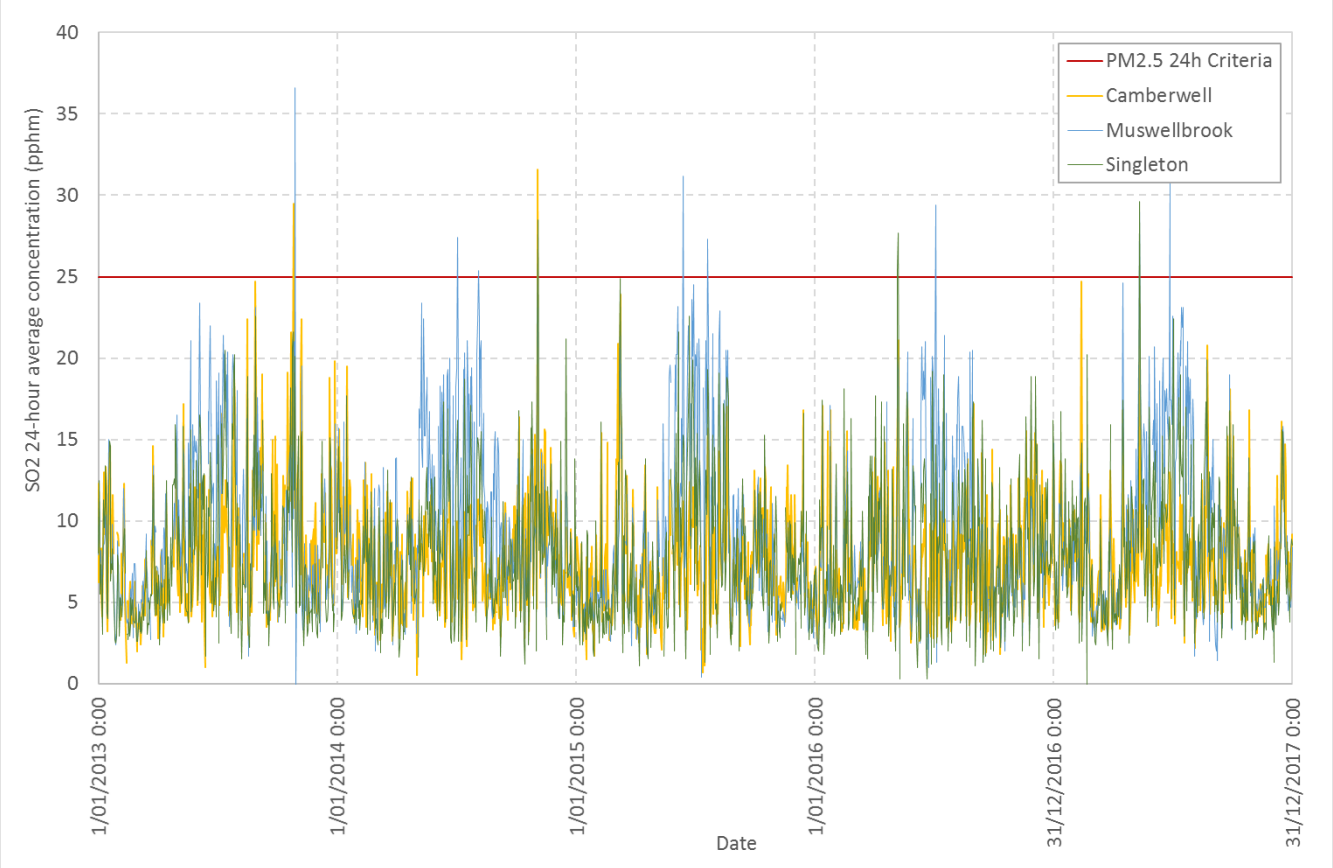


Figure 8.2 : Average 24-hour $PM_{2.5}$ (µg/m³) measured at Muswellbrook, Singleton and Camberwell, 2013 – 2017

Table 8.5 : Annual average SO_2 (pphm) monitoring data from Muswellbrook and Singleton, 2013 – 2017:

Year	Muswellbrook	Singleton	Annual Criterion
2013	0.2	0.1	2
2014	0.3	0.1	
2015	0.2	0.1	
2016	0.2	0.1	
2017	0.2	0.1	

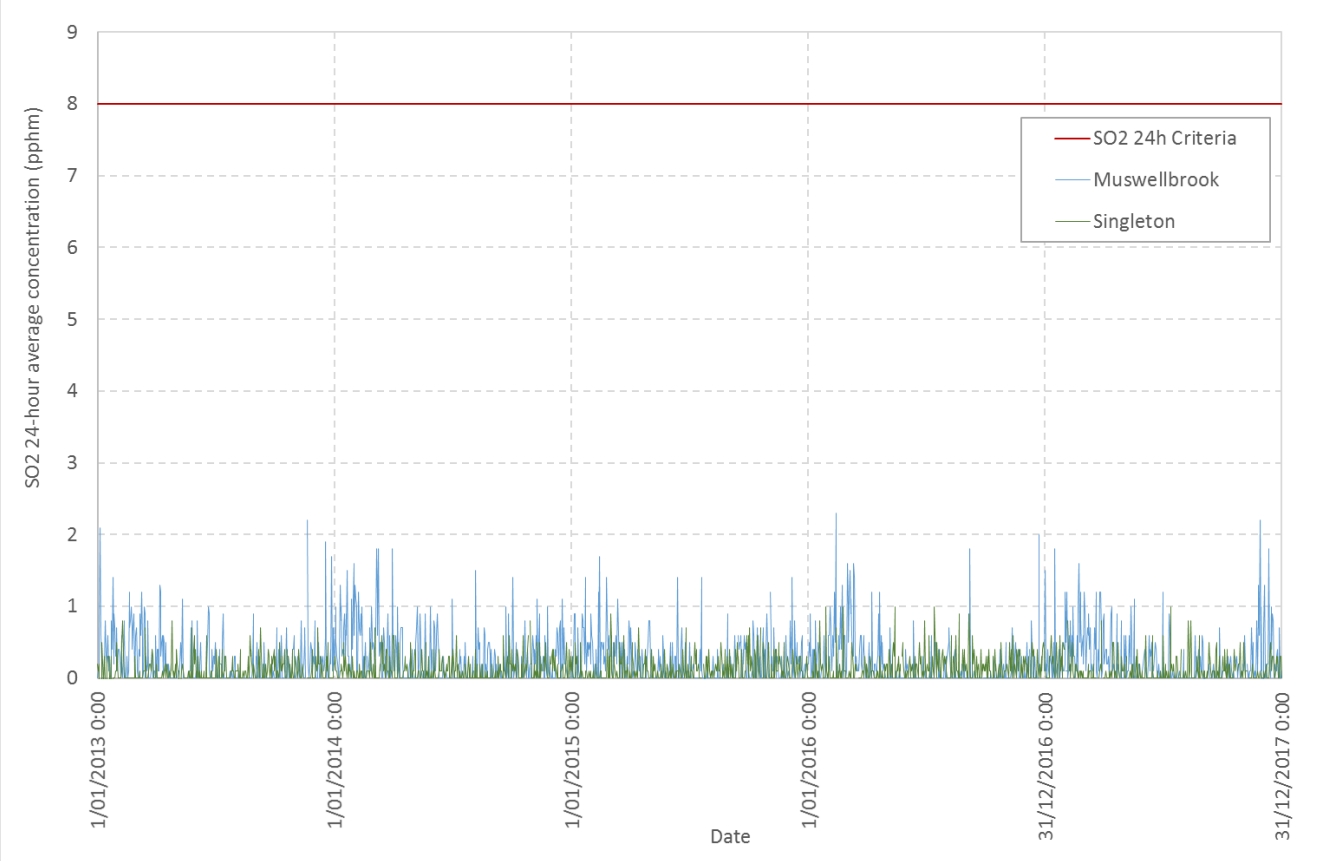


Figure 8.3 : Average 24-hour SO_2 (pphm) measured at Muswellbrook and Singleton, 2013 – 2017

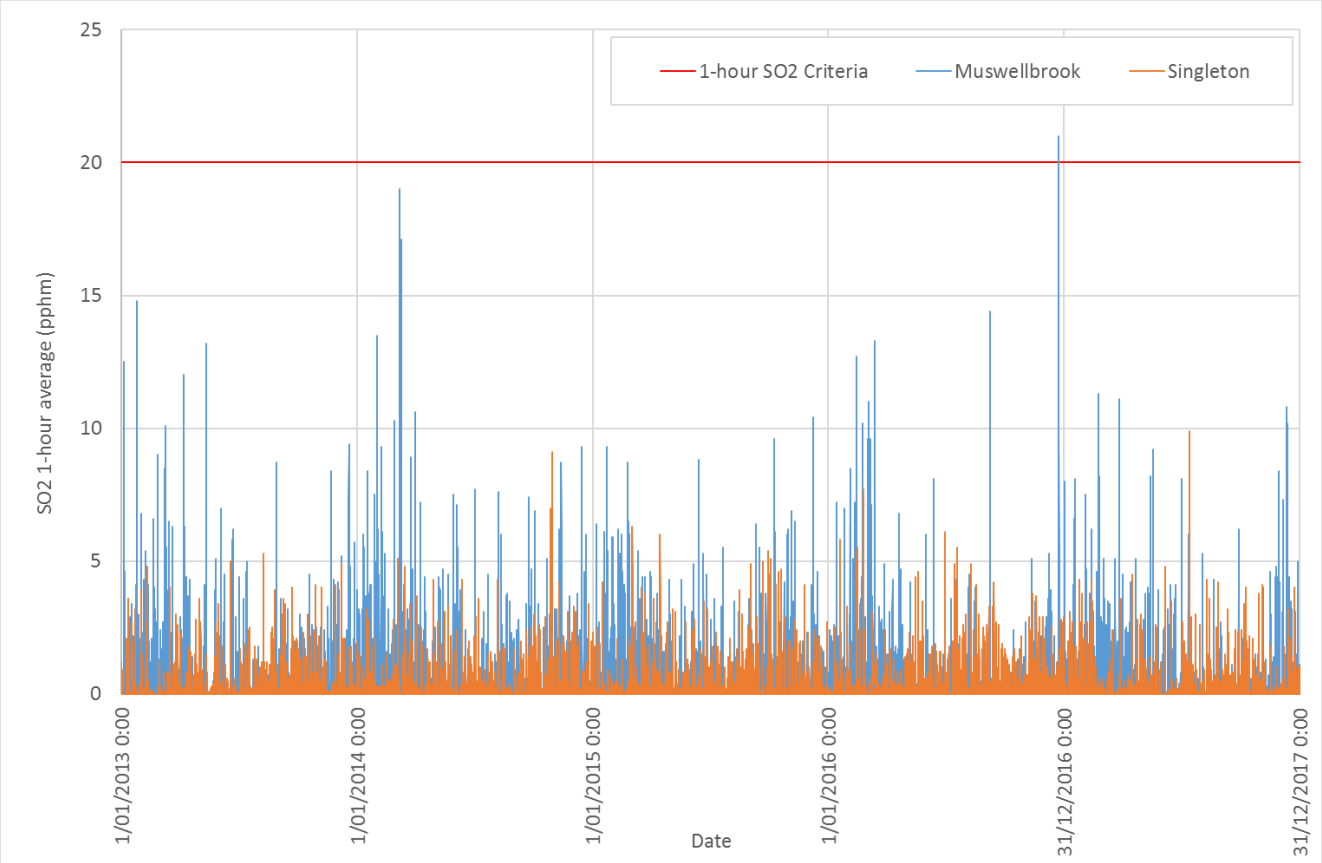


Figure 8.4 : Average 1-hour SO_2 (pphm) measured at Muswellbrook and Singleton, 2013 – 2017

Table 8.6 : Annual average NO_2 (pphm) monitoring data from Muswellbrook and Singleton, 2013 – 2017

Year	Muswellbrook	Singleton	Annual Criterion
2013	0.9	0.9	3
2014	1.0	0.8	
2015	0.9	0.8	
2016	0.9	0.8	
2017	1.0	0.8	

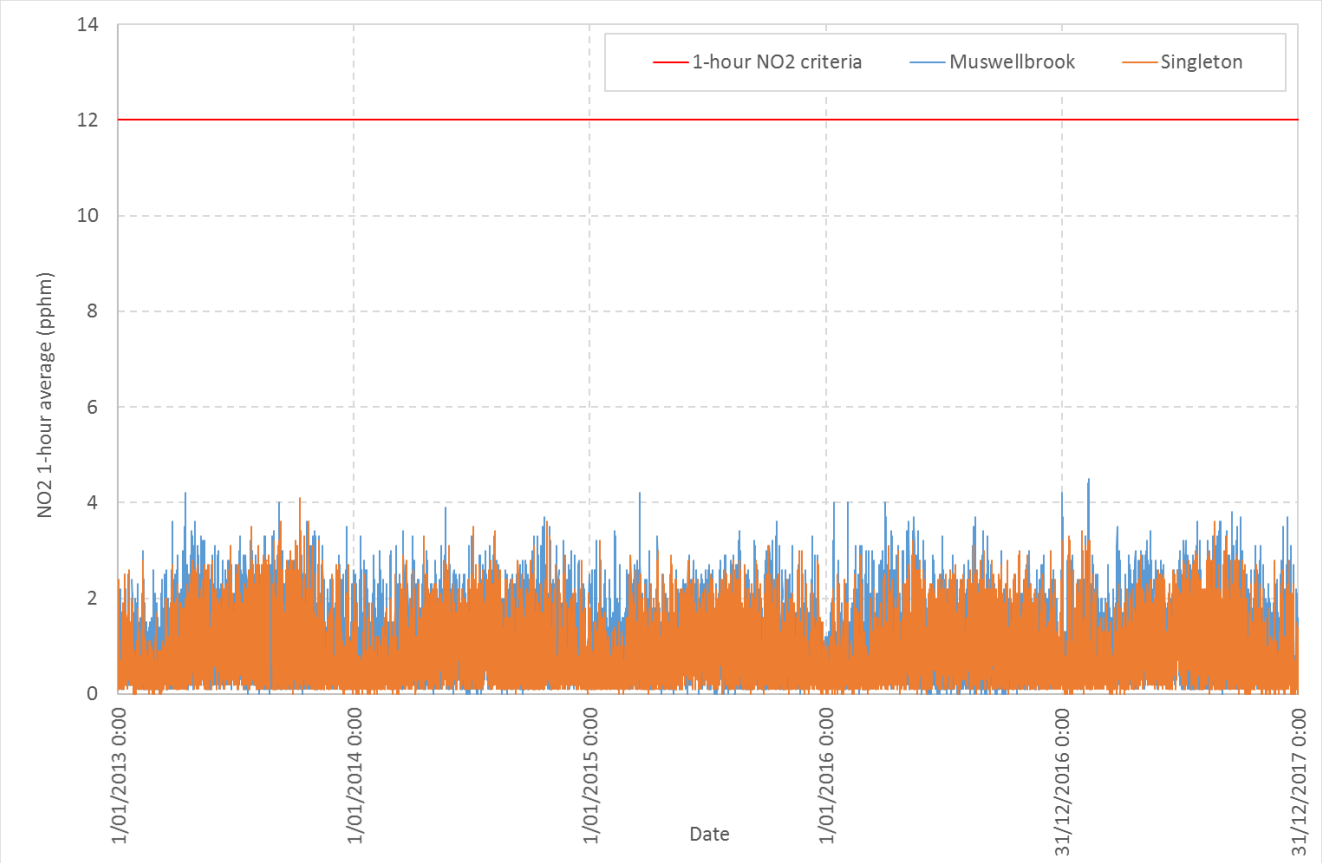


Figure 8.5 : Average 1-hour NO_2 (pphm) measured at Muswellbrook and Singleton, 2013 – 2017:

In summary, ambient quality in the Hunter region is considered as good, noting however, fine particle ($PM_{2.5}$) pollution exceeds annual ambient air quality criteria at the Muswellbrook monitoring station with some exceedances of 24-hour criteria (refer to Table 8.4 and Figure 8.2).

Acknowledging that PM_{10}/$PM_{2.5}$ and NO_X as NO_2 are common to many emission sources in the Upper Hunter including coal mines, agriculture, diesel exhausts and wood fired heaters, SO_2 is considered the best indicator of coal fired power stations impacts on local and regional air quality. As can be seen from Table 8.5, Figure 8.3 and Figure 8.4 annual average and 24-hour ambient SO_2 concentrations are generally low. In terms of 1-hour impacts there has been one exceedance of the SO_2 criteria in the past five years, as measured at the Muswellbrook monitoring station. AGL Macquarie has confirmed that Bayswater and Liddell were in compliance with their EPLs during this time.

In response to elevated fine particle ($PM_{2.5}$) ambient air quality concentrations the OEH and NSW Health commissioned the Upper Hunter Valley Particle Characterisation Study (Hibberd *et al*., 2013) conducted by CSIRO and ANSTO, to explore elevated $PM_{2.5}$ in Muswellbrook and Singleton during winter. Samples were collected for 24-hours, every third day during 2012 using high volume and low volume air samplers. The samples were analysed by ion beam analysis and ion chromatography for twenty elements and black carbon, and then sources were attributed using positive matric factorisation (PMF). The results of the study are reproduced, without error estimates for simplicity in Table 8.7.

Table 8.7 : Contribution of PM2.5 at Singleton and Muswellbrook during 2012, and potential sources (Hibberd et al., 2013)

Factor	Contribution of factor to annual $PM_{2.5}$ mass at Singleton	Contribution of factor to annual $PM_{2.5}$ mass at Muswellbrook	Potential source
1. Wood smoke	14%	30%	Domestic wood heaters
2. Vehicle / industry	17%	8%	Vehicles, industry
3. Secondary sulphate	20%	17%	Such as power stations
4. Biomass smoke	8%	12%	Bushfires, hazard reduction burns
5. Industry aged sea salt	18%	13%	Such as sea salt and power stations
6. Soil	12%	11%	Soil dust and coal dust
7. Sea salt	8%	3%	Sea salt
8. Secondary nitrate	3%	6%	Motor vehicles and power stations

While the largest single source contributor for fine particle ($PM_{2.5}$) sources in the Upper Hunter are wood heaters, coal fired power stations also contribute to these source emissions, both as direct emissions and secondary sulphates and nitrates.

The study demonstrated the importance of secondary particles and long-range transport to $PM_{2.5}$ concentrations, and highlighted the contribution of industry to $PM_{2.5}$ concentrations in the region.

8.4 Assessment of Impacts

As stated above air emissions are a consequence of coal combusting in the Bayswater boilers. Coal input and combustion at Bayswater is not expected to increase from current throughput as a result of the Project. The new turbines at year of opening are expected to need less steam power from the boilers (1,526MWth to generate 685 MW per unit rated capacity as opposed to 1,533MWth to generate 660 MW from the existing units) and it is expected that coal consumption will accordingly decrease slightly.

In the GHG assessment in Chapter 7 coal consumption is forecast over the period 2020-2035 for a base case where the power station continues operation with the existing 660 MW turbines (assuming maintenance outages) compared to the new turbines operating at the 685 MW rated capacity. The forecast considered expected efficiency degradation of the existing and proposed new turbines over time and also that Bayswater will continue to operate at a 69% capacity factor, similar to recent years of operation. Over the 15 year assessment period (2020-2035) there is an annual average decrease in coal consumption associated with operation of the new turbines of 0.1%. Table 8.8 shows changes in coal consumption and air emissions assuming a 0.1 per cent decrease in coal consumption.

Table 8.8 : Coal Consumption and Air Emissions

Pollutant	Load Intensity (kg/tCoal)	Load (kg/year) – existing 660MW units	Load (kg/year) new 685 MW units	Decrease (kg/year)
Coarse Particulates	0.001284372	9436	9427	9
Fluorides	0.082920148	609196	608587	609
Benzo(a)pyrene	5.89374E-08	0.433	0.433	0
Lead	4.90011E-06	36	36	0
Arsenic	3.26674E-06	24	24	0
Sulphur Oxides	8.112105863	59597849	59538251	59598
Nitrogen Oxides	5.422545717	39838245	39798407	39838
Fine Particulates	0.071679848	526616	526089	527
Mercury	0.000010481	77	77	0

The 0.1% decrease in coal consumption is estimated to result in a 0.1% decrease in emissions. Changes of this order are not material and would not result in any significant change in ambient air quality as measured by the UHAQMN (refer to Section 8.3.2).

Additionally, the Project completion coincides with, and is designed to help replace, the announced Liddell closure in 2022. With minor decreases in air from Bayswater associated with the Project and with Liddell emissions reducing to zero, it is estimated that that Upper Hunter airshed power station particulate emissions will reduce by 30-50 per cent, and NOx and SO_2 by approximately 30 per cent. This will result in significant overall net improvements in the Upper Hunter ambient air quality.

9. Traffic and Transport

This chapter addresses the EARs for traffic and transport including:

- *Details of the number, frequency and type of construction related vehicles, key transport routes, and proposed site access and parking arrangements;*
- *An assessment of the likely traffic and transport impacts during the construction of the Project on the capacity, condition, safety and efficiency of the road network, including key intersections; and*
- *A description of the measures that would be implemented to manage and mitigate any impacts, including any proposed road or intersection upgrades developed in consultation with the relevant road authorities (if required).*

9.1 Existing conditions

9.1.1 Site Location and Road Network

Bayswater is located 15km south east of Muswellbrook on the New England Highway. The local land use is primarily rural, with multiple surrounding coal mines and Liddell in the vicinity.

Bayswater has direct access to the New England Highway via slip-lanes and a grade-separated interchange. The key surrounding roads are:

- **New England Highway** – The New England Highway is a national highway linking Newcastle to Brisbane. Near Bayswater the New England Highway is dual carriageway with two lanes in each direction. The speed limit is 100km/h in the section of road near the power station.
- **Bayswater Power Station Access Road** –Bayswater is accessed from the New England Highway via an interchange that is shared by Liddell as shown in Figure 9.1. The roads have no sign-posted speed limits and would therefore be subject to the default speed limit of 100km/h for rural roads. Ownership of the access roads was transferred from Macquarie Generation to Roads and Maritime in recent years.

9.1.2 Access

Access to Bayswater is from an access road that is shared by the Liddell Power Station. Access to Bayswater is controlled by a security gate.

9.1.3 Traffic Volumes

New England Highway

Traffic volumes for the New England Highway were obtained from the Roads and Maritime permanent count station located (ID 6155) located 1.57km south of Muscle Creek Road to the north of Bayswater as shown in Table 9.1.

Table 9.1 : Average Annual Weekday Traffic Volumes

Direction	2016	2017	2018*
Northbound	4,889	4,864	4,680
Southbound	4,915	4,947	4,782
Total	**9,804**	**9,811**	**9,462**

**Up until February 2018*

Source: Roads and Maritime, Traffic Volume Viewer

The average weekday traffic volumes for the New England Highway are in the order of 9,800 vehicles per weekday. The data indicates that 30% of the weekday traffic volumes are heavy vehicles. The hourly traffic volume profile for an average weekday in 2017 is shown in Figure 9.2.

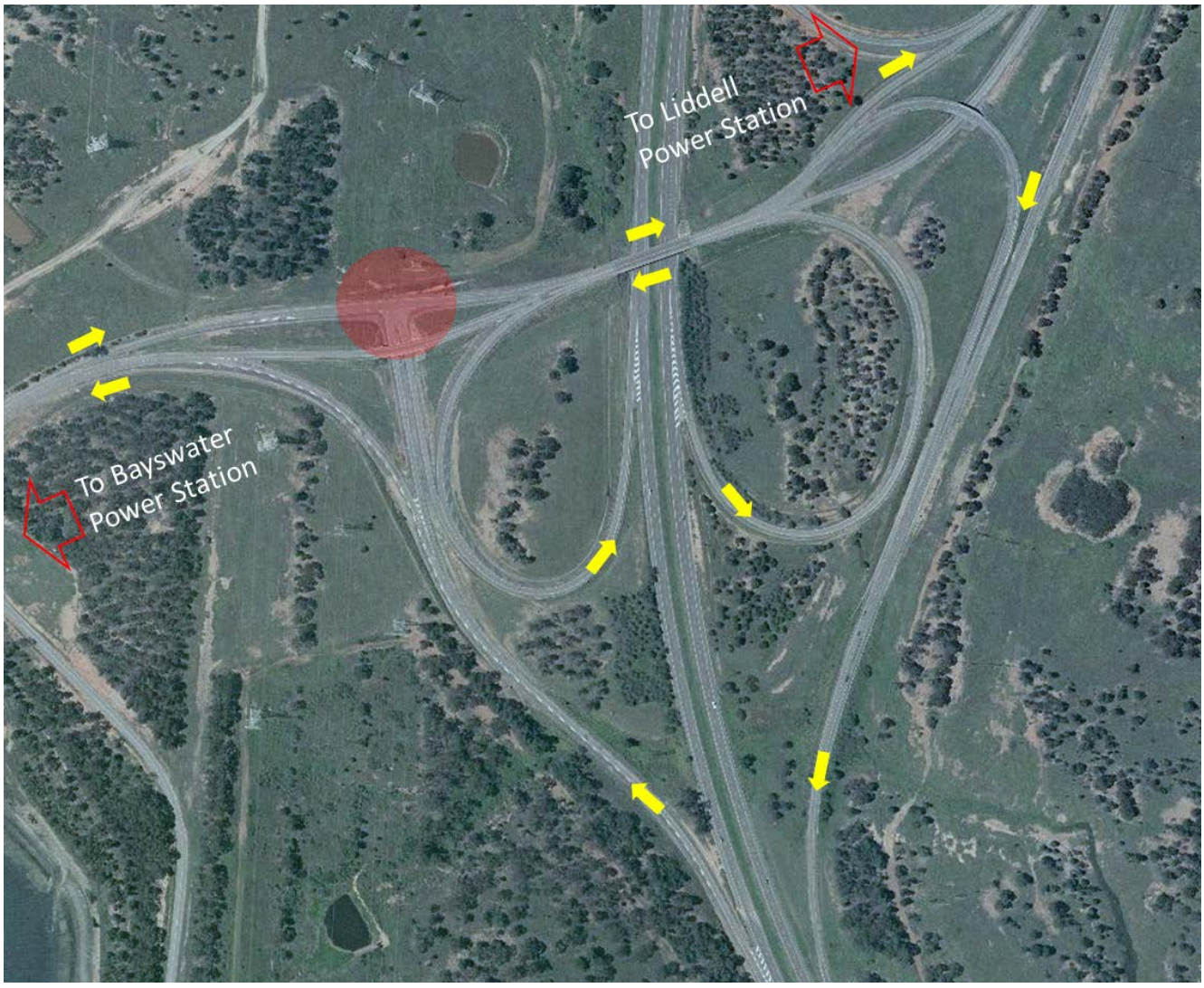


Figure 9.1 : Interchange with the New England Highway

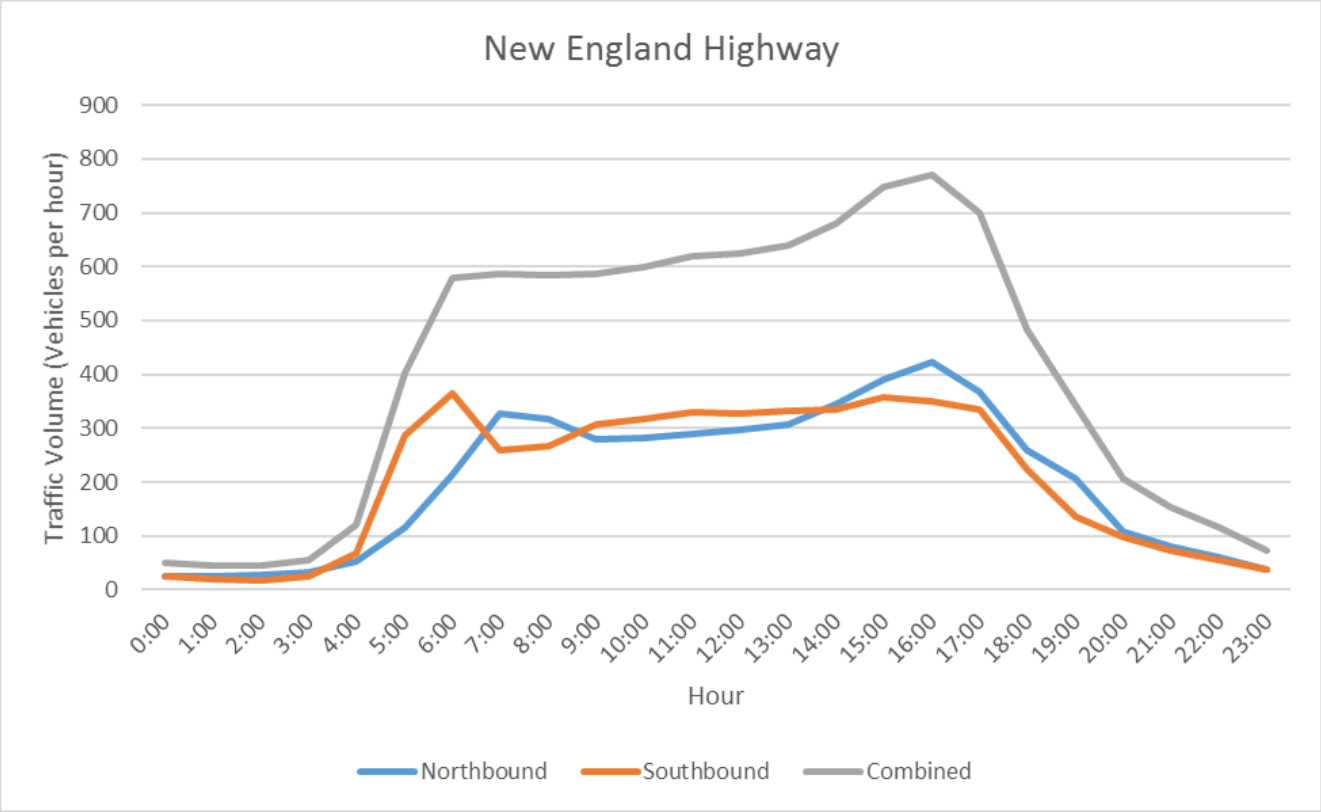


Figure 9.2 : Hourly Traffic Volumes (2017) Average Weekday

Figure 9.2 indicates that peak traffic periods occur in the hours starting at 6:00am and 4:00pm for the morning and evening peaks respectively. Peak hour traffic volumes recorded are provided in Table 9.2. The inter-peak period remains at volumes close to the peaks between 5:00am and 6:00pm.

Table 9.2 : Peak Hour Traffic Volumes

Direction	Morning Peak Hour	Evening Peak Hour 4:00pm – 5:00pm
Northbound	329	422
Southbound	258	349
Total	**587**	**771**

Interchange Traffic Volumes

Traffic surveys were undertaken on 22 May 2018 by TTM. Bayswater was in a maintenance outage period at the time of the surveys and accordingly an additional 462 contractors were at the site. AGL Macquarie confirmed that staffing levels were typical of outage maintenance periods in which the Project would occur. The key traffic volumes are shown on Figure 9.3, Figure 9.4 and Figure 9.5 for the daily traffic, morning peak hour and evening peak hours respectively.

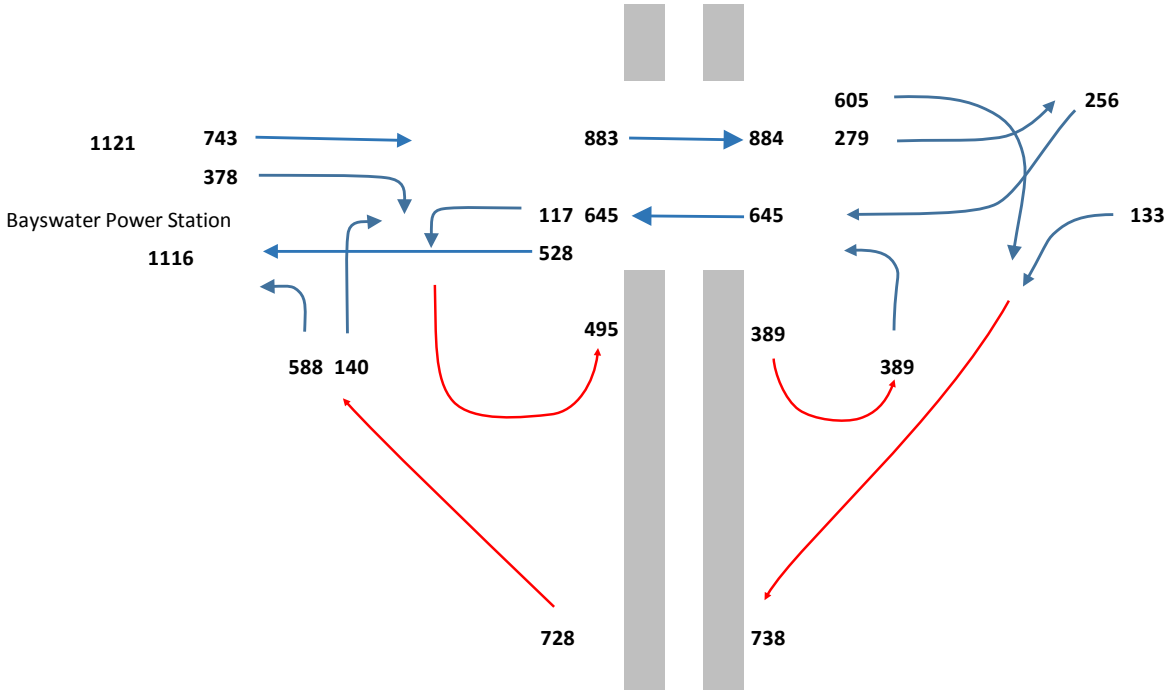


Figure 9.3 : Bayswater Power Station Access Road Daily Traffic Volumes 24 hrs

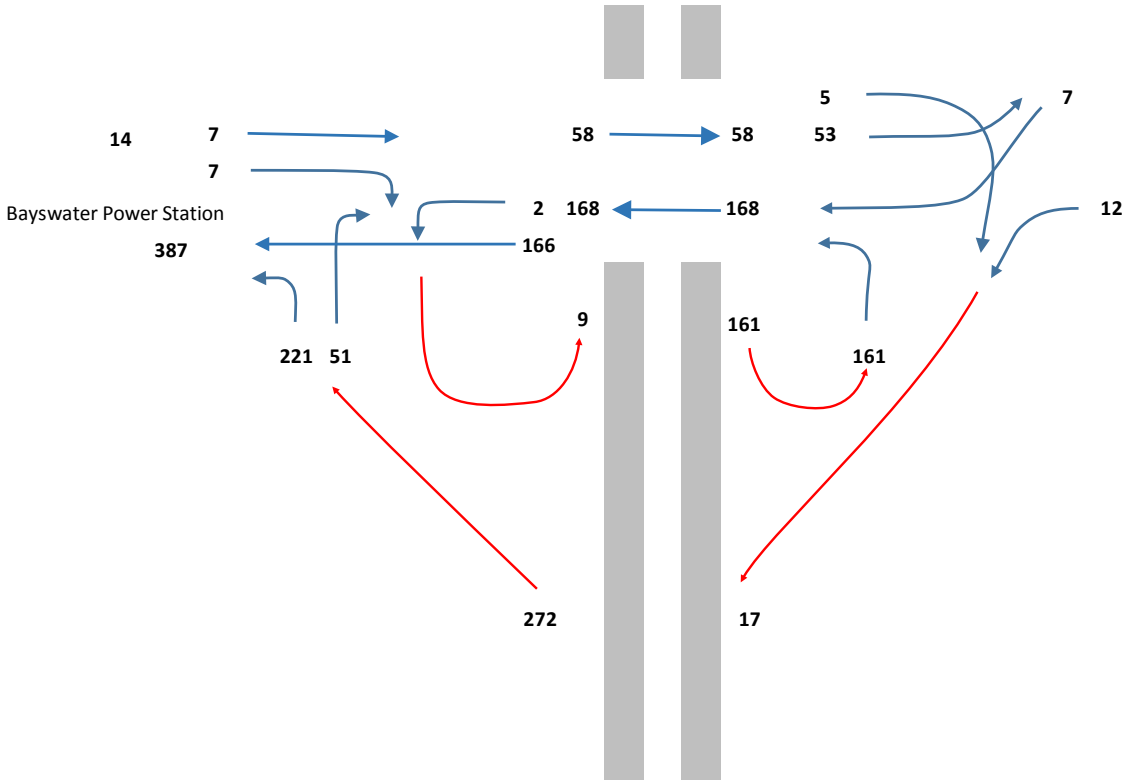


Figure 9.4 : Bayswater Power Station Access Road Morning Peak Hour Traffic Volumes (6:00am - 7:00am)

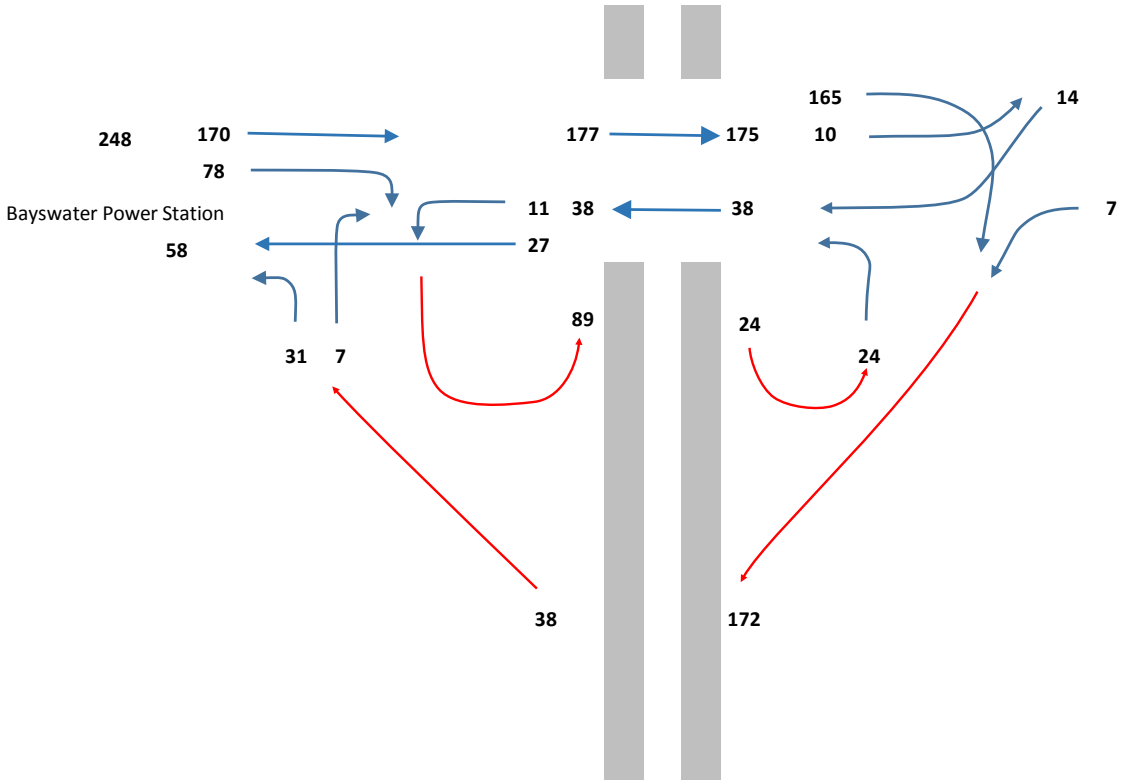


Figure 9.5 : Bayswater Power Station Access Road Evening Peak Hour (5:30pm - 6:30pm)

Most of the traffic generated by Bayswater goes to and from the south. There is only a small volume of traffic between Liddell and Bayswater.

Heavy vehicle volumes at the New England Highway interchange make up between 5 and 10 per cent of the total amount of traffic.

9.1.4 Existing Traffic Generation

The traffic surveys captured a typical shutdown period where AGL Macquarie recorded the attendance of 462 day shift contractors in addition to the typical 98 day shift operational staff. Furthermore, there were 58 night shift contractors in addition to the typical 70 night shift operational staff. The peak period traffic generated in and out of Bayswater is shown in Table 9.3.

Table 9.3 : Existing Traffic Generation During Shutdown

Time Period	Into the Site (Vehicles)	Out of the Site	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

Existing traffic generation data shows that the peak traffic occurs in the hour from 6:00am to 7:00am in the morning and in the evening between 5:30pm and 6:30pm. The traffic generation rate is less than one vehicle for every staff member at Bayswater, however to be conservative one vehicle per person has been modelled.

9.2 Identified Traffic Impacts

The section summarises the scope of the works and estimates of the traffic generation and the distribution of traffic during the Project.

The Project requires the replacement of four turbines over a four-year period. The work is to be undertaken during the annual shut down periods. Shutdowns are scheduled to occur over a 72 day period each year with installation works for the Project occurring over a 50 day period within these scheduled shut-downs. The works will involve:

- Transporting parts and equipment to site;
- Removal of the old turbines;
- Installing the new turbines; and
- Removal of old turbine parts from site.

9.2.1 Traffic Generation

Traffic generated by the Project will involve employees' vehicles and the transportation of containers and oversized turbine parts. Each element of the traffic generation is described below.

Light Vehicles

During the upgrade process 70 workers would be required for this Project commencing work at 6:30am and undertaking a 10 hour shift. The installation contractor anticipates that these workers would form a subset of the contractor numbers that were attending site during the traffic counts. For this assessment it has been conservatively assumed that they would be in addition to the typical shutdown period workers captured by the traffic counts.

The traffic generation rate is assumed to be one vehicle per employee. The estimated traffic generation would be:

- 70 light vehicles to the site during the morning peak period; and
- 70 light vehicles out of the site potentially during the evening peak period if not before.

Heavy Vehicles

There are proposed to be 27 containers delivered in the lead up to the shutdown. These would be transported from Port Botany in Sydney. The installation contractor is required to deliver these containers to Bayswater in advance of each shut-down. For this assessment, it was assumed that five trucks will arrive and five will depart during the peak period of a shutdown. However, it is more likely that these deliveries would occur out of the peak traffic period. The estimated traffic generation used in the assessment is 5 trucks in and 5 trucks out during the morning and evening peak periods.

Oversized Vehicles

Oversized turbine parts would be transported from the Port of Newcastle to the Bayswater. There are proposed to be 10 deliveries of oversized parts to Bayswater and 10 deliveries from Bayswater associated with the removal of the existing turbines. These types of movement would occur outside peak traffic periods and under the escort of traffic controllers and have not been included in modelling of the New England Highway intersection performance.

Summary

For the analysis it has been assumed that the traffic generation would be as shown in Table 9.4 in addition to the typical shutdown period traffic.

Table 9.4 : Project Traffic Generation

Vehicle Type	Morning Peak		Evening Peak	
	To Site	From Site	To Site	From Site
Light Vehicles	70	-	-	70
Heavy Vehicle	5	5	5	5

9.2.2 Traffic Distribution

Traffic distribution was based on the existing traffic patterns during shutdown. There were 588 vehicles (60%) from the south and 161 vehicles (40%) from the north. It is assumed that all heavy vehicles (including trucks) would travel to and from the south.

9.3 Traffic impact assessment

9.3.1 Background traffic growth

The Project impacts will occur over the next four years for 50 days a year during the maintenance outage periods. The access roads to Bayswater is shared only with Liddell, therefore, it is not expected that there would be any growth in background traffic within the next four years within the New England Highway interchange. Growth in traffic on the New England Highway is unlikely to change significantly over the four year period and therefore this is assumed to be negligible growth to warrant further analysis.

9.3.2 Road network performance

Two key intersections within the New England Highway interchange were modelled with Sidra Intersection software using the shutdown period traffic volumes and a scenario including traffic associated with the Project. The locations modelled are shown in Figure 9.6.

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 9.5. 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 9.5 : 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; at signals, 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, version 2.2, 2002)

Figure 9.6 : Intersection Model Locations

The results of the traffic modelling are presented in Table 9.6 and Table 9.7 for the 'T' intersection and the merge.

Table 9.6 : Sidra Results - T Intersection

Scenario	Peak	Average Delay (seconds)	Degree of Saturation	Level of Service
Shut down Period	Morning Peak	8	0.04	A
	Evening Peak	9	0.09	A
Shutdown plus project traffic	Morning Peak	8	0.04	A
	Evening Peak	9	0.12	A

Table 9.7 : Sidra Results - Merge

Scenario	Peak	Average Delay (seconds)	Degree of Saturation	Level of Service
Shut down Period	Morning Peak	6	0.13	A
	Evening Peak	6	0.18	A
Shutdown plus project traffic	Morning Peak	6	0.16	A
	Evening Peak	6	0.18	A

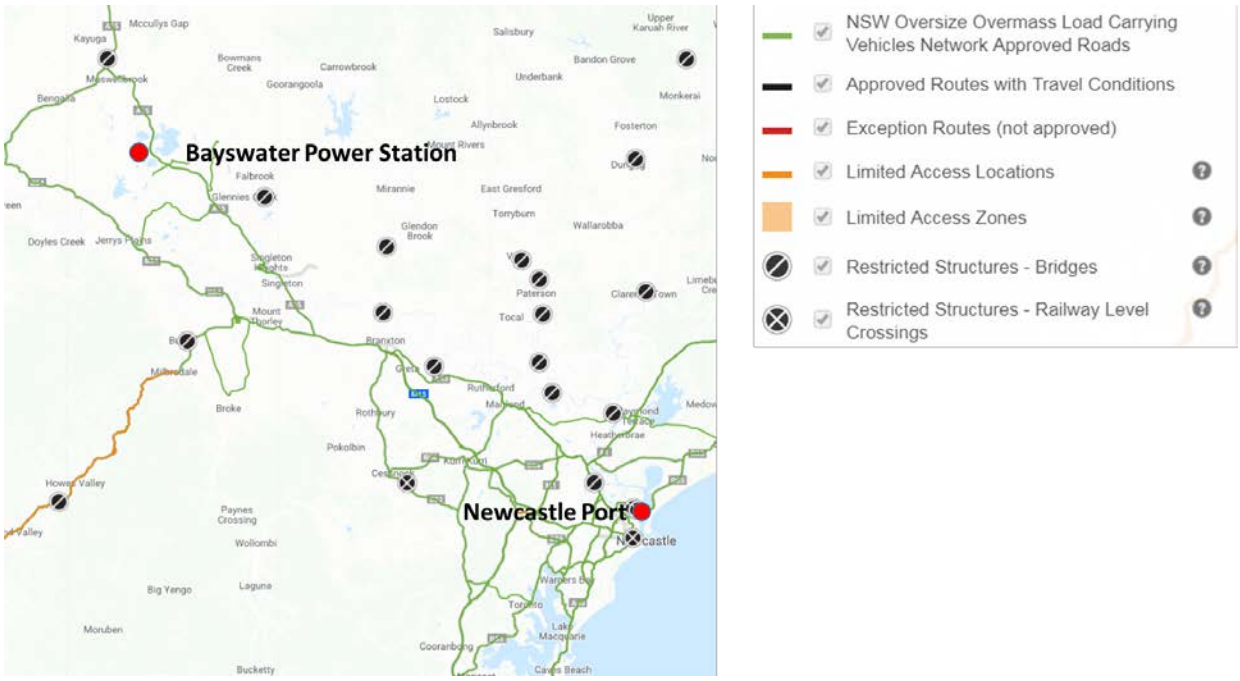
The modelling indicates that the New England Highway interchange operates with excellent levels of service and additional spare capacity. This is mostly due to the grade separation of most of the conflicting movements and low angle merges. Queue lengths under all scenarios will be less than one vehicle and will not impact on the highway operation.

9.3.3 Motorway Impacts

The New England Highway has a divided carriageway and two lanes in each direction. Roads and Maritime data indicates that peak traffic volumes are in the order of 250 to 450 vehicles per hour across two lanes. This indicates that there is sufficient capacity for the forecast traffic vehicles (an additional 30 to 40 vehicles per hour in each direction) to merge without impacting the highway operation. Transport of oversized loads would occur outside of peak traffic periods. The transporting of oversized loads associated with the local coal mines are relatively frequent events along the New England Highway and therefore the impact on the road network would be minimal.

9.3.4 Heavy Vehicle Access Routes

The Project will involve transporting of turbines from the Port of Newcastle Port to Bayswater. The route from the Port to Bayswater would make use of the existing oversized and over-mass load approved road network as shown in Figure 9.7.



Source: Roads and Maritime 2018

Figure 9.7 : Over-size Over-mass Load Carrying Network

9.3.5 Cumulative and operational impacts

Once the turbine upgrade has been completed, Bayswater will return to normal operation. The shutdown periods are timed by AGL Macquarie so that they do not coincide with similar shutdowns at Liddell.

9.4 Environmental management measures

Traffic impacts have been shown to be minimal and would be similar to the impact of the existing shutdown periods that already occur annually and are adequately accommodated by existing access roads and intersections. To minimise the impacts of the movement of the oversized and over-mass deliveries AGL Macquarie will require the haulage contractor to prepare and implement a traffic management plan for these tasks, 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; and
- Communication strategy and liaising with emergency services and police.

10. Other Issues

This Chapter addresses Noise, Land-use Safety, Waste and Water impacts.

10.1 Noise

This section addresses the noise and vibration component of the environmental assessment requirements for the Project including an assessment of any potential changes to the noise and vibration impacts of Bayswater during the construction and operation of the Project.

10.1.1 Existing noise environment

Existing background noise levels in the area surrounding Bayswater are currently influenced by nearby industrial and coal mining activities and road traffic noise from the New England Highway, Thomas Mitchell Drive and the Golden Highway to the south.

The nearest noise sensitive receiver to Bayswater is a single residential property located 3km to the northwest (adjacent to Mt Arthur Coal Mine). This receiver is screened from Bayswater by local topography. Other nearby receivers are located in the vicinity of Antiene (more than 5km to the northeast) and Jerry's Plains (5km to the south). Again both of these areas are screened by local topography.

AGL Macquarie has confirmed that no noise related complaints have been made in recent times associated with Bayswater.

10.1.2 Noise Criteria

Construction noise impacts in NSW are managed in accordance with the *Interim Construction Noise Guideline* (**ICNG**), (DECC, 2009). The ICNG has been developed to assist with the management of noise impacts, rather than to present strict numeric noise criteria for construction activities.

The ICNG describes two methods of assessing noise impacts from construction activities: the quantitative method, which is suited to major and complex construction projects; and the qualitative method, suited to short-term works undertaken during standard construction hours. Owing to the very large separation distances between the work site and nearby noise sensitive receivers and therefore low risk for noise impact, this assessment adopts the qualitative approach.

The Project will require the delivery of equipment and materials required for the upgrade. Potential noise impacts associated with this traffic have been considered in accordance with application notes for the *NSW Road Noise Policy* (RNP), (DECCW, 2011) (http://www.epa.nsw.gov.au/noise/roadnoiseappnotes.htm):

> *'…for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

The Roads and Maritime *Construction Noise and Vibration Guideline* (**CNVG**) notes that this guidance also applies to traffic noise associated with construction activities.

10.1.3 Installation Works Noise Assessment

The installation works for the Project (refer to Section 3.2) will coincide with the scheduled maintenance outage works of each turbine as described in Table 2.1. The installation works for the Project are also consistent with outage works undertaken in 2017 and May 2018 which required the removal of turbine casing, inspection and maintenance of turbine components and reassembly. As such the Project installation works are predicted to be

consistent with conditions experienced on site during noise level monitoring undertaken in association with the assessment of the Project.

The following plant and equipment would be used during installation:

- Existing overhead heavy lift cranes;
- Small cranes and elevated work platforms;
- Hand tools including grinders, welders, drills and pneumatic ratchets; and
- Transport vehicles including overweight and over mass vehicles to deliver large turbine components.

With the exception of deliveries (refer to Section 3.2.4) and dispatch of waste (refer to Section 3.2.5), all installation activities associated with the Project would be contained within the fully enclosed turbine hall. No additional laydown areas, access upgrades, parking areas, temporary or permanent structures or clearing is required to facilitate the Project.

Noise measurements of turbine maintenance works during an outage, considered by AGL Macquarie to be representative of works anticipated associated with the Project, were carried out on 25 May 2018. These measurements were used to predict likely noise impacts associated with the installation works. Operator attended noise measurement was carried out using a Svantek Svan 958A Type 1 Precision Sound Level Meter (serial number 34557). The instrument was positioned 1.2 metres above ground level and was fitted with a windshield. The sound level meters were set on A-weighted, fast. Observations of ambient noise influences were recorded during the measurement interval. Instrument sets were calibrated by a NATA accredited laboratory within two years of the measurement period and comply with Australian Standard AS-1259: *Sound Level Meters*.

Noise measurements from within the turbine hall indicated that, with the exception of short term noise from hand tools, $L_{Aeq\ (15\ minute)}$ noise levels during maintenance activities were 15dB(A) lower than the total noise of the operating turbines. External noise measurements were also taken at the site access road, located 500 metres north west of the turbine hall. At this location turbine maintenance works noise was inaudible. On the basis that the installation works for the Project would be very similar to the works undertaken at the time the noise measurements were undertaken, noise impacts associated with the installation works for the Project are considered to be highly unlikely.

Installation noise impacts are not expected as a result of the Project.

10.1.4 Installation works traffic noise assessment

The Project will require an estimated 70 additional workers attending site over a scheduled 50-day installation program each year for four years. Staff undertaking the installation works will be accommodated in the Hunter region and travel to site each day in private vehicles or by private bus. The contractor parking provided on site is capable of accommodating the standard shutdown workforce.

- It is anticipated that 11 heavy load and 27 standard shipping container deliveries will be required per 50-day shutdown period; and
- All deliveries would be to the existing loading bay within the turbine hall using existing established access roads, with turbine components being lifted to the turbine floor by existing cranes located within the turbine hall.

Heavy vehicle deliveries will generally be made from the Port of Newcastle and Port Botany, and will arrive to the site only via existing designated heavy vehicle routes. The New England Highway presently conveys a high volume of heavy vehicles and an additional 38 heavy vehicle trips per year, even if these were to occur within the space of one day, would make no discernible difference to existing levels of traffic noise.

Likewise, the addition of a single return bus trip or seventy light vehicles from within the Hunter region to Bayswater will not noticeably increase existing levels of road traffic noise from the New England Highway.

10.1.5 Operational noise assessment

Currently the EPL for Bayswater does not contain specific noise limits relating to noise from operations.

Changes to noise emissions as a result of turbine replacements are typically associated with changes to turbine blade shape, changes to blade passing frequency, operating steam pressure or the position and specification of the control valves. In order to predict noise impacts associated with the Project, specifications for the existing and proposed equipment were compared. Jacobs has been advised by AGL Macquarie that no changes are proposed to either the operating steam pressure or the control valves and as such noise emissions associated with these sources will remain unchanged.

The turbine manufacturer has confirmed that the maximum noise emitted from the upgraded turbines would not be greater than the maximum noise levels generated by the current turbines.

Changes to the blade shape or passing frequency typically affect high frequency noise emissions. Noise of this type attenuates rapidly. Given the large separation distances to the nearest noise sensitive receivers (about 5km), any changes to high frequency noise emissions, should they eventuate as a result of the Project, are unlikely to be audible at these properties.

10.1.6 Noise management measures

No installation or operational noise impacts are expected to occur as a result of the Project. Accordingly, no specific noise management measures are required for the Project.

10.2 Land-use Safety

This section addresses the land-use safety component of the environmental assessment requirements for the Project including a preliminary risk screening completed in accordance with Hazardous and Offensive Development Application Guidelines - Applying SEPP 33. Should the screening indicate that the Project is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis.

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".

The methodology used to address the land-use safety environmental assessment requirements has responded to the SEPP 33 Guidelines and included:

- Screening of hazardous chemicals proposed to be used in the turbine hall either associated with the Project installation works or coinciding upgrade works to confirm that the Project is not potentially hazardous in its own right;
- Screening of hazardous chemicals associated with the existing operation of Bayswater to confirm that these do not 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 Macquarie's current approach to risk management at Bayswater to provide confidence that Bayswater would remain acceptable in its current location.

10.2.1 SEPP 33 Screening

The SEPP 33 Guideline screening procedure is based on the quantity of dangerous goods involved in the proposal and, in some cases, the distance of these materials from the Bayswater site boundary. Key inputs to the screening exercise provided by AGL Macquarie include:

- Details from Toshiba as to the components expected to be delivered to Bayswater and used within the turbine hall during the installation works for each generating unit; and
- Current Hazardous Chemicals manifest and plan of storage locations for the existing operations of Bayswater.

The information provided by Toshiba lists the chemicals to be shipped to site for the Generator Stator Rewind Work (which does not form part of the Project) and the Turbine Efficiency Upgrade Project (the Project). The chemicals specified to be used for generator rewind work are not associated with the Project. To provide a conservative approach, a SEPP 33 screening of all chemicals listed (including the Generator Stator Rewind Work which does not form part of the Project) was undertaken as the Project work may be carried out in the same place and at the same time.

The chemicals to be used in the turbine hall are class 3 and class 8 chemicals in quantities well below the screening threshold. Table 10.1 shows the screening results of the packing list chemicals to confirm that the Project is not "potentially hazardous" by itself. A PHA as per HIPAP paper no. 6 is not deemed necessary for the Project.

Table 10.1 : SEPP 33 Screening

Area	Material	DG Class	Sub Risks	PG	Qty (L)	Storage	Screening Method	Threshold(Tonne)	Remark
Turbine hall	Polyester Resin	3		II	72	SKID			
Turbine hall	Thinner	3		II	355	SKID			
Turbine hall	Varnish	3		II	11	SKID			
				Total	**438**		Graph if >5T	5	Below Threshold
Turbine hall	Hardener	8		III	1	CASE	Table 3	50	Below Threshold

A review of hazardous chemicals handled and stored as part of existing ongoing operations at Bayswater was undertaken to assess potential interaction of the Project with the current chemical storage locations and to ensure that the risks of existing Bayswater operation are effectively managed and meet regulatory compliance requirements. Through the review of various documented evidences provided by AGL Macquarie, it was determined that:

- Management of hazardous chemicals on site is governed through AGL Macquarie 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 Macquarie 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 Macquarie 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 the EPL.

The storage locations of the hazardous chemicals associated with the existing operation are not within the turbine hall. 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 will 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.

10.2.2 Management of Change

Risks associated with the Project are managed through a Management of Change process. AGL Macquarie has identified the Project as a 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). In accordance with AGL Macquarie's *Asset Change Management Standard*, a major change must undergo a detailed risk assessment using AGL Macquarie's *Risk Management and Assessment Framework* to assess the risks that may be introduced by the proposed change.

The Project risk profile has been assessed in line with AGL Macquarie's *Integrated Risk Assessment Matrix*. The management of Change process is executed through SAP and the actions are documented in the Design Risk Assessment Form. Absence of land use safety risk on this form indicates that no new land use safety risks have been identified for the Project in the design risk assessment.

10.2.3 Summary of Land-use safety change

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 turbine hall 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.

10.2.4 Mitigation Measures

The following land-use safety mitigation measures will be implemented prior to and during the installation works for the Project:

- Completion of all outstanding actions arising out of the management of change process; and
- Preparation of a Health Safety and Environment Management Plan for the Project as a component of the wider outage works Health Safety and Environment Management Plan.

10.3 Waste

This section addresses the waste component of the environmental assessment requirements for the Project including identification, quantification and classification of the likely waste stream to be generated during construction and operation of the Project in accordance with the EPA Waste Classification Guidelines, and a description of the measures to be implemented to manage, reuse, recycle and safely dispose of waste generated by the Project.

10.3.1 Regulatory context

In NSW the Waste Avoidance and Resource Recovery Act 2001 (**WARR Act**) and the POEO Act are the key legislation that govern the issues of waste generation, reuse, recycling, transport and disposal and establish a waste hierarchy (see Figure 10.1).

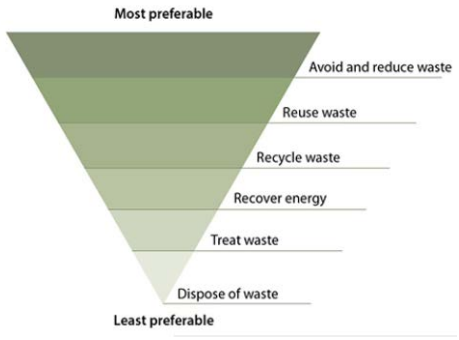


Figure 10.1 : The Waste Heirarchy in NSW

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)
- 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 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 Environment Protection Authority 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.

10.3.2 Assessment methodology

The NSW EPA Waste Classification Guidelines (2014) sets out a six step process for establishing the classification of waste as set out in clause 49 of Schedule 1 of the POEO Act.

It is expected that waste associated with the Project would comprise of turbine packaging, the old turbine components (steel) and residues.

Building and demolition wastes are pre-classified as 'general solid waste (non-putrescible)' if they are unsegregated material (other than material containing asbestos waste or liquid waste) that results from the construction, replacement, repair or alteration of infrastructure development such as roads, tunnels, sewage, water, electricity, telecommunications and airports and includes materials such as bricks, concrete, paper, plastics, glass and metal.

Segregation of waste is permitted to facilitate reuse, recycling or recovery. The following waste types listed in the *NSW EPA Waste Classification Guidelines* have been identified for this Project:

- Glass, plastic, rubber, plasterboard, ceramics, bricks, concrete or metal;
- Paper or cardboard;
- Wood waste; and
- Building and demolition waste.

10.3.3 Waste identification and quantification

Table 10.2 provides an estimate of tonnage, broken down by waste type for the Project.

Table 10.2 : Waste Materials and Estimated Tonnages

Description	Materials	Classification	Quantities (tonnes)			
			HP	IP	LP-A	LP-B
Turbine Components	Steel	general solid waste (non-putrescible)	40.2	45.8	129.0	129.0
Packaging*	Clean pallets, dunnage and other wood waste	general solid waste (non-putrescible)	6.0	8.2	19.0	19.0
	Composite wood packaging	general solid waste (non-putrescible)				
	Plastic packing	general solid waste (non-putrescible)				
	Plastic wrap	general solid waste (non-putrescible)				
Maintenance waste	Consistent with existing maintenance and not proposed to be handled separately					

** Exact composition of packaging materials is unknown (as these are not weighed separately) but comprises approximately 12% of the total net weight of new turbine components.*

The Project installation process will generate similar wastes to those produced during general maintenance through handling components, cleaning, lubrication and other activities. Maintenance type waste, generated during the installation process will be managed in accordance with the AGL Macquarie Waste Management Plan (2016, AGLM-HSE-PLN-009.07 version 2.0).

10.3.4 Offsite Transport and Disposal

Table 10.3 summarises the intended management measures for anticipated waste streams associated with the Project. All waste will be tracked in accordance with *Protection of the Environment Operations (Waste) Regulation 2014*. Waste tracking documentation will be provided where required for all waste disposed of offsite. Where Consignment Authorisations are required they are arranged on behalf of AGL Macquarie by Toshiba and its waste contractor. All required waste tracking documentation will be kept by AGL for four years.

Table 10.3: Summary of Waste Materials and Management Plan

Description	Materials	Recycling or Reuse options
Turbine Components	Steel	Scrap steel recycling. Used turbine components are 'end of life' with no option for reconditioning or reuse.
Packaging	Clean pallets, dunnage and other wood waste	Reused for transporting old turbine components to metals recycler where practicable
	Composite wood packaging	Reused for transporting old turbine components to metals recycler where practicable
	Plastic packing	Recycling where practicable
	Plastic wrap	Recycling where practicable

10.3.5 Mitigation Measures

As the supplier, Toshiba will be contracted to dispose of the old turbine components and packaging. The following commitments have been made:

- Up to 100% of the metal turbine components will be recyclable at an offsite recycling facility;
- The principal or structural elements of the new turbine packaging will be used to package the old turbine components where practicable, assisting onsite handling and onward transportation for recycling;
- Where recycling options are not available, waste classified as General Solid Waste (putrescible or non-putrescible) would be transported by a licensed contractor for disposal at a licensed solid waste landfill; and
- Hazardous wastes are not anticipated to result from the Project, but were they to occur they would be segregated from other waste streams and stored in an appropriately bunded area prior to transportation offsite. Transportation of hazardous waste would be undertaken by a licensed waste transporter for disposal at a suitably licensed facility, in accordance with the existing Waste Management Plan for Bayswater.

10.4 Water

This section addresses the water component of the environmental assessment requirements for the Project including an assessment of any potential changes to the existing water supply arrangements for the Bayswater Power Station as a result of the construction and operation of the Project, including any associated licensing requirements.

10.4.1 Existing Environment

Bayswater requires secure water supplies to operate and as such requires access to a large volume of water. AGL Macquarie holds a water licencing package (NSW Office of Water, 2011). This water licensing package brings together all the Water Access Licences (**WALs**) and Combined Water Supply and Use Approvals (**CAs**) (also collectively referred to as regulatory instruments within the package) held by AGL Macquarie for Bayswater and Liddell. Although the WALs and CAs are separate regulatory instruments in themselves their

overall management is intrinsically linked. The Water Licensing Package recognises the links between these instruments and intended to facilitate the coordinated management of the use of water resources for the purpose of power generation. The main aims of the Water Licence Package as stated by NSW Office of Water (2011) were to:

- Provide a repository of all of the regulatory instruments under the Water Management Act 2000 (WM Act) held by Macquarie Generation;
- Assist with management of Macquarie Generation's use of water resources in a holistic and efficient manner; and
- Provide a linkage for the reporting requirements within all of the regulatory instruments to avoid duplication.

The WALs and CAs were transferred to AGL Macquarie as part of the acquisition of Macquarie Generation, and are updated on an annual basis, while the Water Licence Package has not been updated. Nevertheless, the intent of the Water Licence Package remains applicable and is to enable AGL Macquarie to obtain sufficient water for the operation of Bayswater and Liddell in the long term.

While the specific details of WALs and CAs held by AGL Macquarie differs from those listed in the Water Licence Package, the current WALs and CAs provides for water to be taken from various sources, including purpose built storages, to ensure Bayswater and Liddell can continue to operate during extended periods of drought. Details of current WALs held by AGL Macquarie are provided in Table 10.4 and the CAs held in relation to Bayswater as summarised in Table 10.5.

Table 10.4 : Existing Water Access Licences

Water Access Licence	Category	Tenure	Share
18317	Unregulated river	Continuing	20 Units
18322	Unregulated river	Continuing	5 Units
23300	Major Utility	Specific Purpose	770 Mega litres
498	Regulated River (High Security)	Continuing	16 Units
499	Regulated River (General Security)	Continuing	21 Units
527	Regulated River (General Security)	Continuing	207 Units
7810	Regulated River (High Security)	Continuing	3 Units
7811	Regulated River (General Security)	Continuing	168 Units
10266	Major Utility (Power Generation)	Specific Purpose	36000 Mega litres
10265	Regulated River (High Security)	Continuing	1735 Units
10267	Regulated River (General Security)	Continuing	2271 Units
10264	Supplementary Water	Continuing	36000 Units
10347	Regulated River (General Security)	Continuing	59 Units
10472	Regulated River (General Security)	Continuing	40 Units
13777	Regulated River (General Security)	Continuing	68 Units
13779	Regulated River (General Security)	Continuing	74 Units

Table 10.5 : CAs

Works Approval	Kind	Authorised Works
20CA211020	Water Supply Works Water Use	Construct and use the water supply works being the Liddell Cooling Water Dam, Lake Liddell Pumping Plant, Plashett Dam and Freshwater Dam to capture, store, transfer and extract water for Power Generation and Associated Activities and to release water for environmental and other releases as required by the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources.
20CA211343	Water Supply Works and Water Use	Construct and use the water supply works being the Weir and spillway (Oaky Creek Regulating Structure) and discharge structure to capture, store, transfer and extract water for Power Generation and Associated Activities and to release water for environmental and other releases as required by the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources.
20CA203133	Water Supply Works and Water Use	Construct and use the water supply works being the Jerrys Plains Pumping Station, to capture, store, transfer and extract water for Power Generation and Associated Activities and to release water for environmental and other releases as required by the Water Sharing Plan for the Hunter Regulated River Water Source.

Due to the overall water balance deficit in relation to rainfall verses evaporation in the region, water used at Bayswater is predominantly sourced from regulated water supplies subject to these existing WALs under the WM Act. Water use and management at Bayswater is intrinsically linked with the operation of Liddell due to cross-reliance on storage and pumping infrastructure. Regulated water is extracted from the Hunter River and transported to Bayswater via the Plashett pumping station or the Hunter River pumping station. Water is pumped to storages or directly into the Bayswater cooling water make up reservoir. Unregulated water is also impounded on site including rainfall and run-off from surrounding lands.

The majority of the water obtained by AGL Macquarie is consumed through evaporation. This includes natural evaporation from storages and forced evaporation through the cooling towers at Bayswater and Lake Liddell for Liddell. Other existing uses for the water at Bayswater include supply for use in the boiler water system, domestic water system, fire water system, wash down water system and make up water for the ash water system.

10.4.2 Consideration of potential changes

The Project does not involve a change in the source, storage, use or treatment of water at Bayswater. There is available capacity within existing infrastructure including pumping and storage and management systems to facilitate the continued operation of Bayswater. The Project does not affect the water consuming infrastructure or processes.

11. Socio-economic assessment

This Chapter addresses the social and economic component of the environmental assessment requirements for the Project including an assessment of the likely social and economic impacts and benefits of the project for the Muswellbrook LGA (including consideration of any increase in demand for local infrastructure and services), the Hunter Region and the State as a whole.

11.1 Assessment methodology

Bayswater is located within the Muswellbrook Shire LGA in the Hunter region of NSW. The Project is located near the boundary of Muswellbrook Shire with the Singleton LGA. Installation workers for the Project are proposed to be accommodated in the Hunter region. The study area for this assessment includes both 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 Environment and Planning, 2017). It involved:

- Scoping of the potential socio-economic issues relevant to the upgrade of the Bayswater power station and of communities likely to be most affected by the proposal and identification of the study area;
- Describing the existing socio-economic environment of the study area to provide a baseline from which impacts of the proposal 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 significance of potential social risks for the identified impacts as outlined in the *Social impact assessment guideline for State significant mining, petroleum production, and extractive industry development, September 2017* (refer to Figure 11.1). This considered the:

- 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.

			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: DP&E (2017)

Figure 11.1 : Risk assessment matrix

Information on Australian and NSW Government policies and AGL policies relevant to the Project are discussed in Section 1.6.

11.2 Existing socio-economic 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.

11.2.1 Regional context

The study area for this assessment is located within the Hunter region of NSW.

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 key population centre in the region with Singleton and Muswellbrook being key 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.

The Muswellbrook LGA is located in the Upper Hunter Valley region, 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 numerous rural communities (www.economyprofile.com.au/muswellbrook). 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 this LGA (NSW DP&E, 2016).

The Singleton LGA is located approximately 75 km 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. This 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 DP&E, 2016).

Bayswater is located between Singleton and Muswellbrook and over recent years has produced over 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.

11.2.2 Community profile

Table 11.1 provides an overview of key population and demographic characteristics of communities in the study area, compared to NSW.

Muswellbrook LGA had an estimated resident population (**ERP**) of 16,427 people in 2017, while Singleton LGA had an ERP of 23,496 people. This is projected to grow to 20,300 people and 28,600 people respectively by 2036. Over the 10 years to 2017, the population of the LGAs grew at an average annual rate of growth well below the NSW average. This trend is projected to continue through to 2036, although the rate of growth for the Muswellbrook and Singleton LGAs is projected to be above past growth rates.

Compared to NSW, the Muswellbrook and Singleton LGAs generally has:

- Younger population, with lower median ages, higher proportions of children and lower proportions of older people;
- Lower levels of cultural diversity, with lower proportions of people born overseas or who speak a language other than English at home;
- Higher proportions of couple only families in Muswellbrook and higher proportion of families with children in Singleton;

- Housing that comprised predominantly separate detached dwellings and lower rental costs; and
- Higher proportions of rental accommodation in Muswellbrook LGA and lower proportions of rental accommodation in Singleton, which may reflect the likely fly-in/fly-out workforce associated with mining operations and greater distance of Muswellbrook to Newcastle.

Table 11.1 : Population and demographic characteristics

Demographic	Characteristic	Muswellbrook LGA	Singleton LGA	NSW
Population and growth	Estimated resident population (2017)*	16,427	23,496	7,861,068
	Average annual change in ERP (2007-2017) (%)	0.4%	0.4%	1.4%
	Population projection (2036)**	20,300	28,600	9,925,550
	Projected annual change in population	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 (%)	7.9	7.9	27.7
	Speaks language other than English (%)	3.5	3.1	25.2
Families and households***	Couple family with no children (%)	37.2	36.1	36.6
	Families with children (%)	42.5	47.9	45.7
	Total families	4,095	5,962	1,940,226
Housing***	Total private dwellings	5,764	7,741	2,604,314
	Separate houses (%)	87.8	87.7	66.4
	Rented (%)	38.9	28.4	31.8
	Median weekly rental costs ($)	250	280	380

*Sources: *Based on ABS (2018), ERP by LGA and by SA2 and above, 2001 to 2017; **DP&E (2016), 2016 NSW State and Local Government Area Population Projections; ***Based on ABS 2016 Census of Population and Housing, General Community Profile for Muswellbrook (A) LGA, Singleton (A) LGA and NSW*

11.2.3 Economic profile

Table 11.2 provides an overview of income and employment data for communities in the study area, compared to NSW. At the 2016 Census, compared to NSW:

- Muswellbrook LGA generally had lower weekly personal and household incomes, lower levels of workforce participation and higher levels of unemployment; and
- Singleton LGA generally had higher personal and household incomes, higher levels of workforce participation and lower levels of unemployment.

The importance of coal mining to the economy of the LGAs is reflected in coal mining being the highest industry of employment, employing about one in five workers in both Muswellbrook and Singleton. Electricity generation was also an important industry employing about 2.9 per cent of workers in Muswellbrook.

Table 11.2 : Employment and income

Demographic	Characteristic	Muswellbrook LGA	Singleton LGA	NSW
Income*	Median weekly personal income ($)	640	684	664
	Median weekly household income	1,346	1,682	1,486
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 (top 5)**	Coal mining Horse farming Fossil fuel electricity generation Supermarket and grocery stores Primary education	Coal mining Defence Takeaway food service Primary education Cafes and restaurants	Hospitals (excl psychiatric hospitals) Cafes and restaurants Supermarket and grocery stores Aged care residential services Primary education

- *Source: * Based on ABS 2016 Census of Population and Housing, General Community Profile for Muswellbrook (A) LGA, Singleton (A) LGA and NSW, **ABS 2016 Census of Population and Housing, Census QuickStats for Muswellbrook (A) LGA and Singleton (A) LGA*

11.2.4 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 facilities 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 schools and local sport and recreation uses.

Bayswater is located within an area dominated by mining and power generation. As such, 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.

11.2.5 Transport and access

Access to the Bayswater is provided from the New England Highway.

The New England Highway is a national highway connecting Tamworth, Armidale and South East Queensland in the north to Newcastle in the south. Within the study area, the highway is the key access route for communities and industry to and from Newcastle. The mining industry in particular places 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. Roads and Maritime 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.

11.3 Impact assessment

This section assesses potential socio-economic impacts of the installation works and operation of the upgrade.

11.3.1 Installation works

During installation, potential impacts from the Project would mainly be associated with direct and indirect employment opportunities, benefits for businesses that support installation activities, increased traffic and workforce accommodation.

Due to the remoteness of Bayswater to sensitive uses, impacts are not expected to result from noise, dust or lighting associated with the Project installation works.

Employment

Installation of the Project would require an additional workforce of about 70 people over a period of 50 days for during of the four years of the upgrade. This would include about:

- 35 workers who are likely to be sourced from within NSW;
- 20 workers who are likely to come from interstate; and
- 15 workers, being mainly managers and supervisors, who would be sourced from overseas.

Flow on benefits from this employment may also result in increased economic activity and spending at businesses providing goods and services to support installation works.

Local business

The main components required for installation works are expected to be sourced internationally (from Japan). At a local level, potential benefits for businesses would mainly be associated with the provision of goods and services to support the additional workers. Increased spending by workers on such things as accommodation, food and services is also likely to impact positively on local businesses.

Installation workers are expected to be accommodated in temporary, visitor accommodation in the Hunter region. The use of tourist accommodation would provide temporary economic benefits for accommodation owners by increasing use of under-utilised accommodation. The Hunter region has businesses that provide accommodation to workers for the power and mining industries, and the level of workers required for the Project does not significantly differ from the number of workers engaged on previous major outages at Bayswater and Liddell who were able to be accommodated within the Hunter region.

Locally, there are no businesses near the Project site that would be impacted by increased activity.

Transport and access

Installation of the Project would generate traffic associated with the haulage and delivery of materials and equipment, transport of the workforce, and general site activities.

The roads used for 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 region. The region is a key tourist area attracting visitors from across NSW, interstate and internationally. Increased traffic, including oversized loads, has potential to impact on perceptions of 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 region. This includes consideration of key tourist events in the timing of major haulage tasks.

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 interchanges.

11.3.2 Operation

Once operational, the Project benefits communities, businesses and industry across NSW by providing more efficient and reliable generation and additional peak capacity and contributes to the replacement of energy generate lost as ageing coal power stations in NSW reach their end of life. In particular, the Project would:

- Improve security and continuity of energy supply to NSW and the NEM during periods of maximum hourly and daily demand, supporting communities, business and industry across NSW;
- Reduce the operating risk profile and improve reliability of Bayswater enabling it to continue operating with decreased outage durations until its scheduled closure in 2035; and
- create additional capacity of 100 MW (about 1 TWh annually) at a time when energy security is a critical issue for NSW and Australia, particularly after the Liddell closure in 2022.

At a local level, the Project is expected to result in minimal change to the operational impacts of Bayswater for communities closest to the Project site and within the Muswellbrook and Singleton LGAs. In particular, the Project is not expected to change the permanent workforce requirements. The Project is also not expected to change amenity for communities in the study area from current operations in relation to emissions, noise and vibration from the new turbines, traffic and transport.

The upgrade would result in a minimal reduction in air emissions and would improve the greenhouse gas emissions intensity of Bayswater.

11.4 Evaluation of socio-economic impacts

The Project's socio-economic impacts as described in the sections above are listed and ranked in **Table 11-3**. The ranking is based on Figure 11.1.

Table 11-3 - Socio-economic impact evaluation

Impact	Likelihood	Consequence / Benefit	Ranking
Negative impacts			
Increased vehicular traffic, including heavy and oversize haulages on the New England Highway, impacting on perceptions of safety for road users.	Possible	Minor	Moderate
Impacts on the availability of visitor accommodation due to increased demand by installation workers.	Possible	Minor	Moderate
Positive impacts			
Improved security and continuity of energy supply and additional electricity generation capacity of 100 MW.	Almost certain	Minor	High
Improved greenhouse emission per MW generated ratios.	Likely	Minimal	Low
Support plans to reduce electricity costs to households.	Likely	Moderate	High
Direct employment of local people for installation activities.	Possible	Minimal	Low

Impact	Likelihood	Consequence / Benefit	Ranking
Indirect benefits for employment due to increased demand for goods and services by installation workers and installation activities.	Possible	Minimal	Low
Benefits for businesses that support construction activities (e.g. accommodation providers, etc).	Possible	Minimal	Low

11.5 Impact management

Table 11.4 outlines measures for managing, avoiding or mitigating potential socio-economic impacts from the installation and operation of the Project. Additional measures relating to such things as traffic and transport are also described in other chapters of the EIS.

Table 11.4 : Management measures

Impact	Proposed mitigation measure
Increase in heavy and oversize vehicles on the New England Highway impacting on perceptions of road safety.	Implementation of a traffic management plan for management of installation traffic, including oversized loads. Communication with key stakeholders and communities about potential changes in installation traffic and major haulage tasks.
Impacts on the availability of visitor accommodation due to increased demand by installation workers.	Where possible, use local labour to reduce the number of people requiring accommodation.
Benefits for businesses that support installation activities.	Identify opportunities to maximise the use of local suppliers and businesses in the provision of goods and services for installation.

12. Management and Monitoring Measures

The environmental assessment requirements include 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.

12.1 Existing Management Arrangements

AGL Macquarie operates under an Environmental Management System (**EMS**) that is integrated with AGL's information management system. The EMS is currently ISO 14001 accredited.

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 EPL799, the Emergency Management Plan and Emergency Response Plan.

The EPL stipulates the discharge points to air and water. It also stipulates monitoring requirements and limits for discharges from these points. Key monitoring currently undertaken includes:

- **Air Emissions (Stack):** A continuous emissions monitoring system (**CEMS**) is installed and operated on all four generating units. This consists of continuous monitoring for Nitrogen Oxides, Sulphur dioxide and opacity. There are two monitors for each parameter per unit. Each unit has two ducts and monitors are operated for each. The monitors are alarmed to provide early warning so operators can take steps to prevent exceedances of the license limits. Monitoring results are uploaded to the AGL Macquarie website on a monthly basis and included in the Annual Return documentation required by the EPL;

- **Stack testing:** Conducted by a contractor on an annual basis, once per EPL799 reporting period per unit. Results are uploaded to the AGL Macquarie website on a monthly basis and included in the Annual Return documentation required by the EP;

- **Ambient Air Monitoring:** Three sites are monitored for ambient air quality. Muswellbrook and Ravensworth sites monitor continuously for Nitrogen Oxides, Sulphur dioxide and fluoride. Lake Liddell site monitors continuously for Nitrogen Oxides and Sulphur dioxide. Reporting is included in the Annual Return documentation required by the EPL

- **GHG:** National Greenhouse Gas Reporting results are submitted annually;

- **Fluoride:** Monitoring of Fluoride in grape leaves is conducted every three years at the vineyards specified in EPL799;

- **Weather:** A weather station monitors continuously for the meteorological parameters specified in the EPL799. Monitoring data is available in real time and a wind speed alarm is set to alert risk of windblown dust associated with ash dam management;

- **Acid deposition:** Monitoring of acid deposition is conducted at Singleton and Muswellbrook and reporting is included in the Annual Return documentation required by the EPL;

- **Water:** Monitor of specified anolytes and volumes of water discharged is undertaken as required by EPL799. Monitoring results are uploaded to the AGL Macquarie website on a monthly basis and included in the Annual Return documentation required by the EPL. The water monitoring program also includes other sites for surface and groundwater which are not stipulated in the EPL. Some sites are included in consents and are reported on in annual reviews. There are two Hunter River Salinity Trading Scheme discharge points and discharge only occurs from the Lake Liddell point. Discharge monitoring results are reported monthly on the AGL Macquarie website, to the regulator and in the Annual Return documentation required by the EPL. Water licence package monitoring requirements are reported annually; and

- **Load Based Licencing:** Bayswater falls under the load based licensing scheme. The assessable pollutants are included in the EPL9 and load based licencing results are submitted along with the Annual Return documentation required by the EPL.

12.2 Project commitments

The commitments made associated with the Project are summarised in Table 12.1. On the basis that no increased impacts to ongoing environmental performance of Bayswater are predicted, these commitments and mitigation measures would be implemented through the preparation of outage specific Health, Safety and Environment Management Plans. No changes to the ongoing management and monitoring approach described above are proposed.

Table 12.1 : Summary of Mitigation Measures

Issue	Commitment
Approvals	AGL Macquarie will comply with its environmental obligations under existing authorisations. The ongoing operation of Bayswater, including coal combustion and all associated environmental impacts, will continue to be managed in accordance with the existing planning approvals and authorisations. AGL Macquarie has committed to rehabilitating Bayswater in accordance with the *AGL Rehabilitation Report* (AGL, 2017).
Air Quality	No additional air quality impacts are predicted to occur as a result of the Project and accordingly no additional air quality mitigation measures are proposed as part of the Project.
Greenhouse Gas	In line with commitments made by AGL in its *Greenhouse Gas Policy* AGL will continue to improve the carbon intensity of its operations, and seek to close all coal fired generation in its portfolio by 2050. No additional mitigation measures to those already used are proposed as part of this Project on the basis that the Project does not result in increased total greenhouse gas emissions or intensity.
Traffic	To minimise the impacts of the movement of the oversized and over-mass deliveries it is proposed that a traffic management plan would be developed for these tasks, and would include: • Identification of the routes; • Measures to provide an escort for the loads; • Times of transporting to minimise impacts on the road network; and • Communication strategy and liaising with emergency services and police.
Noise	No additional noise impacts are anticipated. However, in the unlikely event that noise complaints are received after the turbines are installed, it is recommended that noise monitoring be conducted to determine the acceptability of operational noise levels.
Land-use Safety	The following land-use safety mitigation measures will be implemented prior to and during the installation works for the Project: • Completion of all outstanding actions arising out of the management of change process; and • Preparation of a Health Safety and Environment Management Plan for the Project as a component of the wider outage Health Safety and Environment Management Plan.
Waste	As the supplier, Toshiba will be contracted to dispose of the old turbine components and packaging. The following commitments have been made: • 100% of the metal turbine components will be recycled at an off-site recycling facility;

Issue	Commitment
	• The principal or structural elements of the new turbine packaging will be used to package the old turbine components, assisting onsite handling and onward transportation for recycling; • Where recycling options are not available, waste classified as General Solid Waste (putrescible or non-putrescible) would be transported by a licensed contractor for disposal at a licensed solid waste landfill; and • Hazardous wastes are not anticipated to result from the Project, but were they to occur they would be segregated from other waste streams and stored in an appropriately bunded area prior to transportation off-site. Transportation of hazardous waste would be undertaken by a licensed waste transporter for disposal at a suitably licensed facility, in accordance with the existing Waste Management Plan for Bayswater.
Water	The Project does not affect the water consuming infrastructure or processes at Bayswater.
Social and Economic	• Implementation of a traffic management plan for management of installation traffic, including oversized loads. • Communication with key stakeholders and communities about potential changes associated with installation traffic and major haulage tasks. • Where possible, use local labour to reduce the number of people requiring accommodation. • Identify opportunities to maximise the use of local suppliers and businesses in the provision of goods and services for installation.

13. Evaluation

This Chapter provides an evaluation of the Project having regard to:

- *relevant matters for consideration under the EP&A Act including ecologically sustainable development;*
- *the strategic need for the project having regard to energy security and reliability in NSW and the broader National Electricity Market; and*
- *the biophysical, economic and social costs and benefits of the Project;*

This chapter provides the justification for the Project taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the Project is in the public interest. The Project is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

13.1 Justification

The benefits of the Project, particularly more efficient energy generation and additional peak capacity along with overall reductions in greenhouse gas intensity, are considered to outweigh the mostly temporary and minimal adverse impacts and risks associated with the Project.

While there would be some minimal environmental impacts as a consequence of the Project such as temporary traffic inconvenience, these have been avoided or minimised wherever possible through design and mitigation measures.

13.1.1 Social costs and benefits

The installation works associated with the Project would have some localised social impacts. These would include minor volumes of additional traffic travelling within the Hunter region to Bayswater and additional demands on local services associated with accommodating approximately 70 workers over the shutdown period. Positive social impacts include the flow-on effects of those 70 workers accessing goods and services in the region.

The long-term effect would be an overall social benefit, through the more efficient and reliable generation of energy and additional peak capacity which also contributes to the replacement of energy generation lost as aging coal power stations in NSW reach the end of life. Ongoing operations at Bayswater would continue to emit air impurities in accordance with EPL limits with minor reductions predicted to result from the Project.

13.1.2 Biophysical costs and benefits

The Project does not involve any clearing or ground disturbance and no impacts to threatened fauna or flora species or endangered ecological communities will result from the Project. The Project does not involve any changes that would increase pressure on any coal handling, ash disposal or water management infrastructure. As such the Project does not directly impact terrestrial or aquatic environments.

The continued operation of Bayswater would continue to impact atmospheric environment through the emission of air impurities and GHG in accordance with EPL limits and existing practice. However, the Project would result in more efficient operations and as such less atmospheric impacts on a total and per megawatt hour basis. When considering the future operating scenario after completion of the Project as compared to the 'do nothing' continued operation base case, a decrease in coal consumption and resulting emissions is anticipated. The Project is considered to have greater merit than a ‘do nothing’ option under all future scenarios as a result of reduced impact per megawatt hour of electricity generated.

The expansion of capacity using existing infrastructure is considered preferable from a biophysical perspective to developing alternative generation capacity in a less disturbed setting.

13.1.3 Economic costs and benefits

The Project has an estimated capital investment value of $129 million. The vast majority of parts and supplies are to be sourced internationally, as they are not manufactured in Australia. Similarly, AGL Macquarie does not have discretion in the sourcing of labour due to the specialist nature of the installation works and requirements associated with performance guarantees. Regional and wider benefits are identified as the provision of access to more reliable and affordable electricity. Local benefits would be limited to these regional benefits and spending by additional workers required for the Project on accommodation, food and services in the local area.

Public Interest

The Project represents a cost-efficient private investment in energy generation 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. Any short term traffic or social impacts during the installation works would be outweighed by the long-term benefits once the Project is operational.

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, along with submissions, is required to be considered by the Minister for Planning in determining whether to approve the Project and, if so, on what conditions.

13.2 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 13.1.

Table 13.1 : Consideration of Objectives of the EP&A Act

Objective	Comment
(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The Project design, impact, safeguards and management measures detailed in this EIS allow for the proper management, development and conservation of natural and artificial resources. The Project is considered to have long term positive social and economic benefits with limited environmental impacts. The more efficient operation of Bayswater would result in increased energy generation of electricity for every tonne of coal consumed and air impurity emitted.
(b) 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 13.2.1 to 13.2.4 below.
(c) to promote the orderly and economic use and development of land.	The site is completely developed as a power station and the Project objective is to more efficiently and reliably use this land for the generation of electricity.
(d) to promote the delivery and maintenance of affordable housing.	Not applicable.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The Project does not involve clearing, ground or habitat disturbance and as such does not affect the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.

Objective	Comment
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The Project has no potential to impact built or cultural heritage.
(g) to promote good design and amenity of the built environment.	The works will be undertaken within the existing turbine hall and no opportunity to promote good design and amenity of the built environment exists, however there will be no negative impacts in this regard.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The Project has an objective of allowing Bayswater to safely attain its current scheduled end of life. The turbine replacement reduces the risk of failure of turbine components.
(i) 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.
(j) to provide increased opportunity for community participation in environmental planning and assessment.	The Project development process involved consultation with relevant stakeholders. Consultation undertaken and proposed is outlined in Chapter 5.

13.2.1 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 has sought to take a precautionary approach to minimising environmental impact through the selection of technology that achieves capacity, efficiency and reliability gains while avoiding increases in GHG and air quality emissions. A range of environmental safeguards are proposed to address identified impacts. These safeguards would be implemented during installation works and continued operation of the turbines.

The Project is limited to the replacement of turbine components and no safeguards have been postponed as a result of lack of scientific certainty. 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 Project 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.

13.2.2 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 has been identified as critical to meeting an identified energy generation shortfall post 2022. It is acknowledged that as a significant consumer of coal and emitter of greenhouse gasses, the continued operation of Bayswater through to 2035 does have the potential to impact future generations through consumption of finite resources and contribution to human induced climate change. However, a marginal decrease in total coal consumed and total emissions is predicted as a result of the Project under current assumptions of future energy generation scenarios. The more efficient generation of electricity resulting from the Project means that environmental performance would improve on a per megawatt hour of energy produced basis.

On the basis of how Bayswater operates within the NEM, the Project does not compete on price with renewable energy generation and as such is not considered to displace future investment in renewables. The Project is more likely to displace less efficient coal fired generation and as such is considered carbon neutral on a total emissions basis.

The Project does not seek an extension to the duration of operation of Bayswater. In committing to the closure of Bayswater in 2035, AGL are seeking to enhance the local, regional and global environment while meeting obligations to customers and wider consumers within the NEM in relation to the provision of reliable and affordable electricity.

Should the Project not proceed, generation of electricity would be required via other means at other locations. In the absence of a significant increase in impacts or risks associated with the Project, the use of the existing, developed site for energy generation is considered to be aligned with the intergenerational equity principle in that it avoids impacts at other locations.

13.2.3 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 is located wholly within the existing disturbance footprint of Bayswater. No vegetation clearing endangered ecological communities or threatened flora is proposed and the Project will not fragment or isolate any existing large patches of vegetation or compromise biological diversity or ecological integrity.

13.2.4 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 a $129 million investment by AGL Macquarie aimed at securing increased efficiency, reliability and capacity of generation at Bayswater. The Project forms part of AGL’s NSW Generation Plan which seeks to address the identified energy generation shortfall post 2022 in the most cost effective means available within the parameters of AGL’s commitment to decarbonise its generation portfolio. AGL Macquarie is solely responsible for purchasing resources used at Bayswater and is subject to load based licensing for emissions. Any change in resource consumption or emissions would be reflected in changed costs to AGL. Ultimately, these costs are passed on to energy users. While AGL Macquarie does not control market mechanisms, they have fully acknowledged their influence within the NEM and made commitments to influencing the market to improve environmental performance.

13.3 Conclusion

The Project is critical State significant infrastructure subject to assessment under Part 5, Division 5.2 of the EP&A Act. This EIS has been prepared to address the EARs and reflects the form and content requirements of the EP&A Regulations. This has included consideration the objectives of the EP&A Act. The Project as described in the EIS best meets the Project objectives resulting in negligible changes in environmental impacts from the continued operation of Bayswater.

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Appendix A. Environmental Assessment Requirements and Agency Inputs

Environmental Assessment Requirements

Section 5.16 of the *Environmental Planning and Assessment Act 1979*

Application Number	SSI 9234
Proposal Name	Bayswater Power Station Turbine Efficiency Upgrade Project
Location	Bayswater Power Station on the New England Highway within the Muswellbrook Local Government Area (LGA)
Applicant	AGL Macquarie Limited
Date of Issue	4 May 2018
General Requirements	The Environmental Impact Statement (EIS) for the project must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). In particular, the EIS must include, but not necessarily be limited to, the following: • an executive summary; • a full description of the project, including all components, materials activities and processes required to construct and operate the proposed upgrade, including any ancillary development or changes to the existing operations at the Bayswater Power Station; • a summary of the strategic context for the project with regard to its critical significance for NSW and relevant State and Commonwealth Government policy; • an analysis of feasible alternatives to the project (and its key components), including the consequences of not carrying out the project; • the likely interactions between the project and any other existing, approved or proposed development on the site or in the vicinity of the site; • 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 all 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; • an assessment of the likely impacts of the project on the biophysical and socio-economic environment, focusing on the specific issues identified below, including: - a description of the existing environment likely to be affected by the project; - an assessment of the potential impacts of the project, including any cumulative impacts associated with existing, approved and proposed developments in the region; and - a description of how the project has been designed to avoid and minimise impacts; • 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 the Bayswater Power Station; • an evaluation of the project having regard to: – relevant matters for consideration under the EP&A Act including ecologically sustainable development; – the strategic need for the project having regard to energy security and reliability in NSW and the broader National Electricity Market; and – the biophysical, economic and social costs and benefits of the project; • relevant project plans, maps, and diagrams in an appropriate electronic format. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the assessment of this project.
Key issues	The level of assessment of likely impacts should be commensurate with the significance or degree or extent of impact within the context of the proposed location and surrounding environment, and having regard to applicable NSW Government policies and guidelines. In particular, the EIS must address the following matters: • **Air Quality** – including an assessment of any potential changes to the air emissions (including greenhouse gas emissions) at the Bayswater Power Station as a result of the construction and operation of the project; • **Noise and Vibration -** including an assessment of any potential changes to the noise and vibration impacts of the Bayswater Power Station during the construction and operation of the project; • **Traffic and Transport** – including - details of the number, frequency and type of construction related vehicles, key transport routes, and proposed site access and parking arrangements; - an assessment of the likely traffic and transport impacts during the construction of the project on the capacity, condition, safety and efficiency of the road network, including key intersections; and - a description of the measures that would be implemented to manage and mitigate any impacts, including any proposed road or intersection upgrades developed in consultation with the relevant road authorities (if required); • **Land Use Safety** – including a preliminary risk screening completed in accordance with *Hazardous and Offensive Development Application Guidelines - Applying SEPP 33*. Should the screening indicate that the project is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis*; • **Waste** – including identification, quantification and classification of the likely waste stream to be generated during construction and operation of the project in accordance with the EPA *Waste Classification Guidelines*, and a description of the measures to be implemented to manage, reuse, recycle and safely dispose of waste generated by the project; • **Water –** including an assessment of any potential changes to the existing water supply arrangements for the Bayswater Power Station as a result of the construction and operation of the project, including any associated licensing requirements; and

	• **Social and Economic –** including an assessment of the likely social and economic impacts and benefits of the project for the Muswellbrook LGA (including consideration of any increase in demand for local infrastructure and services), the Hunter Region and the State as a whole.
Consultation	During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. The EIS must describe the consultation process and the issues raised, and identify how these issues have been considered and addressed.
Further consultation after 2 years	If you do not lodge the EIS for the project within 2 years of the issue date of these assessment requirements, you must consult further with the Secretary in relation to the preparation of the EIS.

ATTACHMENT 1

Environmental Planning Instruments, Policies, Guidelines & Plans

Air Quality	
	Protection of the Environment Operations (POEO) Clean Air Regulations 2010
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
Greenhouse Gas	
	National Greenhouse Accounts (NGA) Factors (DoEE)
	AGO Factors and Methods Workbook (AGO)
	NSW Climate Change Policy Framework
Noise	
	NSW Noise Policy for Industry (EPA)
	Interim Construction Noise Guideline (EPA)
	NSW Road Noise Policy (EPA)
Transport	
	Guide to Traffic Generating Developments (RTA)
	Road Design Guide (RMS) & relevant Austroads Standards
	Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines – Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Waste	
	Waste Classification Guidelines (EPA)
Water	
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
Environmental Planning Instruments	
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	Muswellbrook Local Environmental Plan 2009

All communications to be addressed to:

Headquarters
15 Carter Street
Lidcombe NSW 2141

Telephone: 1300 NSW RFS
e-mail: records@rfs.nsw.gov.au

Headquarters
Locked Bag 17
Granville NSW 2142

Facsimile: 8741 5433

The Secretary
Department of Planning and Environment (Sydney Offices)
GPO Box 39
Sydney NSW 2001

Your Ref: SSI 9234
Our Ref: D18/5121
DA18041012582 AB

ATTENTION: Eleanor Parry

16 April 2018

Dear Ms Parry

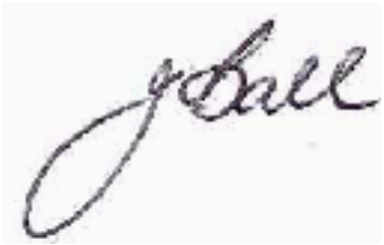
Part 3A/State Significant Development Application - Request For Sears - Bayswater Power Station Turbine Efficiency Upgrade

I refer to your correspondence dated 5 April 2018 seeking key issue and assessment requirements regarding bush fire protection for the above Part 3A/State Significant Development Application in accordance with section 75F (4) of the 'Environmental Planning and Assessment Act 1979'.

The New South Wales Rural Fire Service (NSW RFS) has considered the information provided and has no specific recommendations in relation to bush fire protection.

Should you wish to discuss this matter please contact Alan Bawden on 1300 NSW RFS.

Yours sincerely



John Ball
Manager

For general information on bush fire protection please visit www.rfs.nsw.gov.au

Department of Industry

OUT18/5714

Eleanor Parry
Environmental Assessment Officer
Resource and Energy Assessments - Planning Services
NSW Department of Planning and Environment

Eleanor.Parry@planning.nsw.gov.au

Dear Ms Parry

Bayswater Turbine Efficiency Upgrade Project (SSI 9234)
Comment on the Secretary's Environmental Assessment Requirements (SEARs)

I refer to your email of 5 April 2018 to the Department of Industry in respect to the above matter. Comment has been sought from relevant branches of Crown Lands & Water and Department of Primary Industries. Any further referrals to Department of Industry can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

The department has reviewed the Preliminary Environmental Assessment and recommends the EIS be required to address the following with relation to water resources and impacts:

- Include an assessment of impacts to surface and groundwater sources including water use, impacts on water users, waterfront land and aquifers, as well as compliance with relevant policies;
- Provide details on water licencing arrangements, including:
    - Whether any additional take of water or water licence(s) is required as a result of the proposed works.
    - Whether there is any need for alterations to any water supply works.
    - Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project);
- Consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy 2012.

Yours sincerely

Alison Collaros
A/Manager, Assessment Advice
19 April 2018

DOC18/235862-02; EF14/25399 (SSI 9234)

Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Eleanor Parry
By email: eleanor.parry@planning.nsw.gov.au

BAYSWATER POWER STATION TURBINE EFFICIENCY UPGRADE PROJECT - (SSI 9234)
SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

I refer to your email to the Environment Protection Authority (EPA), dated 17 April 2018, seeking the EPA's comments on the draft Secretary Environmental Assessment Requirements (SEAR's) for the proposed Turbine Efficiency Upgrade Project at Bayswater Power Station in the Muswellbrook local government area.

The EPA understands that the proponent is seeking to replace the turbines in each of the four existing generating units over a four-year period- one generating unit per year. This will improve the reliability, efficiency and security of electricity supply to New South Wales during peak demand periods without increasing coal consumption or air emissions. There will be no changes to existing pollution control equipment.

Consequently, the draft SEAR's could be simplified by replacing all Air Quality requirements under the heading of Key Issues with the following:

- The proponent should undertake an assessment of any potential changes to air quality impacts arising from the project.

The Air Quality section of Attachment 1 to the draft SEAR's should be modified to include:

- Protection of the Environment Operations (POEO) Clean Air Regulations 2010.

If you require any further information regarding this matter, please contact Genevieve Lorang on 4908 6869 or by email to hunter.region@epa.nsw.gov.au.

Yours sincerely

MITCHELL BENNETT
Head Strategic Programs Unit - Hunter
Environment Protection Authority

23 APR 2018

Phone 131 555 Fax 02 4908 6810 PO Box 488G 117 Bull Street info@epa.nsw.gov.au
Phone 02 4908 6800 TTY 133 677 Newcastle Newcastle West www.epa.nsw.gov.au
ABN 43 692 285 758 NSW 2300 Australia NSW 2302 Australia

Enquiries
Please ask for Scott Brooks
Direct 02 6549 3862
Our reference
Your reference

20 April 2018

Ms Eleanor Parry
Environmental Assessment Officer
Dept of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Eleanor,

Bayswater Power Station Turbine Efficiency Upgrade SSI 9234 2 EAR Comment

I refer to an application from AGL Macquarie ("the Proponent") for the Bayswater Power Station Turbine Efficiency Upgrade Project (SSI 9234). We make the following submission on behalf of Muswellbrook Shire Council ("Council") with respect to the Proponents Preliminary Environmental Assessment (PEA) dated 27th March 2018. A site meeting and inspection was hosted by AGL on Wednesday the 11th April. This was attended by Council's Mayor Martin Rush, A/GM Fiona Plesman and Scott Brooks. Council appreciates the opportunity for comment on the PEA and outcomes of the meeting and inspection.

The proposal involves the removal and replacement of the 4 steam turbine units at the Bayswater Power Station. The current units are aging and will require maintenance. Further there have been technological advances since the units were installed in 1985, and there is an opportunity to increase to efficiency of the power station's generating units. Council has been advised that this will lift the stations capacity from 660Mw to 685Mw with no increase in fuel consumption.

Council has reviewed the PEA and it would appear the development will not have any detrimental outcome to the surrounding environment and will not create any additional liabilities on closure. The development will change the nameplate capacity of the plant from 660Mw to 685Mw, spread over the 4 generating units when the project is complete.

The Bayswater power station was commissioned in 1985 based on an "Approval" provided by Muswellbrook Shire Council on the 18th September 1980 (Attached). It should be noted that this document does not approve an activity and only states that Council agrees to the proposal. Since this time the Proponent has sought, and been granted, a number of other planning approvals and has an Environment Protection licence. For some time Council has been concerned about the "Approval" the site depends on for its operation. It is very dated and does not consider, let alone regulate, a number of matters usually considered today and important for our community now and into the future. Council's opinion is based on the following:

1/ The Council "Approval" dated 18th September 1980 was based on an EIS and supplementary information provided to Council prior to the assent of the Environmental Planning and Assessment Act (1979) on the 21st December 1979, and it coming into force on the 1st September 1980. The "Approval" makes no mention of the EP&A Act,

and does not state it is an approval. Given the transition provisions likely to be in place at the time, it is most likely Council's "Approval" is not under the EP&A Act and so must be considered to be operating under Existing Use Rights. Council considers this to be entirely inadequate for an operation of this size that requires ongoing changes to its operation, as described in SSI 9234.

2/ Councils records indicate the Bayswater power station site, together with the neighbouring Liddell power station site, is regulated by the following approvals and licenses:

Type of Approval	Name	Issuing Authority	Source or grant date
Development Approval	DA 81/42 Barnard River Water Supply Project	Upper Hunter Shire Council	16 October 1981
Environment Protection License	EPL 799 Bayswater	Environment Protection Authority	26 April 2000
Development Approval	**DA 98/1995 Sewage effluent reuse project (Mod 2005)**	**Muswellbrook Shire Council**	**4 July 1995**
Development Approval	DA 50-3-2005 Antienne Coal Unloader (Mod 2006)	DP&E	31 March 2006
Deed of Agreement	Excluded Areas Ravensworth 2	DRE	11 March 1994
Radiation Management License	License No. 29408	Environment Protection Authority	27 May 2014
Development Approval	DA 223/2004 Rail Sidings and Associated Facilities	Singleton Council	9 August 2004
Development Approval	**DA 47209 Bayswater Power Station**	**Muswellbrook Shire Council**	**18 September 1980**
Development Approval	DA 460/2001 Rail unloader upgrade	Singleton Council	23 October 2001
Mining Lease	ML 1484 Bayswater	DRE	10 October 2012
Radiation Management License	License No. 5000304	Environment Protection Authority	25 August 2015
Mining Lease	ML 1485 Bayswater	DRE	10 October 2014
Environment Protection License	EPL 2122 Liddell	Environment Protection Authority	20 April 2000
Development Approval	MP 06-0047 Bayswater Water Treatment Plant Upgrade Mod 2	DP&E	April 2018
Development Approval	DA 401/2000.1 Coal/Rail Unloader Augmentation	Singleton Council	11 October 2000
Development Approval	DA 20/98 Ravensworth Rail	Singleton Council	10 June 1998

	Coal Unloading Facility		
Development Approval	DA 144/1993.6 Ravensworth Ash Disposal (No.2 Mine)	Singleton Council	29 October 2012
Development Approval	**DA1/2011 Extension of Liddell Ash Dam**	**Muswellbrook Shire Council**	**1 November 2011**
Development Approval	**DA 138/93.1 Ravensworth Ash Disposal (Mod 2006)**	**Muswellbrook Shire Council**	**5 June 2006**
Development Approval	MP 06-0259 Water Pumping Station Augmentation (Mod1)	DP&E	26 November 2007
Development Approval	DA 86/51Ravensworth South Coal Mine	DP&E	15 December 1986
Development Approval	DA 54/86 Hunter Valley Gas Turbines	Singleton Council	19 June 1986
Development Approval	**DA 2017 – 12 Pipeline replacement**	**Muswellbrook Council**	**7 April 2017**
Development Approval	**DA 2017 – 89 New Effluent Drain Sump**	**Muswellbrook Council**	**25th January 2018**

The Approvals in **BOLD** are held by Muswellbrook Shire Council.

Due to the age and structure of the existing Muswellbrook "Approval" 47209 it is not easy, or may not be possible to modify. If the site had a conventional modern consent a number of the separate consents now held for the site would be done by way of a Sect 4.55 modification and so significantly simplify the approvals for the site. This problem can be expected to grow over time whilst the current "Approval" is in place.

3/ The PEA in Sect 1.5 states:
The project was declared to be State significant infrastructure and critical State significant infrastructure (Critical SSI) by an amendment made to the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) and commenced on 2 March 2018.

At the site meeting and inspection Council were advised that this declaration was made by the Minister for Planning, Minister for Housing, and Special Minister of State, Anthony Roberts.

At no time was Muswellbrook Shire Council consulted as a part of this process.

The only conclusion Council can make from this is the Minister considers the current "Approval" 47209 to be of little or no value as it would be expected that consultation with the primary regulator under the EP&A Act for the site would have occurred.

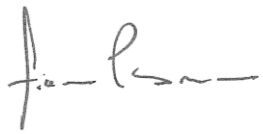
Council is well aware of the limitations of the existing Council "Approval". Should the site have had a conventional Pt 4 approval under the EP&A Act, this development could have been approved by way of a minor administrative amendment and not need the Critical SSI used in this case. The existing "Approval" does not manage existing environmental and community related matters well and does not even consider closure and future land uses.

Council is aware of the time constraints AGL Macquarie have imposed upon themselves for this project. We are also aware that the replacement of the existing "Approval" would not fit within this time frame. We are also aware that being Critical SSI, it is assessed under Division 5.2 of the EP&A Act and so does not need to take into regard matters raised through the assessment process in the same way a Part 4 assessment does.

Muswellbrook Shire Council ask that that as a part of the conditions for the approval of this SSI project a consent condition is included to require AGL Macquarie to apply to DP&E for a replacement of the existing Council "Approval" for the site in a reasonable and feasible timeframe. Council suggest this should be less than 5 years.

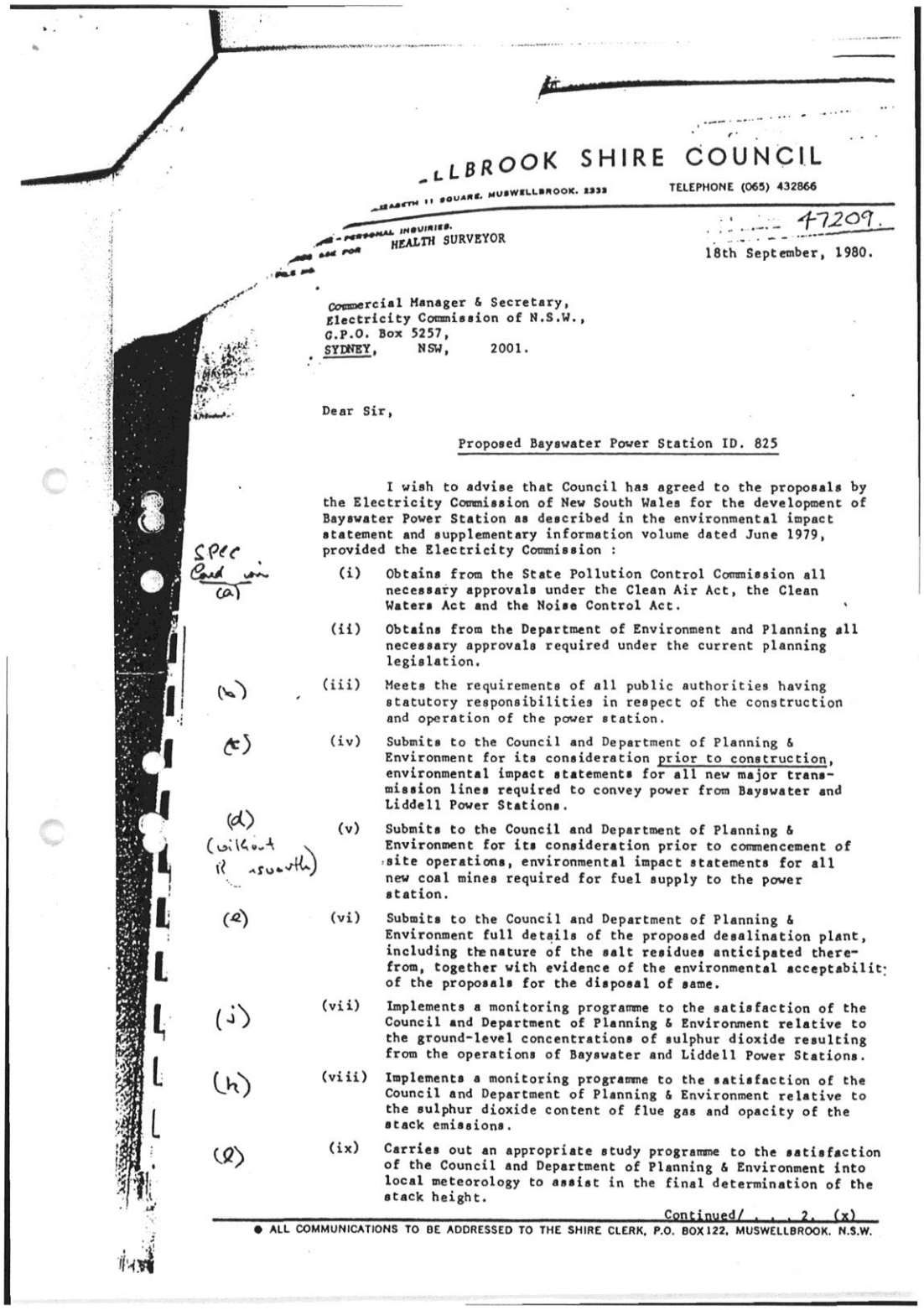
Council appreciates the opportunity to comment and would be pleased to provide additional information if requested.

Yours faithfully



Fiona Plesman
A/General Manager

Attachment 1



-LLBROOK SHIRE COUNCIL

-ABETH II SQUARE, MUSWELLBROOK. 2333 TELEPHONE (065) 432866

-PERSONAL INQUIRIES.
HEALTH SURVEYOR

47209.

18th September, 1980.

Commercial Manager & Secretary,
Electricity Commission of N.S.W.,
G.P.O. Box 5257,
SYDNEY, NSW, 2001.

Dear Sir,

Proposed Bayswater Power Station ID. 825

I wish to advise that Council has agreed to the proposals by the Electricity Commission of New South Wales for the development of Bayswater Power Station as described in the environmental impact statement and supplementary information volume dated June 1979, provided the Electricity Commission :

Spec Cond vin (a)

(i) Obtains from the State Pollution Control Commission all necessary approvals under the Clean Air Act, the Clean Waters Act and the Noise Control Act.

(ii) Obtains from the Department of Environment and Planning all necessary approvals required under the current planning legislation.

(b) (iii) Meets the requirements of all public authorities having statutory responsibilities in respect of the construction and operation of the power station.

(c) (iv) Submits to the Council and Department of Planning & Environment for its consideration prior to construction, environmental impact statements for all new major transmission lines required to convey power from Bayswater and Liddell Power Stations.

(d) (without it asuath) (v) Submits to the Council and Department of Planning & Environment for its consideration prior to commencement of site operations, environmental impact statements for all new coal mines required for fuel supply to the power station.

(e) (vi) Submits to the Council and Department of Planning & Environment full details of the proposed desalination plant, including the nature of the salt residues anticipated therefrom, together with evidence of the environmental acceptabilit of the proposals for the disposal of same.

(j) (vii) Implements a monitoring programme to the satisfaction of the Council and Department of Planning & Environment relative to the ground-level concentrations of sulphur dioxide resulting from the operations of Bayswater and Liddell Power Stations.

(h) (viii) Implements a monitoring programme to the satisfaction of the Council and Department of Planning & Environment relative to the sulphur dioxide content of flue gas and opacity of the stack emissions.

(g) (ix) Carries out an appropriate study programme to the satisfaction of the Council and Department of Planning & Environment into local meteorology to assist in the final determination of the stack height.

Continued/ . . . 2. (x)

...ission of N.S.W.,

47209

...CLERK

18th September, 1980.

...ntinued . . - 2 -

(x) Cooperates with the State Pollution Control Commission in regard to a long-term comprehensive meteorology study to determine the capacity of the region to sustain likely emissions from further power station development, copy of such Study to be made available to the Council.

(xi) Implements a monitoring programme to the satisfaction of the Council and Department of Planning and Environment relative to air particulate concentrations consequent to the coal stockpile and makes suitable arrangements to alleviate any significant adverse effects should they arise.

Note: Regular reports on monitoring programmes mentioned above to be provided to Council.

(xii) Formulates a land-management programme for the buffer zones surrounding the power station to the satisfaction of the Council and Department of Planning and Environment.

(xiii) Negotiates with Muswellbrook Shire Council and any other public authorities that have an interest in the project with a view to meeting any reasonable requirements relative to the development, and refers any disputed environmental matters to the Department of Planning & Environment before determining them.

(xiv) Reports to the Muswellbrook Shire Council as soon as it is able to confirm the accommodation, infrastructure and transport requirements of personnel engaged in the construction and operation of the power station so that appropriate action can be taken to plan and provide for all necessary facilities required.

(xv) As the development will require the provision of, and increase the demand, for amenities and services within the Shire of Muswellbrook, the Commission undertake a study to identify, specify and quantify the impact of the Bayswater Power Station and associated mine development on the local infra-structure and provide a reasonable contribution for the provision, extension or augmentation of these amenities and services.

A copy of this letter has been forwarded to the State Pollution Control Commission and the Planning and Environment Commission for their information.

RECEIVED
THE ELECTRICITY COMMISSION
22 SEP 1980
PAPER

Yours faithfully,

L.P. Fisher,
SHIRE CLERK.

E/rp

CR2018/01465
SF2018/133024
KML

13 April 2018

Department of Planning & Environment
Social and Other Infrastructure Assessments
GPO Box 39
SYDNEY NSW 2001

Attention: Eleanor Parry

PROPOSAL – BAYSWATER POWER STATION TURBINE EFFICIENCY UPGRADE – NEW ENGLAND HIGHWAY MUSWELLBROOK, SSI 9234

Reference is made to Department of Planning and Environment's email dated 5 April 2018, requesting Roads and Maritime Services' (Roads and Maritime) requirements under Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* for the Environmental Impact Statement (EIS).

Transport for NSW and Roads and Maritime's primary interests are in the road network, traffic and broader transport issues. In particular, the efficiency and safety of the classified road network, the security of property assets and the integration of land use and transport.

Roads and Maritime have reviewed the preliminary environmental assessment documents, prepared by Jacobs, dated 27 March 2017. Roads and Maritime understands the prospective development involves the replacement of turbines in each of the 4 existing generating units over a 4 year period (1 generating unit per year). Work will be carried out over 50 days within an annual 72 day maintenance shut down period. Each shut down will generate an additional 60 workers on site and 11 heavy load deliveries to the site.

Roads and Maritime response & requirements

The EIS should refer to the following guidelines with regard to the traffic and transport impacts of the proposed development:

- Road and Related Facilities within the Department of Planning EIS Guidelines, and,
- Section 2 Traffic Impact Studies of Roads and Maritime's *Guide to Traffic Generating Developments 2002*.

Furthermore, a traffic and transport study shall be prepared in accordance with the Roads and Maritime's *Guide to Traffic Generating Developments 2002* and is to include (but not be limited to) the following:

- Assessment of all relevant vehicular traffic routes and intersections for access to / from the subject properties.
- Current traffic counts for all of the traffic routes and intersections.

- The anticipated additional vehicular traffic generated from both the construction and operational stages of the project.

- The distribution on the road network of the trips generated by the proposed development. It is requested that the predicted traffic flows are shown diagrammatically to a level of detail sufficient for easy interpretation.

- Consideration of the traffic impacts on existing and proposed intersections, and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development during both the construction and operational stages. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area.

- Identify the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network for the development. In this regard, preliminary concept drawings shall be submitted with the EIS for any identified road infrastructure upgrades. However, it should be noted that any identified road infrastructure upgrades will need to be to the satisfaction of Roads and Maritime and Council.

    - Traffic analysis of any major / relevant intersections impacted, using SIDRA or similar traffic model, including:

        - Current traffic counts and 10 year traffic growth projections
        - With and without development scenarios
        - 95th percentile back of queue lengths
        - Delays and level of service on all legs for the relevant intersections
        - Electronic data for Roads and Maritime review.

- Any other impacts on the regional and state road network including consideration of pedestrian, cyclist and public transport facilities and provision for service vehicles.

On DPE's determination of this matter, please forward a copy of the final SEARs Roads and Maritime for record and / or action purposes. Should you require further information please contact Hunter Land Use on 4924 0688 or by email at development.hunter@rms.nsw.gov.au

Yours sincerely

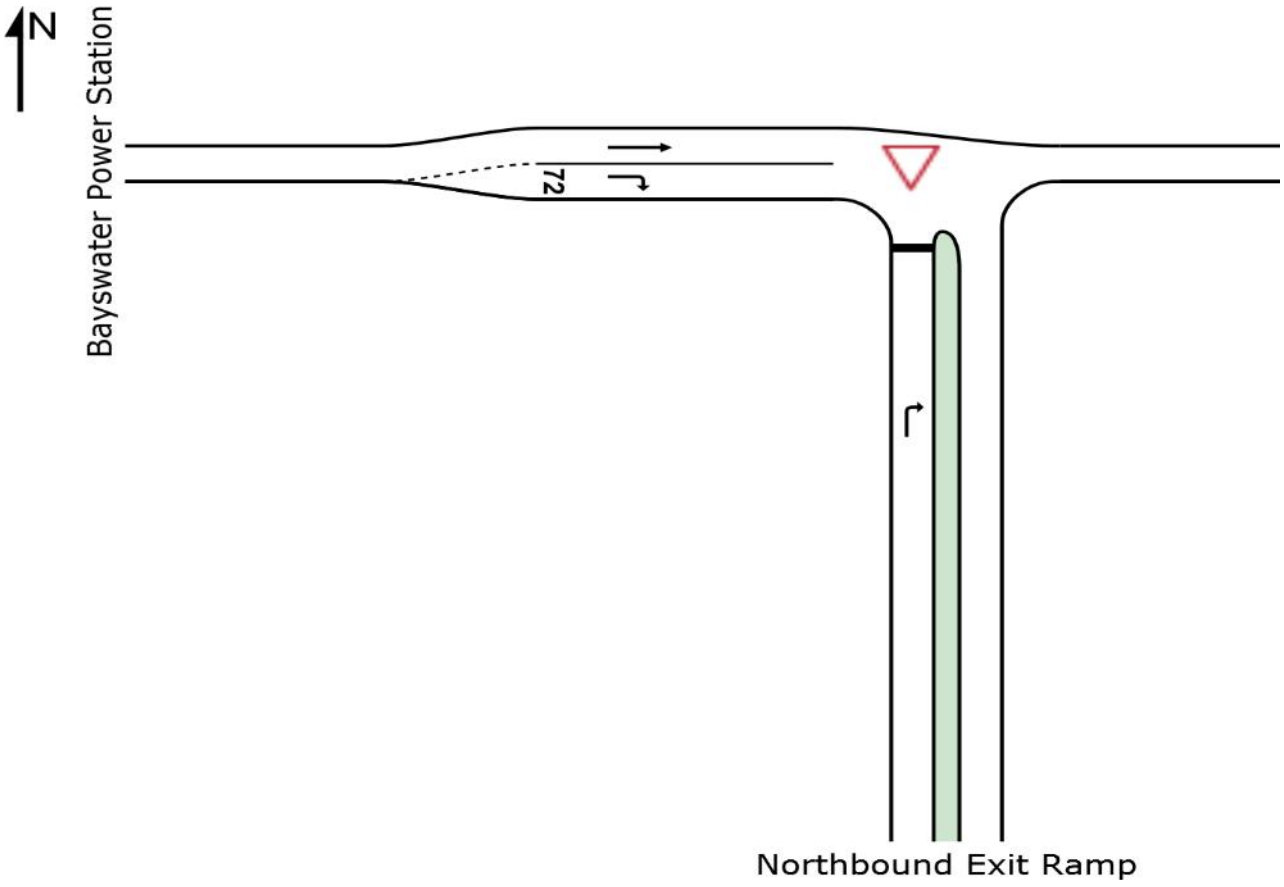
Peter Marler
Manager Land Use Assessment
Hunter

Appendix B. Sidra Intersection Models

SITE LAYOUT

Site: 101 [2018 base AM Peak T Intersection Base]

New Site
Giveway / Yield (Two-Way)



LANE SUMMARY

Site: 101 [2018 base AM Peak T Intersection Base]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Northbound Exit Ramp													
Lane 1	54	5.0	1239	0.043	100	7.7	LOS A	0.1	1.0	Full	500	0.0	0.0
Approach	54	5.0		0.043		7.7	LOS A	0.1	1.0				
West: Bayswater Power Station													
Lane 1	7	5.0	1889	0.004	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	7	5.0	1793	0.004	100	5.8	LOS A	0.0	0.0	Short	72	0.0	NA
Approach	15	5.0		0.004		2.9	NA	0.0	0.0				
Intersection	68	5.0		0.043		6.6	NA	0.1	1.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2018 base PM Peak T Intersection Base]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Northbound Exit Ramp													
Lane 1	7	5.0	986	0.007	100	8.6	LOS A	0.0	0.2	Full	500	0.0	0.0
Approach	7	5.0		0.007		8.6	LOS A	0.0	0.2				
West: Bayswater Power Station													
Lane 1	179	5.0	1889	0.095	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	82	5.0	1793	0.046	100	5.8	LOS A	0.0	0.0	Short	72	0.0	NA
Approach	261	5.0		0.095		1.8	NA	0.0	0.0				
Intersection	268	5.0		0.095		2.0	NA	0.0	0.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2018 Turbine Upgrade AM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit Ramp													
Lane 1	54	5.0	1231	0.044	100	7.7	LOS A	0.1	1.0	Full	500	0.0	0.0
Approach	54	5.0		0.044		7.7	LOS A	0.1	1.0				
West: Bayswater Power Station													
Lane 1	12	42.9	1525	0.008	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	7	5.0	1793	0.004	100	5.8	LOS A	0.0	0.0	Short	72	0.0	NA
Approach	20	28.7		0.008		2.2	NA	0.0	0.0				
Intersection	73	11.3		0.044		6.2	NA	0.1	1.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2018 base PM Peak merge]

New Site
Giveway / Yield (Two-Way)

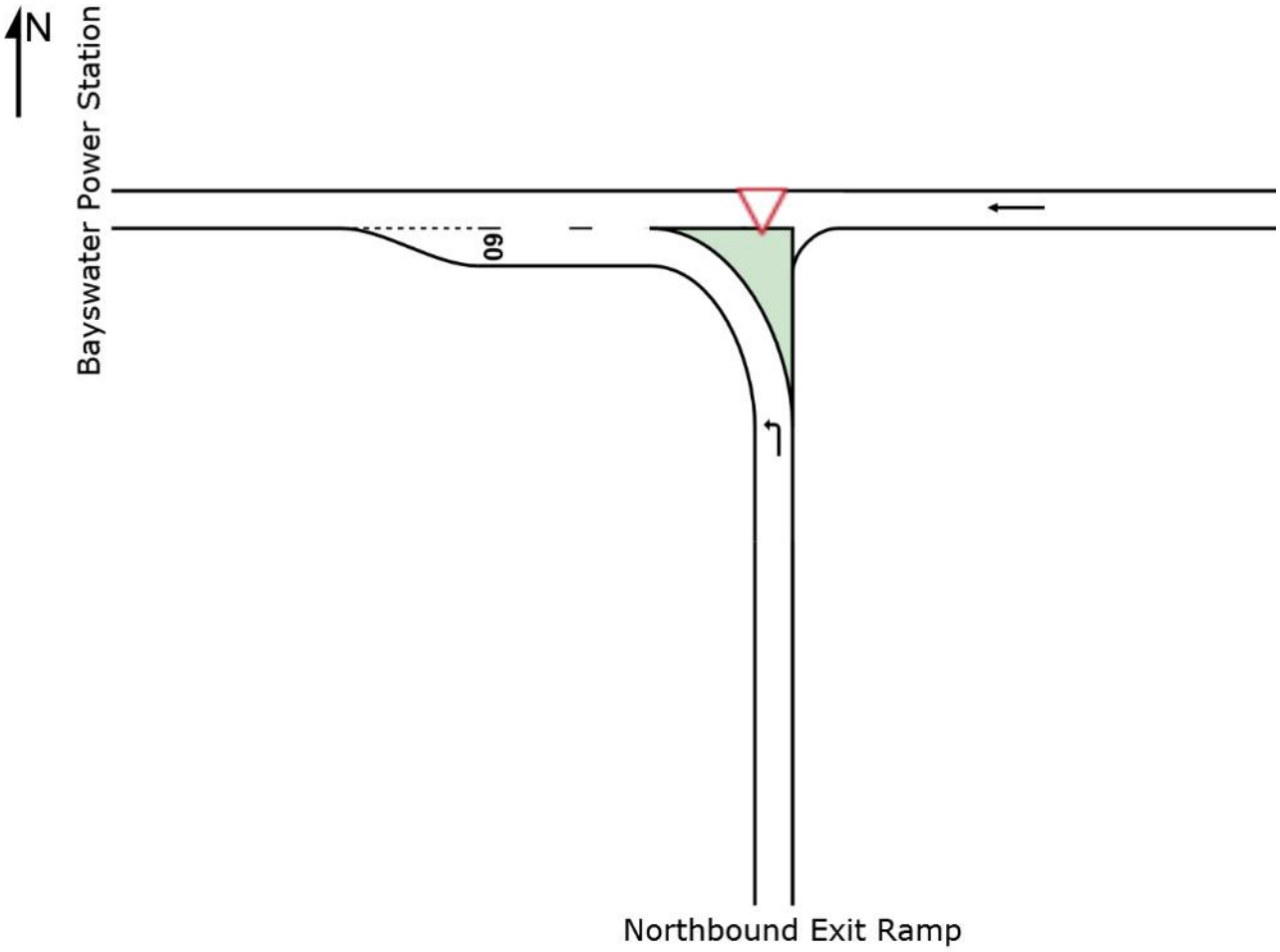
Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit													
Lane 1	33	5.0	1793	0.018	100	5.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	33	5.0		0.018		5.7	NA	0.0	0.0				
East: Liddell Power Street													
Lane 1	28	5.0	1889	0.015	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	28	5.0		0.015		0.0	NA	0.0	0.0				
Intersection	61	5.0		0.018		3.0	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [2018 base AM Peak merge]

New Site
Giveway / Yield (Two-Way)



LANE SUMMARY

Site: 101 [2018 base AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit Ramp													
Lane 1	233	5.0	1793	0.130	100	5.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	233	5.0		0.130		5.7	NA	0.0	0.0				
East: Liddell Power Station													
Lane 1	175	5.0	1889	0.093	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	175	5.0		0.093		0.0	NA	0.0	0.0				
Intersection	407	5.0		0.130		3.2	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2018 base PM Peak merge]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance													
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit													
Lane 1	33	5.0	1793	0.018	100	5.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	33	5.0		0.018		5.7	NA	0.0	0.0				
East: Liddell Power Street													
Lane 1	28	5.0	1889	0.015	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	28	5.0		0.015		0.0	NA	0.0	0.0				
Intersection	61	5.0		0.018		3.0	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2018 Turbine Upgrade AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit Ramp													
Lane 1	277	6.8	1771	0.156	100	5.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	277	6.8		0.156		5.7	NA	0.0	0.0				
East: Liddell Power Station													
Lane 1	175	5.0	1889	0.093	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	175	5.0		0.093		0.0	NA	0.0	0.0				
Intersection	452	6.1		0.156		3.5	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2018 Turbine Upgrade PM Peak merge]

New Site
Giveway / Yield (Two-Way)

Movement Performance Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Northbound Exit											
1	L2	33	5.0	0.018	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
Approach		33	5.0	0.018	5.7	NA	0.0	0.0	0.00	0.53	54.8
East: Liddell Power Street											
5	T1	28	5.0	0.015	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		28	5.0	0.015	0.0	NA	0.0	0.0	0.00	0.00	60.0
All Vehicles		61	5.0	0.018	3.0	NA	0.0	0.0	0.00	0.28	57.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.