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Prepared for:

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Preliminary Environmental Assessment Proposed Power Station Bayswater Liddell Power Generation Complex

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Preliminary Environmental Assessment Proposed Power Station
Bayswater Liddell Power Generation Complex

1 July 2009

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1.0 Introduction

1.1 Background

Macquarie Generation (MacGen) owns and operates Liddell and Bayswater Power Stations between Singleton and Muswellbrook in the Upper Hunter Valley.

Liddell Power Station was commissioned during 1971 to 1973, and comprises four 500 Megawatt (MW) steam driven turbo-generators which use steam to generate electricity. A key feature of the Liddell Power Station is Lake Liddell, which has a surface area of some 1,133 hectares (ha) and was created as a cooling pond for the power station. Water is supplied to Lake Liddell by accessing high flow events in the Hunter River and local dam catchment inflows.

Bayswater Power Station was commissioned in the mid 1980s and comprises four 660 MW generating units. Electricity is generated by producing steam in coal-fired boilers, which is subsequently used under high pressure to drive turbo-generators. Cooling water for Bayswater Power Station is supplied from the Hunter River from entitlements held in Glenbawn Dam. Plashett Dam is used to manage the receipt and distribution of water to both Bayswater and Lake Liddell.

MacGen is now proposing to expand the capacity of the Bayswater-Liddell power generation complex to provide an additional 2000 MW, being either coal or gas-fired generation, on land within its ownership adjacent to the existing Bayswater Power Station (the proposed "Bayswater B" project). Fuel supplies would be delivered to the existing power station complex using existing and/or constructed infrastructure dependent on final design.

1.2 Project Context

1.2.1 Inquiry into Electricity Supply 2007

The NSW government's *Inquiry into Electricity Supply* (Owen Inquiry September 2007) made a number of findings relating to the need, timing and technology for additional electricity generation capacity in NSW. A review of the Owen Inquiry recommendations based on the NEMMCO 2008 Statement Of Opportunities (SOO) found that the findings still stand with the exception that the timing for the next base load generator is now between 2014 to 2016, rather than 2013/14. However uncertainty remains on the impact that the Federal Government's Carbon Pollution Reduction Scheme (CPRS) and proposed expansion of Renewable Energy Target (RET) may have on this revised timing of the next base load generator in NSW.

Notwithstanding these uncertainties due to the long lead time required to bring these types of facilities on line, provisions have to be made now to satisfy the key finding of the Owen Inquiry "…*with a risk-adverse approach, NSW needs to be in a position where new baseload generation can be operational by 20013/14 if necessary, in order to avoid potential energy shortfalls* .." (Page 2-1).

Drawing on the review of the "Owen Inquiry" key aspects relate to;

- Need: Demand management and energy efficiency initiatives remain factored into the demand forecasts which indicate the need for additional base load power supply by 2014/16. The need for additional base load capacity remains based on the importation of base load power from other States (currently around 6% of NSW energy needs) is projected to reduce due to energy consumption and demand in those other States. NSW therefore needs to be in a position where new base load generation can be operational by 2014/16 in order to avoid potential energy shortfalls.

- Readiness: The lead time required to accommodate planning approvals, design and construction of a new base load power station ranges from five to seven years, so the process has to start now.
- Technology: Base load energy needs can be met by coal-fired and/or gas-fired generation as other technologies can only contribute on a relatively small scale or are unlikely to mature until 2020 at the earliest. Of the various coal-fired technologies, only Ultra supercritical pulverised fuel coal-fired generation would be capable of being operational by 2014/16. It has a carbon intensity lower than the current coal fired plant and would displace less efficient and more carbon intensive coal-fired generation in the order of dispatch, thereby reducing the average carbon intensity in the NSW region of National Electricity Market. Carbon capture and storage (CCS) is the major enabling technology to counteract carbon dioxide emissions although application on the scale of a base load power station is just entering the pilot stage. Although CCS is unlikely to be available within the timeframe required for new base load generation to be operational in NSW, such plant would be made 'carbon capture ready'.

  Gas-fired generation is envisaged as increasingly viable with access to the vast coal seam gas reserves in Queensland and the Hunter. The relative higher thermal efficiency and lower carbon intensity represent more significant benefits in displacing less efficient and carbon intensive generators. This flows through to potentially greater reductions in average carbon intensity in the NSW region of National Electricity Market. Gas used as the fuel for power generation in a Combined Cycle Gas Turbine (CCGT) plant would emit CO_2 albeit at lower rates than for Ultra supercritical pulverised coal-fired plant. It is envisaged that if a CCGT plant were built on the Bayswater B site it would be made 'carbon capture ready'.

1.2.2 MacGen Response

MacGen has previously identified that the establishment of new power generating capability has a significant lead time owing to the need for preliminary feasibility studies, concept design, preparation of environmental studies, planning and environmental approvals/permits and detailed design and construction, all of which can take in the order of five to ten years.

In recognition of the pending need for additional base load power supply in NSW and the timeframe involved in being able to have such a facility operational, MacGen has instigated the initial phases of the development of additional electricity generation capability. This report represents the first stage of the environmental planning and assessment approvals process under the *Environmental Planning and Assessment* (EP&A) *Act 1979*.

In order to maximise the flexibility for the ultimate design, Macquarie Generation is seeking concept approval for the operation of addition coal or gas-fired generation at the Bayswater B site.

The Bayswater B project offers a range of commercial and practical benefits including:

- remote location with no significant residential impact.
- site size sufficient to accommodate future expansion and the retrofitting of post combustion carbon capture plant.
- access to fuel supplies (coal via the Macquarie Generation Antiene Rail Unloader and access to the approved Queensland to Newcastle Gas Pipeline).
- adjacent to rail transport infrastructure.

- proximity to existing transmission infrastructure.
- access to water supplies.
- co-located with existing power generation infrastructure.

1.3 Location

The Bayswater Power Station site comprises approximately 1,200 ha of land and is located off the New England Highway, Muswellbrook, NSW. Bayswater Power Station is located within the Muswellbrook Local Government Area (LGA). It is noted that Plashett Dam, which is used as part of the existing power station operations, is located within the Singleton LGA.

The proposed project would be located to the west of the existing Bayswater Power Station, adjacent to Plashett Dam, on land owned by MacGen and within the Singleton LGA.

1.4 Approval Regime

The proposed project falls within the definition of **major development** (formerly state significant development) under Schedule 1, clause 24 of *State Environmental Planning Policy 2005 (Major Projects)* (SEPP 2005), being works for the purpose of an electricity generation facility with a capital investment of more than $30 million. The proposal, which has a preliminary estimated value in excess of $2 billion, is therefore eligible for declaration as a major project under Part 3A of the *EP&A Act* with the Minister being the decision making authority.

On 26 February 2008, the Minister for Planning declared certain power generating facilities to be critical infrastructure projects. The Minister's declaration relates to development for the purpose of a facility for the generation of electricity that has a capacity to generate at least 250MW and that is the subject of an application for approval under Part 3A of the *EP&A Act* which is lodged before 1 January 2013. Accordingly, the declaration of **critical infrastructure** projects applies to the proposed project.

A **concept approval** under section 75O of the *EP&A Act* is being sought for the proposed project to allow for further details and environmental assessment to be undertaken once greater certainty of the project is assured. In this respect, in accordance with section 75M, an outline of the proposed additional power generating project is provided in this draft Preliminary Environmental Assessment (PEA).

1.5 Purpose of this Report

The purpose of this report is to provide the Minister with outline information and background environmental data on the site and the proposed project, sufficient to establish the key environmental issues of importance to the project and the level of environmental assessment required for the application. The report would form the basis for discussion by relevant government agencies, to be convened by the Department of Planning (DoP), on the requirements for environmental assessment of the project.

1.6 Sources of Information

A variety of sources of information were used to produce this draft PEA including the following publicly available information:

- *Bayswater Power Station, Environmental Impact Statement, The Electricity Commission of New South Wales, June 1979;*
- *Information available at www.macgen.com.au :*
- *NSW Government Inquiry into Electricity Supply, September 2007;*

- *National Electricity Market Management Company Limited, Energy and Maximum Demand Projection, 2008;*
- *Owen, AD Inquiry to Electricity Supply in NSW, September 2007;*
- *State of the Environment Report 2002/2003, Muswellbrook Shire Council;*
- *State of the Environment Report 2003/2004, Muswellbrook Shire Council;*
- *State of the Environment Report, Singleton Council, November 2005;*
- *2001 Census Basic Community Profile and Snapshot, Muswellbrook (Statistical Local Area), Australian Bureau of Statistics, 2001;*
- *2001 Census Basic Community Profile and Snapshot, Singleton (Statistical Local Area), Australian Bureau of Statistics, 2001;*
- *Rural Land Capability Mapping, Soil Conservation Service of NSW, K.A. Emery, Land and Water Conservation, 1986.*

1.7 Structure of Report

To inform relevant government agencies and local councils of the level of environmental assessment required, this draft PEA has been structured to provide information on broad areas as outlined in **Table 1**.

Table 1: Outline of Structure of Report (To be completed on finalisation of subsections)

Section	Issues Addressed
Section 1	Provides a background to the project, including information about the proponent.
Section 2	Outlines a description and justification of the proposed project.
Section 3	Describes the planning context, including the approvals required.
Section 4	Discusses the draft Communication Strategy to be implemented at the local level.
Sections 5 and 6	Reports on the environmental implications in terms of physical and biological effects, including the baseline situation and anticipated impacts.
Section 7	Examines the likely impacts of the project on resources (community and natural).
Section 8	Outlines the potential community effects, including the social, heritage and cultural, visual impact, economic and transport implications of the project.
Section 9	Provides an initial analysis of environmental risk to assist with the prioritisation of issues for the project and subsequent environmental assessment.
Section 10	Presents a summary of the findings.

1.8 The Proponent

Macquarie Generation (MacGen) is a State Owned Corporation (SOC) that owns and operates Bayswater and Liddell power stations between Singleton and Muswellbrook in the Upper Hunter Valley, NSW. MacGen operates under the *Energy Services Corporations Act* (1995) and the *State Owned Corporations Act* (1989) and was established on 1 March 1996.

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2.0 Project Description

2.1 Overview

MacGen is investigating the development of additional power generation capacity of some 2000 MW at a facility known as the “Bayswater B” proposed project, on land surrounding its existing Bayswater Power Station.

A Feasibility Study for the proposed project has been undertaken by Worley Parsons, and has considered a number of key drivers impacting on the feasibility of the proposal.

The key components of the project include:

- Main power plant
- Fuel transfer
- Raw water supply
- Ash plant (dependent on fuel source)
- Transmission and major electrical plant

2.2 Project Objectives

MacGen has identified that this proposed project has the appropriate environmental, economic and technical solutions to help meet forecast base load demands in the NSW electricity market.

In addition, MacGen has nominated as part of its project objectives, the need to balance the environmental, social and economic impacts of the proposal, in order to provide a solution to electricity supply which is as sustainable as possible.

As part of the feasibility assessment, Worley Parsons identified key objectives for the proposed project as:

- low capital cost;
- reduced greenhouse and other emissions;
- high thermal efficiency;
- political and community acceptance;
- minimal environmental impact;
- secure economic fuel supplies;
- secure water supplies;
- reliable operation; and
- appropriate water usage.

2.3 Options Considered

Electricity is a transformed form of energy. The challenge is to generate large quantities of electricity economically and in an environmentally appropriate manner to meet society's demand, 24 hours a day, 365 days a year for electrical energy.

The provision of society's electrical energy requirements is based on transforming a fuel source of energy into electrical energy or in the case of solar directly into electrical energy. Solar and wind contain by their very nature extremely low levels of energy and require optimal resource sites to generate electricity in an inherently intermittent manner. The following table illustrates the typical comparative levels of energy intensity for different fuel sources that could be used to generate electricity. The comparative energy densities of both wind and solar have not been included as the values are extremely low.

Table 2: Considered Options

Fuel	Energy Density MJ/kg
Water at 100m head	0.001
Begasse (~ 50% water)	10
Wood (~ 30% water)	15
Brown Coal (Lignite, ~ 60% water)	16
Domestic Coal	24
LPG	34
Diesel	48
Natural Gas	53
Hydrogen	120
Nuclear fission (U_{235})	90,000,000
Nuclear fusion	300,000,000

Consideration of the above table illustrates the practical constraints in selecting a fuel source for generating base load electricity. In considering the necessary fuel security required to generate base load energy at the proposed Bayswater B site considerable physical, resource, economic and legislative constraints exist.

In considering the provision of base load generating capacity, all technologies favour large blocks of capacity in order to capture sufficient economies of scale for the project to be viable.

2.3.1 Fuel for Electricity Generation at Bayswater B Site

Electricity can be generated by renewable means such as solar, wind, biomass, but only in relatively small quantities due to the very low energy intensity. Renewable generation is not able to meet the reliability or cost demanded by society for bulk electricity at this stage and for the immediate future. Whilst renewable generation has a supply augmentation role, it is not yet feasible for base load generation.

While nuclear plant could meet the technical criteria for baseload generation and has zero greenhouse emissions, it is not currently acceptable or in any way practical in the timeframes required. Fuel security for nuclear generation is very high as Australia holds the largest nuclear mineral resources in the world. However, at the current time, existing Federal and State statute does not allow consideration of nuclear generation. In addition, it is noted that the cost of nuclear generated electricity is (in the absence of carbon cost) about twice that of coal due to the very high capital cost involved, and concerns remain about the long-term disposal of radioactive waste.

Coal as a fuel for electricity generation is abundant in NSW. Low cost (domestic grade) coal is ideal for low cost bulk electricity generation. The major disadvantage of coal is its greenhouse intensity (tonnes of carbon dioxide emitted for energy generated) and that it emits, albeit low by world standards, other pollutants.

Gas fired combined cycle plant yields moderate greenhouse emissions. The development of approved infrastructure would enable the delivery of reliable and viable quantities for operation of gas plant at the Bayswater B site.

MacGen considers that the only viable and practical plan for the State to meet its baseload electricity needs from 2014/16 onwards, at a reasonable cost for households and business, is to permit both ultra supercritical coal fired or combined cycle gas generating plant using the best commercially available technology.

The coal fired and gas fired generation options are discussed below.

2.3.2 Coal Fired Generation

The following technologies/systems have been investigated for coal fired generation:

1. Integrated Coal Gasification Combined Cycle (IGCC). This technology has been under development over the past 50 years and is not yet commercially viable. The benefit of the IGCC process is reduced greenhouse emissions and near total pollutant capture. Considerable development is being undertaken overseas but the technology remains at the demonstration stage. While the full timing required to move IGCC to commercial viability is uncertain, the technology is not sufficiently advanced to enable full scale commercial operation within the timeframe required.
2. Clean Coal Technologies. These technologies include Oxy firing to capture CO_2 for sequestration. They are at an early (demonstration) stage of development and are not yet commercially viable. Consequently, they are not sufficiently advanced to enable full scale operation within the required timeframe.
3. Carbon Capture and Storage (CCS). While capture technologies have been used in other industries since the 1970s, their application on the scale of a base load power plant is only just entering the pilot stage. The application of this technology, when fully developed, is likely to be part of IGCC technology but is not yet, in any case, proven or commercially viable at the scale required. It is unlikely to be developed at utility scale for incorporation into base load plants until beyond 2020 which is outside the timeframe required for additional base load power supply in NSW.

4 Ultra Supercritical Pulverised Coal Fired plant. Ultra supercritical is commercially viable and offers high thermal efficiency and lower greenhouse emission over current coal fired plant in NSW.

5 Post Combustion Carbon Capture (PCCC). Advances in the development of PCCC technology are being made and it is likely that the technology would become commercially viable within the operational life of new base load generation plant. Manufacturers are able to make generators PCCC ready in their designs to enable retrofitting of the technology when it becomes proven and commercially viable.

Of the various coal fired generation technologies, only Ultra Supercritical Pulverised Coal Fired plant would be capable of being operational within the identified timeframes required for additional base load power supply in NSW. This technology has therefore been considered as an option for the proposed Bayswater B project together with PCCC ready design.

2.3.3 Gas Fired Generation

The two main types of gas turbine technology are Open Cycle and Combined Cycle.

Open Cycle Gas Turbine is the best practice gas technology for peak load operation. An OCGT power station provides the necessary rapid start up capability to generate electricity at full load within minutes and hence is ideal to meet peak demand.

CCGT power stations are suited to intermediate or base load operation, but are not suitable for peak load operation as they have a comparatively slower start up time to full output of up to some 4 hours.

Base load power plant comprising combined cycle gas turbines (CCGT) could be installed at Bayswater B based on the availability of fuel supplies. CCGT is the best available gas technology to meet base load requirements.

2.4 Proposed Features to Maximise the Sustainability of the Proposal

2.4.1 Coal Fired Generation

Technology

MacGen has adopted the Ultra Supercritical Pulverised Coal Fired technology to maximise plant thermal efficiency and minimise greenhouse emissions.

Plant thermal efficiency and water usage

The availability of water for plant cooling improves plant thermal efficiency. The highest thermal efficiency, lowest greenhouse emissions and lowest capital cost are achieved by employing wet cooling. Dry cooling uses less than 10% of the water used by a wet cooled plant but at a cost of lower thermal efficiency, higher greenhouse emissions and higher capital cost. MacGen has investigated a wide range of cooling options in order to quantify the conflicting requirements relating to greenhouse gas emissions, water usage and plant capital cost.

A total of seven cooling system options have been considered at the pre-feasibility stage of which 4 are outlined in **Table 3** below.

Table 3: Cooling System Options

Option	System Description
Wet Natural Draft Cooling System	The main cooling mechanism of the Wet Natural Draft Cooling System is through evaporation of the cooling water, which saturates the air leaving the cooling tower. This option is similar to the cooling system currently utilised at the Bayswater power station. Large pumps circulate the cooling water between the cooling tower and tubed condenser. This solution provides high thermal efficiency, high make up water usage, lowest operations cost and high capital cost.
Wet Mechanical Draft Cooling System	This option is similar to the Wet Natural Cooling System option, except that the air is forced mechanically through the cooling tower by fans. The cooling towers are usually constructed of treated timber and are smaller due to better air flow and heat transfer. This solution provides the highest thermal efficiency, high make up water usage, lowest capital cost and higher operations cost.
Dry Air Cooled Condenser	Air cooled condensers (ACC) use indirect heat transfer to the atmosphere to cool and condense the steam exhausted from the steam turbine. No circulating water system is required nor a tubed condenser as the steam is ducted directly to the large fin-fan heat exchanger. This solution has lowest thermal efficiency, no evaporative losses requiring make up water, high capital cost and moderate operations cost.
Dry Cooling System with Spray Cooling	Heat transfer by dry cooled systems depends on ambient dry bulb temperatures. During periods of high ambient temperatures, the inability of dry cooling systems to dissipate sufficient heat results in limitations on plant output. To counter this effect, water sprays can be used to cool the incoming air and on the external surfaces of the heat exchanger elements to provide cooling by evaporation. Similar performance to above but with improvements in performance on hot days.

Detailed investigations during 2007 established that MacGen's water access licences to water under the Hunter River Water Sharing Plan, plus MacGen's Barnard River entitlement does not provide sufficient water resource to meet the requirements for the projected level of electricity generation at Bayswater and Liddell Power Stations as well as providing up to an additional 24GL/yr for the proposed Bayswater B project to be wet cooled.

Sufficient water resource exists within MacGen's existing entitlements and future water purchases to meet the water demand sufficient for the proposed Bayswater B project to be dry cooled. Given the current constraints regarding additional water requirements for wet cooling, the project would include a dry cooled system.

Plant emissions

The domestic grade coal proposed to be used by MacGen to fire the proposed Bayswater B project has inherently low sulphur content by international standards (typically around 0.5%). As a consequence the base plant proposal would have uncontrolled emissions and employ fabric filter plant for particulate removal.

Employing table mills for the coal pulverising plant has an advantage in that the pyritic sulphur mineral content in the coal is rejected and disposed of with the boiler ash and not burnt. The effect of not burning the pyritic sulphur content of the coal is to reduce the sulphur emissions by more than 30% than would otherwise be the case.

The dispersion of flue gas containing sulphur dioxide would be ducted to a single tall, wake free stack configured with two flues. Air shed modelling of the combined emissions from the existing Bayswater power station, Liddell power station and the proposed Bayswater B coal fired option has demonstrated that there would be no statistically significant increase in ground level exceedences.

Under the *Protection of the Environment (Clean Air) Regulation 2002*, new coal fired plant is required to meet a NO_x limit of 500mg/m^3. The proposed Bayswater B plant will have an engineering specification to meet this limit, including low NOx burners. In thirteen years of ambient air monitoring undertaken as part of MacGen's Environment Protection Licence, there has never been a NO_x exceedance of the goals under the National Environment Protection Measure for Ambient Air Quality. Dispersion modelling has also demonstrated that the transport of pollutants would not make a statistically significant contribution to the greater Metropolitan Air Quality. It is not expected that the proposed Bayswater B project will make any significant impact on existing NOx emissions.

Scrubbing exhaust gases

The deployment of fabric filter plant and wet scrubbing has been investigated for a 2 by 1000MW unit configuration. This option utilises the injection of limestone in a slurry form to absorb SO_X. A reduction in SO_X emissions would be in excess of 90%. The utilisation of limestone and the increased auxiliary electrical load, however, increases greenhouse gas emissions. This would require the mining, transport and processing of in the order of 100,000 tonnes of limestone per year. This along with water usage, increased capital operating and maintenance costs would make wet scrubbing costly relative to the small reduction in ground level concentrations.

Other Options Considered to Maximise Sustainability

A number of options were also considered as part of the feasibility work undertaken by Worley Parsons, particularly in respect of the following:

- ash disposal, by either truck, conveyor or Dense Phase Pumping (DPP);
- removal and handling of ash from the furnace and other locations in the boiler for the coal fired option; and
- flue gas cleaning for the coal fired option.

2.4.2 Gas Fired Generation

MacGen has adopted the F Class Gas Turbine technology to maximise plant thermal efficiency and minimise greenhouse emissions. This technology is based on five gas turbine units with exhaust gases being emitted from five wake free stacks. To increase the efficiency of electricity generation, combined cycle gas turbines incorporating heat recovery steam generators are proposed.

To reduce the impact on steam turbine performance, two condensing system options for the steam turbine exhaust have been considered.

- Air cooled condensers with cooling water sprays (Option 1).
- Wet mechanical draft cooling towers (Option 2).

Generally water availability is the main factor in selecting the condensing system. If water availability is limited, air cooled condensers with water sprays to ameliorate high temperature performance are used.

In order to offset performance degradation of gas turbines during hot periods, systems for cooling the intake air cooling system are often installed.

The most common system is an evaporative type cooler, where the inlet air stream comes in contact with water falling/flowing down the cooler elements and is cooled by evaporation of the water.

Evaporative systems are a low capital cost option, perform best in hot dry climates (increasing density by reducing the air temperature and by the additional water load from evaporated water vapour) but consume water, which is discharged with the exhaust.

In reviewing available plant combinations, economic and performance comparisons are made. Use of evaporative cooling to control turbine gas inlet temperature proved to be the most cost effective and provided the greater return.

To reduce the impact on steam turbine performance, two condensing system options for the steam turbine exhaust have been considered, air cooled condensers with cooling water sprays (Option 1) and wet mechanical draft cooling towers (Option 2). Of the air cooling system options that were assessed for the two power plant, condensing system options are listed below:

- Option 1 - If cooling water is not made available evaporative inlet air cooling (combined cycle plant with air cooled condenser ACC) would be selected.
- Option 2 - If cooling water is made available evaporative inlet air cooling (combined cycle plant with wet mechanical draught cooling tower WMDCT) would be selected.

As with the possible coal technology noted in Section 2.4.1 above, given the constraints regarding the availability of additional water sources, this project will include a dry cooled option (Option1).

2.4.3 Possible Features to Maximise the Sustainability of the Proposal

It is possible to incorporate the following features into modern coal-fired power stations:

- Carbon capture readiness employing PCCC described in **Section 2.3.2** above.
- Solar augmentation by the introduction of solar heat into feed water systems.

MacGen has experience with the use of solar augmentation by the introduction of solar heat into the feedwater system at its Liddell power station. Experience so far has demonstrated that the system is technically viable but not yet proved to be commercially viable.

Notwithstanding that these features are not yet proven, and their development would require some considerable lead time before they could be considered technologically and commercially feasible on the scale of base load power units, MacGen would make provision in the design of the proposed project for their future deployment.

2.5 Site Information

2.5.1 Location of Project Components

As indicated in **Section 1.3** of this report, the main elements of the existing Bayswater Power Station are located on land in Muswellbrook LGA, and include the properties identified in **Table 4**. Support facilities such as Plashett Dam are located within the Singleton LGA.

Table 4: Property Description of Existing Bayswater Power Station Components

Component of Bayswater Power Station	Property Description	LGA
Bayswater Power Station	Lot 6 DP 966589	Muswellbrook
Eastern stacks	Lot 2 DP 574168	Muswellbrook (may partially encroach on Singleton)
Transmission Switch Yard	Lot 2 DP 327372	Muswellbrook

The proposed additional advanced supercritical coal or CCGT gas units are to be located on land situated to the west of the existing power station, as illustrated in **Figures 1 to 3**. The various components of the proposed power units and supporting facilities are located on the properties identified in **Table 5**.

Table 5: Property Description of Bayswater B Components

Bayswater B Component	Property Description	LGA
Power units	Lot 322 DP 625513	Singleton

Infrastructure such as pipelines, roads and services would connect the existing Bayswater Power Station with the proposed Bayswater B power units.

2.5.2 Ownership

The land on which the proposed project and support infrastructure is to be located is owned by MacGen. However the land on which it is proposed to dispose of ash in the case of the coal fired option (i.e. potentially within the Drayton Coal Mine or redundant mine voids) is owned by others.

2.6 Key Components – Coal Fired Generation

2.6.1 Main Power Plant

The main plant associated with the new power units comprises a series of plant areas, including the boiler plant, the turbine plant and the balance of plant. Within each of these plant areas, there are several different components which function together to operate the plant, as outlined below.

Boiler Plant

The boiler plant includes:

- Steam generator (eg. furnace, superheaters, reheaters, economiser, etc).
- Fuel systems (eg. coal feeders, pulverisers, classifiers, burners, pulverised fuel pipes, etc).
- Ignition systems (eg. fuel oil firing system).
- Boiler air and flue gas system (eg. primary and secondary forced draught plant, induced draught plant, air heaters, flue gas cleaning systems, etc).
- Main piping systems (eg. main steam and reheat pipework, etc).
- Miscellaneous piping and valves in boiler area.
- Boiler plant civil and structural works.
- Boiler control and electrical systems.

Turbine Plant

The turbine plant includes:

- Steam turbine and control valves.
- Steam turbine high pressure and low pressure bypass systems.
- Generator (including cooling and seal oil system).
- Excitation system.
- Power transformers and current, voltage and neutral grounding transformer.
- Turbine governing and control system.
- Turbine generator supervisory and protection equipment, local instrumentation.
- Condensing and feedheating plant (eg. air cooled or water cooled condenser and mechanical vacuum pumps, condensate and boiler feed pumps, feedwater heaters and deaerator, etc).
- Piping systems.
- Turbine plant civil and structural works (turbine foundation, turbine house, etc).
- Turbine electrical systems.

Other Plant

Other plant includes:

- Coal supply plant.
- Fuel oil supply.
- Ash handling and disposal plant (includes furnace ash and fly ash collection and flue gas cleaning, materials handling and disposal).
- Water systems (eg. raw/services water, demineralised water and domestic water supplies and stormwater, contaminated water and chemical drains, sewage, recycling and alternative sources etc).
- Chemical dosing plant.
- Condensate polishing and regeneration plant.
- Fire protection systems.
- Hydrogen plant.
- Compressed air plant.
- Station control and electrical plant.
- Switchyard and transmission connections.
- Miscellaneous piping systems.
- Civil and structural works (eg. drainage, roads, buildings, stack etc).
- Other plant and works as required.

2.6.2 Site Services Connections and Interfaces

The connections and interfaces required to provide services to the proposed new plant would include those related to coal and raw water supply. Future discussions would be held with the eventual developers of the Bayswater B plant in respect of coal stockpile management, fuel oil supply, hydrogen supply and chemicals is provided below. Water management, ash disposal and transmission and major electrical plant are addressed in a greater level of detail below.

Coal Supply

It is intended to supply coal to the proposed Bayswater B option from a variety of locations via MacGen's existing coal unloader. A coal stockpile would provide sufficient storage for up to 20 days coal supply.

2.6.3 Coal Plant

The proposed Bayswater B project would require approximately 6 million tonnes of coal per year and the majority of this coal would be supplied by rail from remote coal mines. Coal trains delivering approximately 9,000 tonnes each would deliver the coal to the Antiene Rail Coal Unloader (ARCU) to deliver coal for the existing Bayswater and Liddell Power Stations and the proposed Bayswater B plant. Conveyors would be provided connecting ARCU with each of the Bayswater Liddell Power Generation Complex components i.e. Bayswater Power Station, Liddell Power Station and the additional power units (Bayswater B).

Conveyors would deliver coal directly from the Antiene rail unloader and its conveyor system into coal bunkers at the proposed Bayswater B. This Bayswater B conveyor system would be rated at 4,000 tonnes per hour to match the rating of the rail unloader. To cater for maintenance, plant failures or interruptions in supply of coal by rail, it is proposed to provide a stockpile of coal at Bayswater B. This stockpile would include fully mechanised formation and reclamation by means of a long-travelling stacker and a long-travelling reclaimer.

2.6.4 Water Management

Raw Water Supply

Raw water would be supplied from MacGen's water supply infrastructure. The probable point of supply is the Bayswater Cooling Water Make Up Dam via a new pipeline to the proposed Bayswater B site.

Stormwater Drains

Roof and other clean drains would be installed to collect stormwater, which would be kept separate from contaminated water drains. Stormwater is intended to be directed to Plashett Dam.

Contaminated Water Drains

Contaminated water drains would be installed to collect water from sources which may contain oil or other contaminants. Water would be directed for recycling to remove oil and contaminants from the water through oil traps and effluent collection systems. The recovered oil would be recycled off-site.

Chemical Drains

Drains would be installed for facilities which may contain dangerous chemicals (eg. chemical storage areas, demineralised water treatment plant and polisher regeneration plant). Materials collected in closed chemical drains would be neutralised and used for ash conditioning.

Sewage Treatment

One of the options considered for sewage treatment is the installation of a dedicated sewage treatment plant as part of the proposed Bayswater B project.

Cooling Tower Blowdown (if applicable)

Cooling Tower blowdown would involve the installation of a new reverse osmosis treatment plant at the proposed Bayswater B site.

Ash Return Water

There would be no return water associated with ash disposal as dry ash disposal has been adopted.

2.6.5 Ash Plant

The ash plant involves a number of different components, including the Furnace Ash Collection and Handling Plant, Pulverising Rejects Handling Plant, Flue Gas Cleaning Plant, Fly Ash Handling Plant, Ash Conditioning Plant, and Ash Disposal Plant. Each of these is addressed further below.

Pulveriser Rejects Handling Plant

Pulverisers generate rejects which are collected and transported for disposal with the furnace ash using a jet pump system.

Flue Gas Cleaning Plant

Different arrangements for flue gas cleaning are being considered as outlined below. The first involves the collection of fly ash and the second involves the collection of fly ash and the removal of sulphur dioxide:

- Fabric filter collection plant only for the 2 x 1000MW power plant case,
- Fabric filter collection plant with wet Flue Gas Desulphurisation Plant for an alternate 2 x 1000MW power plant case.

Fly Ash Handling Plant

A fly ash handling plant is required to remove and transport fly ash from the Fabric Filter hoppers to the Ash Conditioning Plant prior to disposal.

The dust would be conditioned and disposed of by truck to an adjacent open cut void.

Ash Conditioning Plant

Ash conditioning would be required to improve handling and control dust, however the type and extent of conditioning required is dependant on the condition of the ash and other products received together with the system selected for disposal.

Ash Disposal Plant

Ash disposal is currently planned in voids created as a result of open cut coal mining at a number of locations around the site. The “Ravensworth Void” currently receives ash from the Bayswater Power Station. Consideration is being given to a range of ash disposal technologies including:

- truck transport (for furnace ash and fly ash) on internal haul roads.
- conveyors.
- truck transport is the preferred solution for ash disposal in mine voids.

2.6.6 Transmission and Major Electrical Plant

The transmission and major electrical plant include a 500kV transmission switchyard, generator circuit breaker and transformer yards and auxiliary power supplies, as outlined below.

500kV Transmission Switchyard

The proposed Bayswater project B would be connected to the network via the 500kV system. Connection to the 500kV transmission lines passing the proposed Bayswater B site in a new green fields switchyard developed as part of the proposed Bayswater B project.

Generator Circuit Breaker and Transformer Yards

A generator circuit breaker and transformer would connect each generator with the 500kV transmission switchyard.

Major Electrical Plant

Unit and station electrical plant would consist of 500kV/11kV transformers, 11kV/3.3kV and 3.3kV/415V auxiliary transformers, medium voltage (11kV and 3.3 kV) switchgear, low voltage (415 V) switchgear, all related control, protection and metering and direct current systems.

Large capacity motors (e.g. coal conveyors, pulveriser mills, boiler fans, air compressors, etc) would be supplied from the medium voltage (3.3kV) system while all other smaller motors and lighting, etc would be supplied from the low voltage (415V) system.

110 V direct current and battery systems would also be provided to protect the plant in the event of interruptions to the main power systems and emergency situations.

2.7 Key Components – Gas Fired Generation

The main plant associated with the new power units comprises a series of plant areas, including gas turbines, the heat recovery steam generators, condensing steam turbines and the remaining balance of plant. Within each of these plant areas, there are different components which function together to operate the plant, as outlined below.

Combined cycle plant includes three main items of equipment:

- Gas turbine,
- Heat recovery steam generator and
- Condensing steam turbine.

The gas turbine comprises compressor, combustion and turbine stages. Ambient air is drawn into the compressor stage which increases the air pressure supplied to the combustion stage. Fuel is burnt using low NOx burners with the high pressure air in the combustion stage and the resulting hot gases exhaust through the power turbine stage and out of the gas turbine. The energy recovered in the turbine stage drives both the compressor and an electrical generator.

The exhaust from gas turbine has significant heat energy, which is used to produce steam in the heat recovery steam generator. The cooled gases are discharged to the atmosphere via the stack, while the steam is used to drive the condensing steam turbine adds to the drive of the electrical generator. The steam exhausted from the steam turbine in condensed by discharging waste heat to atmosphere using an air cooled condenser or a water cooled condenser with mechanical draught cooling tower. The condensate (condensed steam) is returned to the heat recovery steam generator.

The performance of combined cycle gas turbine plant varies with ambient conditions, with the output of the plant reducing during hot periods due to:

- Reduced mass flow of air entering the gas turbine (lower density)
- Higher steam turbine exhaust pressure (higher condensing system temperatures).

2.7.1 Water Management

The availability of secure water supplies is a major issue for the existing power stations and the proposed Bayswater B project. The selection of dry cooling systems is in response to these water constraints

There are several water systems handling and treating water and wastewater streams.

Raw Water Supply

Raw water would be supplied from MacGen's water supply infrastructure. The probable point of supply is the Bayswater Cooling Water Make Up Dam via a new pipeline to the proposed Bayswater B project site.

Stormwater Drains

Roof and other clean drains would be installed to collect stormwater, which would be kept separate from contaminated water drains. Stormwater is intended to be directed to Plashett Dam.

Contaminated Water Drains

Contaminated water drains would be installed to collect water from sources which may contain oil or other contaminants. Water would be directed for recycling to remove oil and contaminants from the water through oil traps and effluent collection systems. The recovered oil would be recycled off-site.

Chemical Drains

Drains would be installed for facilities which may contain dangerous chemicals (eg. chemical storage areas, demineralised water treatment plant and polisher regeneration plant). Materials collected in closed chemical drains would be neutralised and used for ash conditioning.

Sewage Treatment

One of the options considered for sewage treatment is the installation of a dedicated sewage treatment plant as part of the proposed Bayswater B project.

Cooling Tower Blowdown (if applicable)

Cooling Tower blowdown would involve the installation of a new reverse osmosis treatment plant.

Filtered Water System

Some of the raw water would be clarified and filtered to supply the domestic water and demineralised water plants.

Domestic Water Supply

Domestic (potable) water would be supplied from a new domestic water treatment plant, which would incorporate chlorination (of filtered water) and storage facilities.

Demineralised Water Supply

Demineralised water is produced by further treating the filtered water using ion exchangers to produce high purity water. A new demineralised water treatment plant would be provided.

Condensate Polishing and Regeneration Plant

Each units has a condensate polishing plant to remove impurities from the condensate and maintain the very high purity of feedwater to prevent corrosion in the steam cycle. The resins used to remove the impurities are regenerated in the regeneration plant.

Auxiliary Cooling Tower Blowdown

The blowdown from the wet cooling tower installed for the auxiliary cooling system and any waste water collected beneath the air cooled condenser from sprays would be discharged via the chemical drains system to the ash plant (for ash conditioning and make-up to the furnace submerged chain conveyor).

2.7.2 Site Services Connections and interfaces

In addition to the boiler and turbine generator unit plant, the proposed power plant would have various common station services. These station systems (balance of plant) would include:

Gas Supply

Gas would be supplied by pipeline to a common metering, regulating and conditioning station. The gas then enters the compressor station before being supplied to each gas turbine.

2.7.3 Transmissions and Major Electrical Plant

The transmission and major electrical plant include a 500kV transmission switchyard, generator circuit breaker and transformer yards and auxiliary power supplies, as outlined below.

500kV Transmission Switchyard

Bayswater B would be connected to the network via the 500kV system. Connection to the 500kV transmission lines passing the Bayswater B site in a new green fields switchyard developed as part of the proposed Bayswater B project.

Generator Circuit Breaker and Transformer Yards

A generator circuit breaker and transformer would connect each generator with the 500kV transmission switchyard.

Major Electrical Plant

Unit and station electrical plant would consist of 500kV/11kV transformers, 11kV/3.3kV and 3.3kV/415V auxiliary transformers, medium voltage (11kV and 3.3 kV) switchgear, low voltage (415 V) switchgear, all related control, protection and metering and direct current systems.

Large capacity motors would be supplied from the medium voltage (3.3kV) system while all other smaller motors and lighting, etc would be supplied from the low voltage (415V) system.

110 V direct current and battery systems would also be provided to protect the plant in the event of interruptions to the main power systems and emergency situations.

2.8 Physical Form

2.8.1 Coal Fired Generation

From the description provided above, it is evident that there are numerous elements that contribute to the operation of the various plant forming the proposed Bayswater B project. Rather than describing the physical form of each element, this section would focus on the key components of the proposed project which contribute to its physical appearance.

Turbine and Boiler Houses

The turbine house would have a width of some 40 metres, a length of around 200 metres and a height of approximately 40 metres. Each boiler house would have a width of some 64 metres, a length of around 80 metres and a height of approximately 175 metres, while each baghouse would be some 50 metres wide, around 42 metres long and have a height of approximately 30 metres.

Air Cooled Condensers

The air cooled condenser for each unit would comprise some 81 cells with overall dimensions 110m x 110m x 38m high.

Chimney

Exhaust gases would be discharged via chimneys/stacks, the configurations of which are dependant on the type of system employed. If a conventional system is employed, a single twin flue stack would be provided, having a height of not less than 250 metres and a diameter in the range of 10 – 11.6 metres (depending on capacity).

2.8.2 Gas Fired Generation

There are numerous elements that contribute to the operation of the various plant forming the proposed Bayswater B project. This section focuses on the key components of the proposed gas fired generation option which contribute to its physical appearance.

On a comparative basis the gas plant shall have a significantly less visual impact and footprint than the coal fired option. The highest point shall be the chimneys while fuel handling space requirements are reduced.

Main Power Plant

Each of the five combined cycle gas turbine units would include a gas turbine – steam turbine – generator enclosure with air inlet filters (40m x 8m x 18m high), heat recovery steam generator (45m x 14m x 22m high) and air cooled condenser (51m x 51m x 27m high).

Chimney

Exhaust gases would be discharged via chimneys/stacks. Each combined cycle unit would have a stack some 55 metres high with a diameter in the range of 7 metres.

2.9 Main Processes

Electricity is made by converting chemical energy (from the combustion of fuel) into mechanical energy and then into electrical energy by passing a wire or other 'conductor' across a magnetic field to create an electric current. This activity occurs in the electrical generators of a power station.

2.9.1 Coal Fired Generation

The main processes that currently occur as part of the Bayswater-Liddell power generation complex to generate electricity include:

- transport of coal from open cut mine via rail and conveyor directly to the plant bunkers;
- coal is pulverised in the pulverising mills and is subsequently fed with heated air into the furnace chamber;
- coal is burnt in the furnace chamber and the heat liberated then heats water flowing through tubes forming the furnace walls to produce supercritical superheated steam which is subsequently piped to the steam turbine. The furnace ash collects in the furnace hopper while fly ash travels with the flue gases and is collected by the fabric filter plant. The furnace ash and fly ash are transferred to the ash plant for conditioning before being trucked to an adjacent open cut void for disposal. The flue gases are released via the chimney stack;
- the supercritical superheated steam, expands and cools as it passes through the steam turbine, which drives the electrical generator, which generates electricity at typically 23,000 volts;
- the voltage of the generated electricity is increased to 500,000 volts (500kV) by the generator transformer before entering the electricity transmission system for distribution to consumers;

- Steam exhausting from the steam turbine is condensed to water in the condenser by cooling water circulating from a wet cooling tower (Bayswater) or Lake Liddell for (Liddell) and returned to the boiler.

2.9.2 Gas Fired Generation

Gas would be supplied via a 15km spur from the approved Queensland to Newcastle gas pipeline which runs to the north of the Bayswater B site (**Figure 4**).

On receival, gas would be compressed and supplied to the gas turbine's low NO_x combustion chambers.

As a consequence of the rotation of the gas turbine shaft, air is drawn through an air cooler into the compressor stage of the gas turbine and delivered to the combustion chamber.

Gas is burnt in the combustion chamber and the resultant hot air passes through the turbine stage of the gas turbine and rotates the shaft and provides mechanical energy to drive the electrical generator.

Hot air exhausting from the gas turbine passes through a Heat Recovery Steam Generator (HRSG) which raises high temperature steam.

The high temperature steam is passed through a steam turbine which is part of the generator drive. The work done increases the output of the electrical generator.

Steam exhausting from the steam turbine is condensed in an Air Cooled Condenser (ACC) for dry cooling or wet condenser and a mechanical draft cooling tower.

2.10 Environmental Controls

As identified in **Section 2.2** of this draft PEA, MacGen has identified as one of its objectives the need to balance the environmental, social and economic impacts of the proposed project, to provide a responsible solution to electricity supply. This is reflected through the consideration of environmental issues at the feasibility stage of the project.

The initial selection of a site to locate the proposed project has taken into consideration environmental issues. The site selected within MacGen's landholdings is relatively level and clear of native vegetation, having been used for grazing over recent years, and is not anticipated to have significant archaeology or heritage constraints. The location of the proposed project, having regard to the site selected, would therefore minimise the extent of impacts.

Potential exists for impacts to more sensitive areas through the construction of support infrastructure, such as pipelines, roads, and transmission lines. There are creeklines which have ecological and archaeological significance located in proximity to the site of the proposed project. MacGen proposes to select the route for such infrastructure to minimise ecological and archaeological impacts.

Physical controls are proposed to be incorporated into the project to minimise impacts. Two key environmental issues associated with the proposal are the impact on air emissions and greenhouse gases, together with water usage. The design of the options adopted would take into account both of these issues with the aim of minimising potential effects on the environment, whilst maintaining the commercial viability of the project.

Operational measures would also be incorporated into the electricity generating facility to minimise environmental impacts.

2.11 Access

Fuel supplies to the Bayswater B site would be provided by utilising existing and/or new plant dependent on final plant design. A number of potential options exist for utilisation of existing infrastructure and corridors in meeting requirements. It is proposed to utilise existing MacGen land holdings wherever feasible for fuel delivery systems.

2.12 Program of Works

The following indicative program of works is anticipated for construction of the proposed project following award of an Engineering Procurement and Construction (EPC) contract:

- Engineering Procurement and Construction (EPC) Site works – 6 months;
- EPC Design work – 12 months;
- EPC Manufacture – 12 months; (subject to manufacturing capacity for large long lead time items and other items such as structural steel etc)
- EPC Erection – 15 months;
- EPC Commissioning – 6 months;

The total construction period for the EPC contract is therefore in the order of 50 months. Based on this indicative program of works, it is anticipated that the proposed Bayswater B project (coal or gas fired generation) would occur between 2014-2016 which is within the timeframe indicated in the *Inquiry into Electricity Supply* report (September 2007) as being required to have new base load generation operational in order to avoid potential energy shortfalls.

2.13 Outline of Construction Methods

The land on which the proposed project is to be located has been disturbed through agricultural grazing which has been the predominant land use. The construction phase of the project would involve both site preparation and construction activities.

Land preparation and construction activities necessary to enable development of the proposed project would include the following:

- construction of the access road providing vehicular access from the sealed road to Bayswater Power Station to the proposed Bayswater B site;
- earthworks and preparation of foundations to enable the establishment of the additional power units and associated facilities;
- installation of service infrastructure, including electricity and waste disposal;
- construction of plant and supporting infrastructure;
- installation of pipelines; and
- construction of electricity transmission facilities.

2.14 Outline of Operations

2.14.1 Coal Fired Generation

Delivery of Coal

The delivery of coal to the coal storage area at the existing Bayswater power station occurs 365 days per year. The same is envisage for the proposed Bayswater B coal fired option.

Power Plant

The coal fired generation option project would operate continuously 365 days.

Ash Disposal

Ash disposal is linked to the electricity generation process, and is anticipated to occur during daylight hours.

2.14.2 Gas Fired Generation

Delivery of Gas

Gas would need to be delivered to proposed project site potentially 365 days per year. Determination of on-site gas storage would be part of the detailed design process.

Power Plant

The gas fired generation option would operate up to 8,760 hours per year.

Ash Disposal

No solid combustion waste generated.

2.15 Interfaces

Service infrastructure including water, electricity, communications and sewage would be required to support the proposed facilities.

As outlined in **Section 2.6.6** above, transformers and connections to the existing transmission system are proposed as part of the project and are outlined in the Project Description.

Roads would be required to be constructed to access the proposed Bayswater B project site from the Bayswater River Road. A road would also be constructed to access the ash disposal site for the coal fired generation option.

2.16 Decommissioning

The proposed project would have an expected life of 30 years, but it may be possible to extend the life of the project if deemed appropriate due to new technology.

3.0 Statutory Planning

3.1 Local Matters

3.1.1 Singleton Local Environmental Plan 1996

The site is located primarily within the Singleton Shire where the principal local planning instrument is *Singleton Local Environmental Plan 1996* (LEP 1996). The aims and objectives of LEP 1996 are as follows:

a) to pr*ovide a framework for controlling and co-ordinating development within the Singleton local government area,*

b) to ensure the most appropriate and efficient use or management of land and natural resources,

c) to co-ordinate economic development so that there is optimum and equitable economic and social benefit to the local community,

d) to ensure that the environmental impact of development is adequately assessed, including the consideration of alternatives,

e) *to establish* a pattern of broad development zones as a means of:

i) separating incompatible uses,

ii) minimising the cost and environmental impact of development,

iii) maximising efficiency in the provision of utility, transport, retail and other services,

f) to retain options for alternative land use strategies so that flexibility to allow economic, social and environmental change is unhindered,

g) to encourage adoption of land management practices which are sustainable over long periods of time without degradation of natural environmental systems,

h) to provide adequate protection and minimise risk for the community (as far as possible) from environmental hazards, including flooding, soil erosion, bushfires and pollution,

i) to enable public involvement and participation in environmental planning and assessment,

j) to progress development in an ordered and economic manner.

Definition of the Proposal

The proposed project is defined as a *utility installation* under LEP 1996, being:

> *a building or work used by a public utility undertaking, but does not include a building designed wholly or principally as administrative or business premises or as a showroom.*

A *public utility undertaking* is defined under LEP 1996 as:

> *any of the following undertakings carried on or permitted or suffered to be carried on by or by authority of any Government Department or under the authority of or in pursuance of any Commonwealth or State Act:*
>
> *a) railway, road transport, water transport, air transport, wharf or river undertakings,*
>
> *b) undertakings for the supply of water, hydraulic power, electricity or gas or the provision of sewerage or drainage services,*
>
> *and a reference to a person carrying on a public utility undertaking includes a reference to a council, county council, Government Department, corporation, firm or authority carrying on the undertaking.*

MacGen is an electricity supply authority authorised under the *Energy Services Corporations Act 1995* (ESC Act) with the following principal functions:

a) to establish, maintain and operate facilities for the generation of electricity and other forms of energy, and

b) to supply electricity and other forms of energy to other persons and bodies

As an electricity generator, under the ESC Act, MacGen may also:

a) provide facilities or services that are ancillary or incidental to its principal functions, and

b) conduct any business (whether or not related to its principal functions) that it considers would further its objectives.

The proposed Bayswater B project falls within the bounds of facilities which are part of the principal functions of MacGen and are therefore adequately defined as a *utility installation*.

Permissibility of the Proposal

The land on which the proposed project is to take place is zoned Rural 1(a) under LEP 1996. The objectives of the Rural 1(a) zone are:

a) to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use,

b) to promote the protection and preservation of natural ecological systems and processes,

c) to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining,

d) to maintain the scenic amenity and landscape quality of the area,

e) to provide for the proper and co-ordinated use of rivers and water catchment areas,

f) to promote provision of roads that are compatible with the nature and intensity of development and the character of the area.

The proposed works for the purpose of pipelines and other such infrastructure associated with the proposed project would not sterilise the land for agricultural purposes and would not have a significant impact upon the amenity of the area outside of the construction period. These works, which are ancillary to the proposed primary use, are therefore considered to be generally in line with the objectives of the zone.

Within the Rural 1(a) zone, development which is not exempt development and that which is not identified as prohibited is permissible with consent. The proposed development for a 'utility installation' is not listed as exempt or prohibited and is therefore permissible with consent in the Rural 1(a) zone.

3.1.2 Muswellbrook Local Environmental Plan 2009

Whilst the site for the proposed project is located within Singleton Shire, infrastructure associated with the proposal such as pipelines etc may encroach within Muswellbrook LGA. The principal local planning instrument applying to Muswellbrook LGA is *Muswellbrook* LEP 2009. The aims of LEP 2009 are as follows:

a) *to encourage the proper management of the natural and human-made resources of Muswellbrook by protecting, enhancing or conserving:*

   i) *productive agricultural land, and*

   ii) *timber, minerals, soils, water and other natural resources, and*

   iii) *areas of significance for nature conservation, and*

   iv) *areas of high scenic or recreational value, and*

   v) *places and buildings* of archaeological or heritage significance,

b) *to manage the urban areas of Muswellbrook by strengthening retail hierarchies and employment opportunities, promoting appropriate tourism development, guiding affordable urban form and providing for the protection of heritage items and precincts,*

c) *to promote ecologically sustainable urban and rural development,*

d) *to manage development in flood-prone areas by ensuring any obstruction, re-direction or pollution of flood waters would not have adverse consequences for the environment or increase the risk of endangering life or property,*

e) *to enhance the urban amenity and habitat for flora and fauna,*

f) *to protect and conserve:*

   i) *soil stability by controlling development in accordance with land capability, and*

   ii) *remnant native vegetation, and*

   iii) *water resources, water quality and wetland areas, natural flow patterns and their catchments and buffer areas,*

g) *to provide a secure future for agriculture by expanding Muswellbrook's economic base and minimising the loss or fragmentation of productive agricultural land,*

h) *to allow flexibility in the planning framework so as to encourage orderly, economic and equitable development while safeguarding the community's interests and residential amenity, and to achieve the objectives of each zone mentioned in Part 2 of this Plan.*

Definition of the Proposal

The proposed project comprises a *''electricity generating works'* under LEP 2009 as:

> *a building or place used for the purpose of making or generating electricity.*

Permissibility of the Proposal

Under the provisions of LEP 2009, the lands which may be affected by the proposed project are predominantly zoned Infrastructure SP2 "Power Station" (see Land Zoning Map - Sheet LZN-022).

The objectives of the SP2 infrastructure 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.*
- *To recognise existing land and to enable future development for utility undertakings and associated purposes.*

The proposed project is for power generation with the primary purpose of supplementing and securing the existing State electricity supply. The development is in accordance with the stated objectives for the SP2 zone and the overall LEP objectives outlined above.

3.2 Regional Matters

There are two regional environmental plans (REPs) applying to the subject site being *Hunter Regional Environmental Plan 1989* (Hunter REP) and *Hunter Regional Environmental Plan 1989 (Heritage)*.

3.2.1 Hunter Regional Environmental Plan 1989

The aims of Hunter REP 1989 are:

> *a) to promote the balanced development of the region, the improvement of its urban and rural environments and the orderly and economic development and optimum use of its land and other resources, consistent with conservation of natural and man made features and so as to meet the needs and aspirations of the community,*
>
> *b) to co-ordinate activities related to development in the region so there is optimum social and economic benefit to the community, and*
>
> *c) to continue a regional planning process that would serve as a framework for identifying priorities for further investigations to be carried out by the Department and other agencies.*

The Minister is required to give consideration to the content of the background report and the objectives, policies and principles contained in REP 1989 in the assessment of the proposed works. Whilst many of these are not directly relevant to the specific project proposed, the proposal is considered to be generally in line with the provisions of the plan as they relate to economic development and environmental protection in the region.

3.2.2 Hunter Regional Environmental Plan 1989 (Heritage)

Hunter REP 1989 (Heritage) applies to land within the Muswellbrook Shire, however it does not apply to land within the Singleton LGA.

The aims of Hunter REP 1989 (Heritage) are:

> *a) to conserve the environmental heritage (including the historic, scientific, cultural, social, archaeological, architectural, natural and aesthetic heritage) of the Hunter Region,*
>
> *b) to promote the appreciation and understanding of the Hunter Region's distinctive variety of cultural heritage items and areas including significant buildings, structures, works, relics, towns, precincts and landscapes, and*
>
> *c) to encourage the conservation of the Region's historic townscapes which contain one or more buildings or places of heritage significance or which have a character and appearance that is desirable to conserve.*

The REP provides protection for certain heritage items and conservation areas listed in Schedules 1 to 5 of the REP. The REP sets out criteria and matters which must be taken into consideration for developments which may affect one of these listed heritage items. A discussion of REP 1989 (Heritage) in relation to the proposed development is provided in **Section 7.4.3** of this report, which identifies that there are no heritage items located in the vicinity of the site that are listed in the Plan.

3.3 State Matters

3.3.1 State Environmental Planning Policy 2005 (Major Projects)

State Environmental Planning Policy (Major Projects) 2005 (SEPP 2005) was gazetted on 25 May 2005. It replaces all existing provisions related to former 'state significant development' in planning instruments, directions and declarations.

The primary aim of SEPP 2005 is:

> *to identify development of economic, social or environmental significance to the State or regions of the State so as to provide a consistent and comprehensive assessment and decision making process for that development.*

Schedule 1 of the SEPP identifies classes of development which are classified as 'major development'. This includes development for the purpose of an electricity generation facility that:

> *a) has a capital investment value of more than $30 million for gas or coal-fired generation, or co-generation, or bioenergy, bio-fuels, waste gas, bio-digestion or waste to energy generation, or hydro or wave power generation, or solar power generation, or wind generation.*

The proposed Bayswater B project meets the requirements of a major project under clause 24 of Schedule 1 to SEPP 2005 as it involves:

- a capital investment of more than $30 million. The proposed project is anticipated to consist of a capital investment of greater than $2 billion; and
- is for the purposes of coal-fired and gas electricity generation.

Therefore, under the provisions of clause 24 in Schedule 1 to SEPP 2005, the proposed project is a candidate for declaration as a major project, with the Minister being the approval authority.

3.3.2 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) aims to ensure that due consideration is given to the potential off-site risks of proposals for potentially hazardous or offensive industries in terms of the surrounding environment, amenity and health. The SEPP aims to ensure that locational and design considerations are an integral part of the assessment process and provides that, in relation to these forms of development, the consent authority should impose conditions to minimise any adverse impact.

The SEPP defines potentially hazardous industry as being:

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

The proposed project is likely to fall within the definition of *potentially hazardous industry* and would therefore be subject to the provisions of SEPP 33. One of the key requirements of SEPP 33 with regard to potentially hazardous industry is that a 'Preliminary Hazard Analysis' (PHA) be prepared. The primary purpose of the PHA is to ensure that the proposed location is appropriate for the development in terms of the risks imposed upon surrounding land uses.

More detailed screening under SEPP 33 would be undertaken as part of the detailed environmental assessment for the project and a PHA would be prepared if required.

3.3.3 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy No.44 – Koala Habitat Protection (SEPP 44) applies to both Singleton and Muswellbrook LGAs. The aim of SEPP 44 is:

- To encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline by:
- requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat;
- encouraging identification of core koala habitat area; and
- encouraging the inclusion of core koala habitat areas in environment protection zones.

SEPP 44 requires the consent authority to consider whether land subject to a development application (DA) is potential koala habitat or core koala habitat, as defined in SEPP 44. Preliminary flora and fauna assessment indicates that the site of the proposed project is unlikely to contain potential or core koala habitat, however the infrastructure and pipelines have the potential to impact on koala feed trees. A more detailed assessment of the potential impacts on koalas would therefore be undertaken as part of the EA, in accordance with the provisions of SEPP 44.

3.3.4 State Environmental Planning Policy No. 67 – MacGen Industrial Development Strategy

State Environmental Planning Policy No. 67 – MacGen Industrial Development Strategy (SEPP 67) applies to land identified as MacGen Buffer land.

The aims of SEPP 67 are:

a) to promote and co-ordinate the orderly and economic development of certain land in the local government areas of Muswellbrook and Singleton (the MacGen Buffer Land), and

b) to facilitate the carrying out of certain types of industrial development of State significance within the MacGen Buffer Land with a strong commitment to sustainable environmental performance, and

c) to enable public involvement and participation in the assessment of applications for consent to carry out this development.

The policy allows development for purposes identified in Schedule 1 of the policy to be carried out with consent. Schedule 1 of the policy currently identifies development for the purposes of a chemical sodium chlorate plant and the installation of utilities that are incidental to such a plant. As the proposal is for additional power generation capability at the Bayswater-Liddell power generation complex and does not involve development for the purposes of a sodium chlorate plant, the provisions of SEPP 67 are not relevant.

3.4 Commonwealth Matters

3.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) came into effect in July 2000 and requires the approval of the Commonwealth Minister administering the EPBC Act for actions that may have a significant impact on matters of National Environmental Significance (NES). Approval from the Commonwealth is in addition to any approvals under NSW legislation.

The objects of the EPBC Act are as follows:-

a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and

b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and

c) to promote the conservation of biodiversity; and

ca) to provide for the protection and conservation of heritage; and

d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, landholders and indigenous peoples;

e) to assist in the co-operative implementation of Australia's international environmental responsibilities;

f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity;

g) to promote the use of indigenous people's knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge.

Approval under the *EPBC Act 1999* is triggered by a proposal which has the potential to have a significant impact on a matter of NES or by a proposal which has the potential to have a significant impact on the environment which involves the Commonwealth. The *EPBC Act* lists eight matters of NES which must be addressed when assessing the impact of a proposal.

Activities with a significant impact on a declared World Heritage property.

There are no declared world heritage properties proximate to the subject site, or that would potentially be affected by the proposal.

Activities with a significant impact on heritage matters.

Amendments to the EPBC Act incorporate heritage protection, through:

- The creation of a new advisory body, the Australian Heritage Council.
- The creation of both a National Heritage List and a Commonwealth Heritage List.
- Retention of the RNE.

The National Heritage List is a list of places with outstanding heritage value to Australia, and includes places overseas. Places listed on the National Heritage List are protected under the EPBC Act, and as such, a person is not able to take action that has, would have, or is likely to have, a significant impact on a national heritage place without approval of the MEH.

The Commonwealth Heritage List is a list of places managed or owned by the Australian Government, and includes places, or groups of places in Commonwealth lands or waters, or under Commonwealth control, and are identified by the Minister as having Commonwealth heritage values. Similar to places listed on the National Heritage List, places on the Commonwealth Heritage List are protected under the EPBC Act.

There are no National Heritage Places within or proximate to the subject site, or that would be potentially affected by the proposal. The EPBC search undertaken did however identify two items listed on the Register of National Estate (RNE) that are protected by the EPBC Act:

- Chain of Ponds Hotel and Outbuildings; and
- Foybrook Cross Beds.

Both these items are located to the east of Lake Liddell. The proposed Bayswater B project is not expected to significantly impact on these heritage items.

Activities with a significant impact on a declared Ramsar wetland.

There are no Ramsar Wetlands on or within the vicinity of the subject site. However, the subject site is located within the same catchment as the Hunter Estuary Wetlands which are declared Ramsar Wetlands. The Hunter Estuary Wetlands are located over 100 km from the subject site and providing water use and discharge is effectively managed, the project would not be expected to have a significant impact on the Hunter Estuary Wetlands.

Actions with significant impact on Commonwealth-listed threatened species or endangered community.

A search of the internet *EPBC Act Protected Matters* has identified a total of 12 threatened species within the area. The proposed project is to be located on land which has largely been cleared and is used for cattle grazing. It is unlikely to contain habitat value for the identified species. The supporting facilitates are not proposed to be located in areas with potential habitat. Potential impacts to threatened species have been addressed in **Section 5**.

Actions with significant impact on a Commonwealth-listed migratory species.

The database search undertaken identified 7 Commonwealth-listed migratory species within the area covered by the search, comprising 5 terrestrial bird species and 2 wetland bird species. The proposed project and ancillary works are not expected to significantly impact on these migratory bird species.

Nuclear actions.

The proposed development would not involve a nuclear action, as defined under the *EPBC Act 1999*.

Activities involving the Commonwealth marine environment.

There are no Commonwealth marine areas in proximity to the proposed activity, or that would potentially be affected by the proposed development of the subject land.

3.4.2 EPBC Referral

Based upon preliminary assessment, the proposal is not expected to significantly impact on matters of NES.

3.5 Other Licences Required

The proposed project would require an environment protection licence (EPL) issued under the *Protection of the Environment Operations Act 1997* (POEO Act) as it involves a scheduled activity, being:

> *'Electricity generating works (including associated water storage, ash and waste management facilities) that supply or are capable of supplying more than 30 megawatts of electrical power from energy sources (including coal, gas, bio-material or hydro-electric stations), but not including from solar powered generators.'*

4.0 Physical Effects

4.1 Air Quality

The characteristic emissions from coal and gas generation and the results of the air quality impact assessment for coal are discussed below in turn. A preliminary air quality impact assessment for gas is currently being undertaken and the results would be provided in the final PEA.

4.1.1 Overview – Coal Fired Generation

Coal fired power units can produce a range of air pollutants. The impact of these air pollutants can be minimised or avoided through the adoption of contemporary control technologies, the appropriate design of stack discharges, careful site selection and diligent management of plant and equipment.

The major air pollutants that can be produced by coal-fired power units include sulphur dioxide (SO_2), oxides of nitrogen (NO_x), potential traces of carbon monoxide (CO), particulate matter and trace amounts of air toxics. Of key importance are sulphur dioxide and oxides of nitrogen and the potential impact of these air pollutants on local and regional air quality has been the focus of the air quality assessment work presented below.

As part of the feasibility study relating to Bayswater B, Katestone Environmental (Katestone) was engaged to MacGen to investigate potential air quality effects relating to additional coal fired generation. The following issues were considered:

- major air quality constraints for the proposed coal fired power station considering baseline air quality monitoring data;
- ground-level concentrations of nitrogen dioxide due to the proposed coal fired power station in conjunction with the existing power stations;
- potential for elevated concentrations of sulphur dioxide using refined dispersion modelling techniques and a realistic characterisation of future sulphur dioxide emissions based on stochastic emissions modelling techniques;
- validation of modelling techniques; and
- potential for NOx emissions from the coal fired plant to be transported into the greater metropolitan region of Sydney, Newcastle and Wollongong and enhancement of photochemical activity.

An overview of the findings of the Katestone investigations is provided below.

4.1.2 Impact Assessment Criteria for Air Quality – Coal Fired Generation

The NSW DECC has set impact assessment criteria for sulphur dioxide, nitrogen dioxide and ozone and these are reproduced in **Table 6**. With the exception of the 10-minute average impact assessment criterion for sulphur dioxide, these are equivalent to the standards specified in the National Environmental Protection Measures (NEPM).

Table 6: Air Quality Impact Assessment Criteria, NSW DECC (2005)

Pollutant	Averaging period	Impact assessment criteria (pphm)
SO_2	10 minutes	25
	1 hour	20
	24 hours	8
SO_2	Annual	2
NO_2	1 hour	12
	Annual	3
Ozone	1 hour	10
	4 hours	8

Source: Katestone, January 2005

4.1.3 Baseline Air Quality

MacGen has monitored the air quality in the vicinity of Bayswater and Liddell power stations since 1986. Katestone has reviewed the air quality monitoring data and power station load information collected since 1994 to identify the major air quality constraints for the proposed additional coal fired generation. The following information has been considered:

- Ambient air quality monitoring data from Lake Liddell (SO_2, NO_x, NO_2, NO).
- Ambient air quality monitoring data from Mt Arthur North (SO_2, NO_x, NO_2, NO).
- Ambient air quality monitoring data from Muswellbrook (SO_2, NO_x, NO_2, NO).
- Ambient air quality monitoring data from Ravensworth (SO_2, NO_x, NO_2, NO).
- Ambient air quality monitoring data from Singleton (SO_2, NO_x, NO_2, NO).
- Climatic data from Liddell (wind speed, wind direction, rainfall, temperature, relative humidity, net radiation).
- Climatic data from Mt Arthur (wind speed, wind direction).
- Climatic data from Ravensworth (wind speed, wind direction).
- Load data from Bayswater Power Station (per unit).
- Load data from Liddell Power Station (per unit).

Table 7 provides a summary of the air quality monitoring data recorded at each of the monitoring stations.

Table 7: Summary of Air Quality Monitoring Data Recorded at Each of the Monitoring Sites

Site	Pollutant	Averaging Period	Maximum (pphm)	99th Percentile (pphm)	Number of Exceedances of Assessment Criteria
Lake Liddell	SO_2	10 minutes	67.0	4.2	124
		1 hour	49.6	4.1	28
		24 hours	7.8	2.2	0
		Annual	0.3	-	0
	NO_2	1 hour	7.9	2.5	0
		Annual	0.9	-	0
Mt Arthur	SO_2	10 minutes	59.3	7.3	40
		1 hour	36.1	6.7	11
		24 hours	6.1	3.1	0
		Annual	0.9	-	0
	NO_2	1 hour	10.2	3.2	0
		Annual	1.3	-	0
Muswellbrook	SO_2	10 minutes	41.1	4.7	13
		1 hour	21.9	4.3	4
		24 hours	3.2	1.7	0
		Annual	0.4	-	0
	NO_2	1 hour	23.9	2.8	0
		Annual	1.3	-	0
Ravensworth	SO_2	10 minutes	34.1	5.7	21
		1 hour	25.3	5.3	6
		24 hours	4.6	2.2	0
		Annual	0.6	-	0
	NO_2	1 hour	8.0	3.5	0
		Annual	1.4	-	0
Singleton	SO_2	10 minutes	37.9	2.6	5
		1 hour	31.1	2.4	1
		24 hours	2.9	1.3	0
		Annual	0.3	-	0
	NO_2	1 hour	6.5	2.9	0
		Annual	1.1	-	0

Katestone analysed the ambient air quality monitoring data in conjunction with the climatic and power station load data to determine the general trends over time. The following trends were observed:

- Sulphur dioxide concentrations were less than half of the 10-minute and 1-hour average impact assessment criteria for 99% of the time.
- Sulphur dioxide concentrations are higher during the day than concentrations during the night.
- Elevated sulphur dioxide concentrations occur mainly during convective conditions that occur during the day.
- Highest short-term sulphur dioxide concentrations are significantly higher than short-term concentrations of oxides of nitrogen at Lake Liddell and Muswellbrook. At Mt Arthur short-term concentrations of sulphur dioxide and oxides of nitrogen are similar.
- Concentrations of oxides of nitrogen are significantly higher than sulphur dioxide at Ravensworth and Singleton and are significantly higher than the peak levels of oxides of nitrogen that are recorded at the other sites, indicating that sources of oxides of nitrogen other than the existing power stations affect these sites.
- For the median monthly 1-hour average concentrations of sulphur dioxide and nitrogen dioxide, Mt Arthur measurements indicate a general seasonal trend with higher values recorded in summer. A similar trend was observed to a lesser extent at Muswellbrook.
- The Ravensworth site experienced a slight trend of higher concentrations in winter while the other two sites did not display an obvious seasonal trend (monthly 1-hour average median data).
- Most of the sites (apart from Mt Arthur) experienced slightly higher nitrogen dioxide concentrations during the winter months compared with the summer months.
- No obvious seasonal trend was noted with the load information for Bayswater and Liddell power stations (based on monthly 30 minute average median trends).

There are no exceedances of the short-term or long-term impact assessment criteria for nitrogen dioxide at any of the ambient monitoring stations. For sulphur dioxide, there are exceedances of the 10-minute and 1-hour average impact assessment criteria for sulphur dioxide at each of the monitoring stations. However, the 24-hour and annual average records are well below the impact assessment criteria at all monitoring stations.

Analysis of the data from each site was also undertaken by Katestone to determine whether particular times of the year are more important for the elevated concentrations of sulphur dioxide. The results indicate that a greater frequency of higher concentrations of sulphur dioxide occurred at most sites during the warmer months of the year, and this is attributed to the high frequency of convective conditions that can result in plume grounding. Impacts during the cooler months of the year would typically occur as a result of fumigation events, which occur less frequently than convective conditions.

4.1.4 Potential Air Quality Impacts – Coal Fired Generation

Construction

During the construction stage, potential exists for impacts on the levels of Carbon Monoxide (CO), NO_x, Total Suspended Particulates (TSP), particulate matter less than 10 µm (PM_{10}), and dust as a result of additional traffic, earthworks and construction activities. An increase in the level of airborne pollution resulting from construction vehicles, motor vehicles associated with construction workers and deliveries is expected, but would not be significant.

Dust generated as a result of earthworks and construction activities is likely to be the most significant impact on air quality during the construction period. The construction impacts are likely to be relatively short-term in nature, when compared with the operational life of the proposed Bayswater B project, and adverse dust impacts can be avoided through good management and the implementation of standard, proven mitigation measures.

Operation

The long-term impact of coal-fired power plant on the local, regional and inter-regional air quality is one of the key considerations for this project, and needs to take into account the cumulative effect of the proposed project with the existing Bayswater and Liddell power stations. The feasibility of introducing a new large source of combustion gases into an already complex air environment requires consideration of the long-term air quality monitoring information for the area and detailed dispersion modelling.

Katestone conducted a preliminary dispersion modelling study using conservative assumptions to determine the potential impacts from the proposed additional power units. The preliminary modelling assessment showed that the only potential constraint to the development of Bayswater B is the occasional (2-4 times per year) short-term peak concentrations of sulphur dioxide above the ambient air quality criteria.

Due to the conservative assumptions made in the preliminary modelling assessment, a subsequent study was undertaken to provide a more realistic projection of sulphur dioxide impacts accounting for the usage of all power plant in the Bayswater Liddell Power Generation Complex (Bayswater, Bayswater B and Liddell), and more realistic information on sulphur dioxide emissions. Key refinements include:

- Predicted hourly load information for each group of power units for a projected year.
- Assessment of varying coal sulphur contents for each group of power units.
- Much of the Pyrite Sulphur mineral matter is rejected during the coal pulverisation process and therefore not burnt - conservatively estimated to be 30%.

In order to provide a realistic picture of potential impacts due to the proposed and existing power units, the variability in coal sulphur content was accounted for in the dispersion model predictions. This study provided the following results:

- The frequency of additional exceedances of the 1-hour average impact assessment criterion for sulphur dioxide is predicted to be less than once per year outside the site boundary with the addition of the Bayswater B project for all of the design configurations tested.
- Up to two additional exceedances of the 10-minute average impact assessment criterion for sulphur dioxide are predicted per year occurring close to the site boundary and 9-14 km to the southwest.

- The predicted frequency of additional exceedances at the nearest towns and monitoring sites is less than 1 every 16 years for the 1-hour criterion for sulphur dioxide. One additional exceedance per year is predicted at Lake Liddell for the 10-minute average impact assessment criterion for sulphur dioxide, with the frequency of exceedances predicted to be less than one per year at all other sites.

In June 2009, Katestone Environmental were engaged to conduct a preliminary assessment of the potential impacts associated with emissions of NO_2 from the proposed project. The impacts were assessed on the incremental impacts of either the coal or gas option in insolation, and the cumulative impact considering incorporating the operation of the existing Bayswater and Liddell coal fired power stations. The gas fired option is discussed in section 4.1.6.

The air quality assessment criteria and the methods for the assessment of impact is in the *Approved Methods for the Modelling and Assessment of Air Pollutant in NSW (2005).*

From the preliminary modelling of the coal fired option of the proposed project, together with the operation of the existing power stations, exceedances of the DECC guideline were predicted to the west-northwest and the southwest of the site. However, the modelling predicts that the coal fired option of the proposed project, together with the operation of the existing power stations does not significantly increase the predicted 1-hour average ground level concentrations of NO_2.

The predicted highest annual average ground-level concentration of NO_2 beyond the site boundary is 2.4 µm/m^3, which is 3.9% of the DECC guideline of 62 µm/m^3.

Therefore, the preliminary modelling by Katestone shows that there is no significant impact on ambient ground level NO_2 concentrations from the coal fired option of the proposed project.

Inter-regional Air Quality Impacts

Katestone was also engaged by MacGen to determine the impacts of emissions from the proposed Bayswater B coal fired option on air quality in the greater metropolitan area. The focus of the inter-regional transport (IRT) study was the potential for emissions of oxides of nitrogen from Bayswater B to be transported into more populated regions and influence the formation of photochemical smog in the Sydney, Newcastle and Wollongong areas.

Four case study periods were considered in order to quantify the effect of the inter-regional transport of air emissions from Bayswater B on ozone levels. The case study periods correspond to those identified by CSIRO in the Inter-Regional Transport of Air Pollutants Study (2002) (IRTAPS).

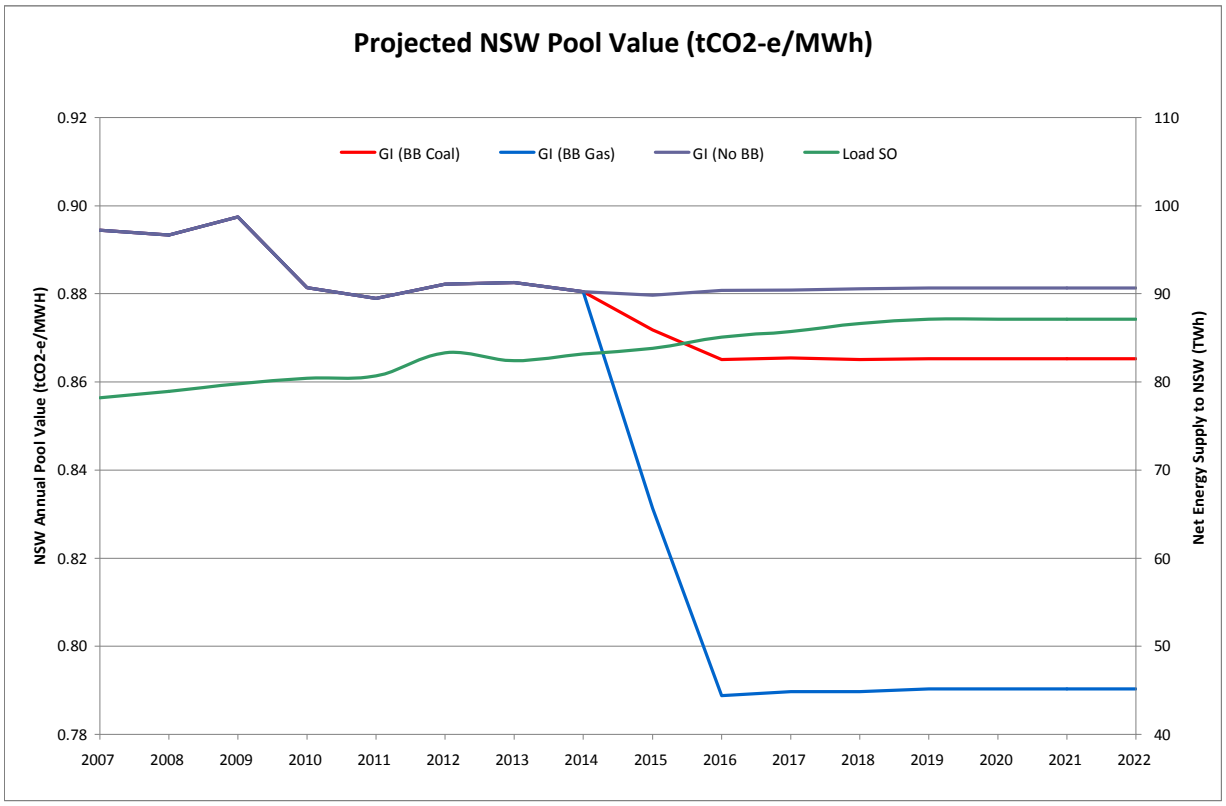
The investigations undertaken by Katestone found that the maximum increase in the 1-hour average concentration of ozone within the study area, over the total eight days studied, did not exceed 10.8 ppb and 11.3 ppb. Regions predicted to experience these variations in the 1-hour average concentration of ozone were found to be located outside the Sydney, Newcastle and Wollongong areas, primarily in the northern portion of the domain, to the west and south of Muswellbrook.

No significant change is expected to the predicted peak 1-hour or 4-hour average concentration of ozone (with values differing by less than 0.3%). Based on current modelling results, the proposed Bayswater B project was found not to have a significant effect on ozone levels within the Sydney airshed during the case days investigated, and the inclusion of the Bayswater B project did not lead to additional exceedences of the 1-hour impact assessment criterion for ozone within the study region.

Greenhouse

If the proposed project were to utilise coal as the fuel to generate electricity, CO_2 emissions are produced. Greenhouse emissions for Bayswater B would be minimised through the adoption of Ultra Supercritical Technology with dry cooling which yields a sent out greenhouse intensity of some 0.83 t CO_2-e/MWh based on site conditions. Further reduction in greenhouse intensity could be achieved through the adoption of wet cooling in place of dry cooling that would give a greenhouse intensity of around 0.80 t CO_2-e/MWh. However for the reasons outlined above, dry cooling is the option being assessed at this stage.

The greenhouse intensity of the proposed Bayswater B project is lower than the NSW annual pool greenhouse intensity value in 2014 estimated to be 0.860 (revise) t CO_2-e/MWh sent out. The effect of the proposed Bayswater B project would be to reduce the NSW annual pool greenhouse intensity value by virtue of having a lower greenhouse intensity and displacing production from the older existing NSW generators and some interstate imports. The projected reduction in NSW annual pool greenhouse intensity for dry cooled coal plant is 0.02t CO_2-e/MWh sent out and for dry cooled gas plant is 0.10 t CO_2-e/MWh reflecting the lower carbon content for gas as a fuel.



Source: Macquarie Generation

It can be seen from the graph that the proposed Bayswater B project would reduce the NSW annual pool greenhouse intensity even if the Bayswater B proposal were to use coal for fuel and would contribute a greater reduction to NSW greenhouse intensity if gas were used as a fuel.

4.1.5 Overview – Gas Fired Generation

The primary pollutants from gas turbine engines are nitrogen oxides (NOx), carbon monoxide (CO), and to a lesser extent, volatile organic compounds (VOC). Nitrogen oxide formation is strongly dependent on the high temperatures developed in the combustor. To control the formation of NOx, low NOx combustion burners would be employed. Carbon monoxide, VOC, hazardous air pollutants (HAP), and PM are primarily the result of incomplete combustion. Trace to low amounts of HAP and sulfur dioxide (SO_2) are emitted from gas turbines. Ash and metallic additives in the fuel may also contribute to PM in the exhaust.

4.1.6 Air Quality Impact Assessment – Gas Fired Generation

As discussed in section 4.1.4, Katestone Environmental were engaged by MacGen to conduct a preliminary assessment of the potential impacts associated with emissions of NO_2 from the proposed project.

From the preliminary modelling of the gas fired option, together with the operation of the existing coal fired power stations, exceedances of the DECC guideline were predicted to the west-northwest and the southwest of the site. However, the addition of the proposed Bayswater B gas fired power station option does not significantly increase the predicted 1-hour average ground-level concentrations of NO_2. The modelling indicates that a small increase in the 1-hour average ground-level concentrations of NO_2 are predicted to the west of the proposed Bayswater B site, beyond the boundary.

The predicted highest annual average ground-level concentration of NO_2 beyond the site boundary is 2.3 µg/m³, which is 3.8% of the DECC guideline 62 µg/m³.

The preliminary air quality impact assessment for the proposed Bayswater B project coal and gas fired power stations indicates there is a marginally greater ground level impact of NO_2 associated with the gas fired option in comparison to the coal fired option. While the emission rate of NOx for the coal fired plant is 5.7 times greater than the gas turbine option, the significantly greater plume height generated by the 250 metre stack, the higher exhaust gas temperature and higher exit velocity provides greater plume dispersion and, consequently, a lower ground level impact within the modelled domain.

The preliminary modelling by Katestone shows that there is no significant impact on ambient ground level NO_2 concentrations from the gas fired option of the proposed project.

4.1.7 Summary and Recommendations

Whilst the proposed project would have impacts on air quality, these impacts are not considered to be significant. Relatively short term localised impacts can be expected as a result of construction activities.

4.2 Water

4.2.1 Baseline

The current Bayswater Power Station, and the proposed Bayswater B project are located in the Hunter River Basin. The Hunter River Basin covers an area of about 21,500 square kilometres and extends further inland than any other coastal catchment in NSW.

The catchment is separated from the Namoi catchment in the northwest by the Liverpool ranges and from the Macquarie in the west by the Great Dividing Range. To the northeast, the catchment barrier runs through the Liverpool Range, the Mount Royal Range, and the Barrington Tops, continuing to the large coastal plains separating Newcastle Harbour and Port Stephens. In the south, the Hunter Range and the Watagan Mountains separate the Hunter from the Hawkesbury catchment (Australian Natural Resources Atlas, 2005).

Water is pumped from the Hunter River near Jerry's Plains and is stored in Lake Liddell (150GL) and Plashett Dam (60GL), which are used as cooling water storages for the Liddell and Bayswater Power Stations.

Based on current water entitlements and purchases and the future expected operating regimes for Bayswater and Liddell Power Stations, sufficient water is available to meet the needs of the proposed (dry cooled) Bayswater B project.

4.2.2 Potential Effects – Coal Fired Generation

Construction

There is potential for water pollution during the construction period due to soil disturbance and the potential for sediment laden runoff to enter Plashett Dam. Potential also exists for impacts upon water quality during construction as a result of spills. Management measures would be put into place during construction to minimise impacts upon local water quality, and include standard, proven sediment and erosion control measures, bunding and nil discharge from the active construction areas.

Operation

The proposed Bayswater B project would generate additional demand for water. Based on feasibility work undertaken by Worley Parsons, it is predicted that the total demand for raw water for a dry cooled plant would be 2.1GL per annum for 2 x 1000 MW plants. These estimates include the sprays for dry cooled systems.

If wet flue gas desulphurisation is deployed raw water demand will increase by up to an additional 3GL/yr.

Various proportions of the raw water would require treatment (e.g. softening, clarification, filtration, chlorination and/or demineralisation) depending on where within the system it is proposed to be used. The waste water would be used to condition ash for disposal in mine voids.

Provided that existing water quality control measures implemented on the Bayswater site are continued and applied at the site of the proposed project, the impacts of the proposal upon water quality are expected to be minimal. Preliminary investigations also indicate that the water required for the proposed Bayswater B dry cooled option of up to 2.1GL per year could be provided from existing MacGen entitlements and therefore would not impact significantly upon other users, including the environment.

4.2.3 Potential Effects – Gas

Construction

The potential effects on water quality during construction of the gas fired option are the same as for the coal fired option. This is discussed in section 5.2.2.

Operation

Bayswater B would generate additional demand for water. Based on studies completed by Worley Parsons, it is predicted the total of less than 2.1GL per year would be required for the dry cooled option which would be supplied from Macquarie Generation's existing water entitlements.

4.2.4 Summary and Recommendations

Further studies would be undertaken into water requirements for the proposed project including an accurate estimate of the amount of water to be used in the proposed Bayswater B project and alternative sources for this water. Studies would also be undertaken to gather baseline data on local water quality for the purposes of monitoring and assessment to better understand the potential water quality impacts of the proposal.

4.3 Soils and Stability

4.3.1 Baseline

A desktop review of the soil landscapes occurring at the site was undertaken with reference to *Soil Landscapes of the Singleton 1:250 000 Sheet (*Soil Conservation Service of NSW, Sydney, Kovac, M. and Lawrie, J.W. (1991)).

Based on this information, the soil landscape occurring at the site is the Liddell Soil Landscape which is associated with the Bayswater Soil Landscape. Soil types include yellow Soloths on slopes with some yellow Solodic Soils on concave slopes. Earthy and Siliceous Sands are found on mid to lower slopes. Some red Soloths, red Solodic Soils and red Podzolic Soils also occur in the landscape. Minor to severe sheet erosion is common in the landscape, with some minor rill erosion.

Landform characteristics associated with the Liddell Soil Landscape include undulating low hills which range in elevation from 140 – 220 m. The slopes are long (1200 – 2000 m) and generally 4-7%. Drainage lines occur at 300 – 1000 m intervals.

Vegetation associated with the landscape generally comprises open woodland of Narrow-leaved Red Ironbark, Yellow Box, White Box, Spotted Gum and some Blakelys Red Gum. Other species include Bull Oak, Swamp Oak and Smooth-barked Apple.

The underlying parent rock comprises lithic sandstone, shale, mudstone, conglomerate, siltstone, and coal seams.

A description of the soil types comprising the Liddell Soil Landscape are provided below.

Yellow Soloths

The topsoil consists of brown loamy sand to sandy loam, single grained at the surface and massive below, with a pH of 6.0. This overlies bleached, light grey or dull yellow orange sandy loam or sandy clay loam to a depth of 25 cm. The subsoil has a clear change to bright brown or dull orange sandy clay with weak or strong structure and distinct brown or orange mottles. The pH is 6.0 – 6.5.

Yellow Solodic Soils

The topsoil comprises dark brown loam with a weak structure and a pH of 6.5. This overlies a bleached, dull orange clay loam with weak structure to a depth of 20 cm. The subsoil is distinguished by a clear change to bright reddish brown light clay with a strong angular blocky structure. At greater depths, the subsoil becomes more yellowish brown with orange and grey mottles.

Earthy Sands

The topsoil goes to a depth of approximately 40 cm and is a dark brown sandy loam, single grained at the surface and massive below. The subsoil is represented by a gradual change to dull yellowish brown sandy loam.

Siliceous Sands

The topsoil comprises brown sand to loamy sand and goes to a depth of approximately 40 cm. The subsoil is represented by a gradual change to light brown loamy sand.

It is noted that AECOM's archaeologist has also provided some discussion in **Section 7.4.2** of this report on the landscape and soil profiles based on observations at the site.

4.3.2 Land Capability

Land suitability and capability of the study area has been determined using the Soil Conservation Service of NSW's *Land Capability Classification.* This classification is used to evaluate rural land and consists of eight classes which were developed based on an assessment of the biophysical characteristics of the land and the extent to which these would place limitations upon land use. Limitations are based on the soil erosion hazards associated with particular land uses, such as cultivation and grazing.

The soil classifications also identify the types of land management practices required to prevent soil erosion and to maintain the productivity of the land. The land classifications associated with the soil types comprising the Liddell Soil Landscape are as follows:

- Yellow Soloths – V, VI;
- Yellow Solodic Soils – V;
- Earthy Sands – V; and
- Siliceous Sands – V.

Descriptions of the land classifications are provided in **Table 8** below.

Table 8: Land Capability Descriptions

Land Classification	Soil Conservation Practices	Interpretations and Implications
V (suitable for grazing, occasional cultivation)	Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class IV.	Land not suitable for cultivation on a regular basis owing to considerable limitations of slope gradient, soil erosion, shallowness or rockiness, climate or a combination of these factors. Soil erosion factors are often severe. Production is generally lower than for grazing lands in Class IV. Can be cultivated for an occasional crop, particularly a fodder crop or for pasture renewal.
VI (suitable for grazing, no cultivation)	Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. May include some isolated structural works.	Productivity would vary due to the soil depth and the soil fertility. Comprises the less productive grazing lands. If used for 'hobby farms', adequate provision should be made for water supply, effluent disposal, and selection of safe building sites and access roads.

Source: Emery, 1986

4.3.3 Potential Effects

The impacts of the site preparation and construction works on the soils of the subject site include soil erosion, soil compaction and changes to runoff patterns. These impacts result from activities such as removal of vegetation, earthworks, stockpiling of materials and movement of heavy vehicles, and can be exacerbated by factors such as wind and rainfall.

Impervious surfaces would increase as a result of the proposed project, thereby increasing the potential for soil erosion to occur as a result of changed runoff patterns. There are also potential impacts associated with unsealed roads. Given that the surrounding areas would be landscaped and managed to avoid soil erosion, the operational phase of the proposed project does not involve activities that would significantly affect the soil and stability of the area.

4.3.4 Summary and Recommendations

There are no soil or landscape issues that would pose a significant constraint to the proposed Bayswater B project. Impacts associated with construction of the proposal on existing soils and landscape are able to be managed.

4.4 Noise

4.4.1 Baseline

The site of the proposed project is in close proximity to the existing Bayswater power station, therefore background noise in the area is likely to be dominated by noise generated by the operation of the existing power station. Other surrounding land uses include quarries and mines which may also contribute to background noise in the locality. The nearest residence is located some 5 km from the site and the township of Jerry's Plains is located around 5 km to the south of the site.

4.4.2 Potential Effects

Construction

Potential exists for noise impacts during the construction period of the proposed project and supporting facilities as a range of heavy machinery would be utilised for site preparation, earthworks and erection of the buildings and related structures.

Noise generated during the construction period would be temporary and given the distance to the nearest sensitive receiver (5km), construction noise is not likely to cause a significant nuisance.

Operation

The proposed project would also generate noise during operation, as the additional power units would include noise generating components such as boiler fans, coal conveyors, generator transformers and air cooled condenser fans.

Operational noise generated by the proposed Bayswater B project would be longer term, however, many of the noise generating components of the proposed project would be enclosed within buildings or fitted with acoustic attenuation, thereby reducing the noise impacts. In addition, MacGen owns significant land around the proposed project site, thereby providing a buffer from adjoining land uses.

Noise impacts and mitigation measures (if required) would however require confirmation through a detailed noise study.

4.4.3 Summary and Recommendations

The cumulative effects of the proposal in terms of noise are not likely to be significant given the distance to the nearest sensitive receivers, the MacGen owned lands which act as a buffer zone and the availability of mitigation measures (if required).

A noise study is required to establish existing background noise levels and adequately assess the noise impacts of the proposal.

5.0 Biological Effects

5.1 Introduction

The legislation relating to the protection of threatened flora and fauna in NSW is the *Threatened Species Conservation Act 1995* (TSC Act). The matters protected by the *TSC Act* are threatened species, endangered populations, endangered ecological communities, key threatening processes and critical habitat. Schedule 1 of the Act lists threatened species, populations and ecological communities, while Schedule 2 lists vulnerable species and Schedule 3 lists key threatening processes.

Threatened ecological communities and threatened flora and fauna species are also protected at a Commonwealth level through the provisions of the *EPBC Act*. Communities or species identified as a matter of NES would trigger assessment/approval requirements under the Commonwealth Act.

The DECC on-line *Wildlife Atlas* (WA) provides a record of flora and fauna species that have been observed in NSW. For the purposes of this draft PEA, a search of the DECC on-line WA has been undertaken to identify records of flora and fauna species protected by NSW legislation observed in the area.

In addition, an on-line search of the Commonwealth EPBC database has been undertaken to identify flora and fauna species protected by the provisions of the *EPBC Act* within the area.

5.2 Fauna

A search of the WA was conducted on 4 June 2009 covering a 20km x 20km grid centred on the proposed Bayswater B project site. A total of 21 threatened fauna species have been identified in the area searched. Of the fauna species identified, the majority of which are bird species, a total of 19 species are identified as vulnerable under the provisions of the *TSC Act*, while the remaining 2 species were identified as endangered. The species identified are listed in **Table 9** below.

Table 9: Threatened Fauna listed under TSC Act

Species Name	Common Name	Status
Pyrrholaemus sagittatus	Speckled Warbler	V
Oxyura australis	Blue-billed Duck	V
Stictonetta naevosa	Freckled Duck	V
Climacteris picumnus	Brown Treecreeper	V
Stagonopleura guttata	Diamond Firetail	V
Melithreptis gularis gularis	Black-chinned Honeyeater (eastern subsp.)	V
Melanodryas cucullata	Hooded Robin	V
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subsp.)	V
Ninox connivens	Barking Owl	V
Tyto novaehollandiae	Masked Owl	V
Litoria aurea	Green and Golden Bell Frog	E1
Dasyurus maculates	Spotted-tailed Quoll	V

Species Name	Common Name	Status
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V
Petrogale penicillata	Brush-tailed Rock-wallaby	E1
Phascolatos cinereus	Koala	V
Mormopterus norfolkensis	Eastern Freetail-bat	V
Petaurus norfolcensis	Squirrel Glider	V
Miniopteris schreibersii oceanensis	Eastern Bent-wing Bat	V
Myotis adversus	Large-footed Myotis	V
Nyctophilus timoriensis	Eastern long-eared bat	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V

V = Vulnerable

E1 = Endangered species

E2 = Endangered population

A review of the species protected under the provisions of the *EPBC Act* identified a total of 13 threatened species, comprising 6 endangered species and 7 vulnerable species. Four of the species identified under the EPBC Act are also identified under the provisions of the *TSC Act* (i.e. Green and Gold Bell Frog, Brush-tailed Rock-wallaby, Spotted-tailed Quoll and Eastern long-eared bat). The species listed as endangered or vulnerable under the *EPBC Act* are listed in **Table 10**.

Table 10: Fauna protected by EPBC Act

Species Name	Common Name	Status
Lathamus discolour	Swift Parrot	E
Rostratula australis	Australian Painted Snipe	V
Xanthomyza Phrygia	Regent Honeyeater	E
Litoria aurea	Green and Golden Bell Frog	V
Litoria booroolongensis	Booroolong Frog	E
Litoria littlejohni	Little John's Tree Frog	V
Mixophyes iterates	Southern Barred Frog	E
Chalinolobus dwyeri	Large-eared Pied Bat	V
Dasyurus maculatus maculatus	Spotted-tailed Quoll	E
Nyctophilus timoriensis	Eastern Long-eared Bat	V
Petrogale penicillata	Brush-tailed Rock-wallaby	V
Pseudomys oralis	Hastings River Mouse	E
Pteropus poliocephalus	Grey-headed Flying-fox	V
Hoplocephalus bungaroides	Broad-headed Snake	V

V = Vulnerable

E = Endangered species

5.3 Flora

Five flora species were identified on the WA on-line database, one being an endangered community and the other a vulnerable species under the *TSC Act*. The species identified are listed in **Table 11**.

Table 11: Threatened Flora listed under TSC Act

Species Name	Common Name	Status
Acacia pendula	*Acacia Pendula population in the Hunter Catchment*	E2
Eucalyptus camaldulensis	*Eucalyptus camaldulensis* in the Hunter Catchment	E2
Eucalyptus nicholii	*Narrow-leaved Black Peppermint*	V
Diuris tricolor	Pine Donkey Orchid	V
Diuris tricolor	*Diuris tricolor in the Muswellbrook LGA*	E2

A total of 8 flora species identified as either endangered or vulnerable species under the provisions of the *EPBC Act* were identified, as listed in **Table 12**.

Table 12: Flora Protected by EPBC Act

Species Name	Common Name	Status
Cynanchum elegans	White Flowered Wax Plant	E
Digitaria porrecta	Finger Panic Grass	E
Diuris sheaffiana	Tricolour Diuris	V
Eucalyptus glaucina	Slaty Red Gum	V
Olearia cordata		V
Pomaderris brunnea	Rufous Pomaderris	V
Thesium australe	Austral Toadflax	V
Wollemia nobilis	Wollemi Pine	E

V = Vulnerable

E = Endangered species

5.4 Biodiversity

5.4.1 Endangered Ecological Communities and Habitat

Two Endangered Ecological Communities (EEC) potentially occur in the area:

- the Weeping Myall - Coobah - Scrub Wilga Shrubland of the Hunter Valley; and
- the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The Weeping Myall - Coobah - Scrub Wilga Shrubland of the Hunter Valley consists of a woodland of Weeping Myall (*Acacia pendula*) up to 10 m high with Coobah (*Acacia salicina*) and Scrub Wilga (*Geijera salicifolia*). Yarran (*Acacia omalophylla*) and Stiff Canthium (*Canthium buxifolium*) are also present in the small tree/shrub layer. The ground stratum is dense and primarily grassy. Grasses include Kangaroo Grass (*Themeda triandra/australis*), Wallaby Grass (*Austrodanthonia* spp.), Snow Grass (*Poa sieberiana*) and Barbed Wire Grass (*Cymbopogon refractus*) (Benson in prep.). Some exotic grasses have also invaded the site.

The ecological community occurs in a small stand on heavy, brown clay soil at Jerry's Plains in the Hunter Valley, in the South Hunter Province of the Sydney Basin Bioregion (Benson in prep).

The White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland are characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box, Yellow Box or Blakely's Red Gum trees. In the Nandewar Bioregion, Grey Box (*Eucalyptus microcarpa* or *E. moluccana*) may also be dominant or codominant. The tree-cover is generally discontinuous and consists of widely-spaced trees of medium height in which the canopies are clearly separated (Yates & Hobbs 1997).

The Box – Gum Grassy Woodland and Derived Grassland ecological community occurs in an arc along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria (Beadle 1981). It occurs in the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes.

5.4.2 Key Threatening Processes (KTP)

- Key threatening processes are defined as processes that threaten, or could threaten, the survival or evolutionary development of species, populations or ecological communities. There are likely to be KTPs already in existence in the area, such as:
- predation by the European Fox; and
- predation by the Feral Cat.

Additionally, the KTPs associated with the proposed project include:

- clearing of native vegetation; and
- human-caused climate change.

Environmental safeguards would be required to manage these KTPs and ensure potential impacts are minimised.

5.4.3 Critical Habitat

No critical habitat has been declared for species, populations or communities, in accordance with the *TSC Act*, or identified within a recovery plan for areas which may be impacted.

5.5 SEPP 44 Koala Habitat

SEPP 44 outlines the controls associated with areas in which either potential koala habitat or core koala habitat exists. Potential koala habitat is related to the presence and abundance of feed tree species. Core koala habitat is related to the presence of a koala population, as evidenced by recent sightings and historical records. SEPP 44 applies to land within the Muswellbrook and Singleton LGAs.

During the site investigation a number of Forest Red Gums (*E. tereticornis)* and River Red Gums (*E.* camaldulensis) were observed. Both species are listed in Schedule 2 of *SEPP 44* as koala feed tree species. They were largely confined to the vegetated areas along the creeks and as such, may be impacted by the construction and operation of the proposed pipelines and other service infrastructure. There has also been a koala observation in the vicinity of the site recorded in the *DECC on-line WA.* Therefore, in the areas in which pipelines and other infrastructure are proposed, it would be important to establish the extent of the two eucalyptus species listed above and also whether there is evidence of koala activity in these areas.

5.6 Potential Effects

The proposed project would be primarily constructed on cleared land, however, pipelines and other associated infrastructure are likely to be constructed through areas of native vegetation and therefore have the potential to impact upon threatened species and populations. In particular, *Eucalyptus camaldulensis* occurs at the site and is protected by the provisions of the *TSC Act,* as it is listed as a threatened population in the Hunter catchment. The species occurs within the vegetation lining the creeks. This vegetation may also provide habitat for other protected species such as the Koala, as described in **Section 5.5**.

There is potential habitat within and around the creeks for aquatic species. Potential impacts are associated with runoff from the proposed project and also with disturbances to ecosystems caused by the construction and operation of the proposed pipelines and other infrastructure.

cological assessment would be required to establish the extent to which the proposed works, particularly the pipeline and road component, would impact upon the factors described above.

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6.0 Resource Implications

6.1 Introduction

A project inevitably has some type of impact on community and environmental resources. An overview of the expected impacts on community and natural resources is provided below.

6.2 Community

The proposed Bayswater B project would have some impact on community resources, during both the construction and operational phases of the project.

During construction, potential exists for an influx of construction workers to the area to supplement the local construction workforce. In this respect, a proportion of workers may temporarily relocate to the Muswellbrook/Singleton area during the construction phase of the project, which would result in increased demand for community resources during this period, including social infrastructure, accommodation, goods and services.

In addition, the construction period is expected to result in increased traffic generation, comprising trucks for deliveries and collection of waste, together with employee vehicles. As a result, the construction of the proposed Bayswater B project would result in increased use of public roads.

The operational workforce would primarily be absorbed from the local skills pool and that of the wider Hunter region. The majority of workers sourced from the local area would live locally in either Muswellbrook or Singleton, while those sourced from the wider region may seek to commute to the site. Given the limited operational employment opportunities expected to be provided by the proposed Bayswater B project, it is unlikely that there would be a significant increase in demand for community facilities and infrastructure.

6.3 Natural

The proposed Bayswater B project would result in increased demand for natural resources, primarily coal or gas, water and possibly limestone.

If coal were deployed as the fuel for the Bayswater B development would be supplied to Bayswater B site by the existing ARCU. Coal is expected to be supplied from the Wilpinjong and further new supplies (74%), Anvil Hill (18%) and Bengalla (7%) reserves. MacGen has determined that there are sufficient reserves within these areas to supply Bayswater B for an estimated 20 years.

If gas were to be deployed as the fuel for Bayswater B it would be supplied by a spur pipeline from the proposed Queensland to Newcastle gas pipeline. The annual demand for gas would amount to some 112 PJ/yr supplied primarily from coal seam gas reserves in Northern NSW and Queensland via the proposed Queensland to Newcastle Gas Pipeline.

The proposed Bayswater B project would generate additional demand for water. Feasibility investigations have been undertaken with the aim of achieving a reasonable balance between demand for water and impact of air emissions, air quality and greenhouse gas emissions. These investigations have identified that the if (dry cooling) were deployed it would generate additional demand for raw water of up to 2.1GL per year which is within MacGen's current water entitlements, and would therefore not have a significant impact on the environment or on other users.

The proposed operations also could require approximately 100,000 tonnes per annum of limestone, for which a source has been identified.

7.0 Community Effects

7.1 Introduction

The existing Bayswater power station site is located within the Muswellbrook LGA, which covers an area of some 3401.55km^2. Bayswater B would be located within the Singleton LGA, together with some existing support facilities such as Plashett Dam. Therefore, for the purposes of this draft PEA, a review of the social and economic characteristics of both Muswellbrook and Singleton LGAs has been undertaken.

7.2 Social

7.2.1 Population Characteristics

Muswellbrook LGA was reported to have an estimated population of 15,237 people in 2006, while Singleton LGA was recorded as having a population of 21,939. The median age of the population of both Muswellbrook and Singleton LGAs was at that time 34 years (www.abs.gov.au). **Table 13** provides a summary of the age distribution of the populations within the Muswellbrook and Singleton LGAs and a comparison with the Hunter Region.

Table 13: Age Distribution of Population

Age Group	% Muswellbrook	% Singleton	% Hunter Region
Under 15 years	24.2	24.4	19.8
15 – 24	13.5	13.3	13.1
25 – 44	28.7	28.7	25.4
45 – 64	23.4	24.2	25.8
65 and over	10.2	9.4	15.9
Total	100	100	100

Source: ABS Census data 2006

Both the Muswellbrook and Singleton LGAs are characterised by a relatively young population compared with the wider region with each having almost a quarter of their population under 15 years and a higher percentage in the 25-44 year age bracket. A relatively low percentage of the population in Muswellbrook and Singleton LGAs is aged 65 and over.

The population in the region is dominated by people who were born in Australia (88% in Muswellbrook, 87.3% in Singleton) with less than 10% of those residing in Muswellbrook and Singleton born overseas, primarily from the United Kingdom, New Zealand and the Netherlands. A low percentage of people were reported of Indigenous origin in both areas. English language proficiency is high in the region with 91 - 94% of the population speaking only English.

7.2.2 Education Characteristics of Population

Less than 30% of the population of Muswellbrook has further tertiary education in the form of degrees or diplomas, as demonstrated by the breakdown of education levels provided in **Table 14.** In the Singleton LGA, slightly less than a third of the population reported having a degree or diploma, which is slightly higher than the Muswellbrook LGA.

Table 14: Level of Education

Qualification	%[1] Muswellbrook	%[1] Singleton
Post Graduate degree, graduate diploma or certificate	2.6	3.3
Bachelor degree	10.9	13.1
Advanced diploma	9.4	12.2
Certificate	47.1	48.9
Inadequately described	30.0	22.5
Total	100	100

Source: ABS 2006

1. Applicable to persons aged over 15 years (excluding overseas visitors)

7.2.3 Potential Effects

It is difficult to identify the social effects of the proposed Bayswater B project with a level of certainty, given the social impacts are linked to the community's perception of the project. It is inevitable that some members of the community would support the proposed, particularly if they are likely to benefit from the employment opportunities created, while others would oppose the proposal. It is anticipated that issues which the community might wish to see addressed in the EA would include:

- issues relating to impacts to the environment, particularly the Hunter River and air quality/greenhouse emissions;
- dust impacts associated with the transport of coal;
- potential impacts on health as a result of air emissions;
- increased traffic, particularly during the construction phase of the development;
- impact on community infrastructure, particularly during the construction period;
- visual impacts (discussed in **Section 7.6** below); and
- impacts on amenity.

Community perception can also be influenced by the level of information and consultation provided in respect of a project. MacGen and AECOM have developed a draft Communications Strategy to inform the community of the proposed Bayswater B project and provide opportunity for feedback. This would assist in addressing issues raised by the community regarding the proposed Bayswater B project.

7.3 Economic

A brief overview of the existing economic environment and the likely impacts of the proposed Bayswater B project are provided below, including a brief overview of the local economic environment of the Muswellbrook and Singleton SLAs (statistical local areas) based on information from the 2006 Census.

7.3.1 Labour Force Characteristics

A high percentage (94.6%) of the labour force of Muswellbrook LGA was reported in the 2006 Census as being employed, with 66.2% working full-time and 27.2% working part-time. Some 5.4% of the labour force was reported as being unemployed. A slightly higher percentage of the Singleton population was employed in 2006 (95.8%), with 66.0% of the labour force working full-time and 27.6% working part-time. A relatively low 4.2% of the Singleton labour force was unemployed.

A breakdown of population employed by occupation is provided in **Table 15** below.

Table 15: Breakdown of Labour Force by Occupation

Occupation	% Muswellbrook	% Singleton
Managers	11.8	12.0
Professionals	10.8	11.7
Technicians and Tradespersons	20.7	19.8
Sales and Community & Personal Service Workers	16.0	16.2
Clerical and Administrative workers	10.7	11.8
Machinery Operators and Labourers	28.8	27.0

7.3.2 Personal Income

The median weekly individual income level in 2006 for the Muswellbrook population was $453, whilst the median weekly household income was $1,060. Singleton LGA had slightly higher median weekly individual and household income levels earning $487 and $1,258 respectively.

7.3.3 Economic Structure

The industries in which the labour force of both Muswellbrook and Singleton LGAs are employed are similar, and the proportion of the population working in each sector is comparable. The key sectors in which the labour force is employed are Retail and Trade and Manufacturing. Of the total labour force in both areas, less than 8% are employed in Construction. A relatively low percentage of the labour force was employed in Rental, Hiring and Real Estate Services, and approximately 11% of the labour force in both LGAs was employed in the provision of community/social services (Education and Health and Community Services). A breakdown of the labour force by industry sector for each of the LGAs is provided in **Table 16** below.

Table 16: Labour Force Employment by Industry Sector

Industry Sector	% Muswellbrook	% Singleton
Manufacturing	7.1	7.4
Construction	6.6	6.0
Retail Trade	10.1	9.8
Rental, Hiring & Real Estate	1.7	1.7
Education	5.6	5.2
Health and Community Services	6.2	6.1

7.3.4 Potential Effects

There are likely to be a number of economic impacts resulting from the construction and operation of the proposed Bayswater B project including:

- capital investment during the construction phase;
- employment generated during the construction phase, which may result in an inflow of workers to the area particularly given the low percentage of local population that works in the construction industry;
- indirect employment during the construction phase, resulting from increased demand for goods and services;
- additional employment generated as a result of operation of the power plant;
- economic benefits to NSW as it secures an adequate supply of electricity to residents, businesses and industry.

A more detailed analysis of the proposal would be undertaken as part of the EA undertaken for the proposed project. However, based on the nature of the proposed Bayswater B project and the likely effects, it is anticipated that the proposed project would result in economic benefits for the local and wider regional community, particularly during the construction phase of the project.

7.4 Cultural Heritage

7.4.1 Introduction

The upper Hunter Valley (Murrurundi to Maitland) includes an abundance of archaeological sites which are evidence for Aboriginal occupation over many thousands of years. The location for proposed Bayswater B project is within the centre of the Hunter Valley within a heavily utilised cultural and historical landscape. Nearby investigations for coal mines such as Ravensworth East and Mount Arthur have revealed a number of Indigenous and non-Indigenous sites in the area.

As part of this study, AECOM has undertaken a brief environmental review of the general study area, including a search of the DECC's *Aboriginal Heritage Information Management System* (AHIMS). A physical inspection of the study area was also undertaken.

This section provides site specific information in relation to heritage, highlights potential issues and outlines generic advice on management and mitigation requirements. The relevant legislation is also discussed.

7.4.2 Environmental Context

Soils and vegetation of the study area have been addressed elsewhere in this document (refer to **Section 4.3 and 5**). Soils are typically duplex solodized solonetz soils where a fine grained A unit soil lies over a deep weathered B unit clay. Archaeological deposits typically develop in these soils close to creeks by a process of bioturbation and gradual aggradation of the A unit over artefact scatters.

The landforms of the general study area consist of large open plains and gentle slopes surrounded by steep hills to the south (Plashett Knob) and creeks to the north and east. The area is covered by low dense vegetation, but with abundant exposures for soil and surface observations.

A search of AHIMS revealed 107 archaeological sites within the general area. The vast majority, approximately 90 (84%), of these follow Saltwater and Wisemans Creek with the remainder typically occurring on their associated tributaries. All but one of the sites are identified as isolated finds or artefact scatters. The remaining site, 37-2-0021, was defined as axe grinding grooves. While the specific study area has yet to be defined, it seems likely that a number of the sites may be affected by the project, specifically the various services and accesses that would cross Saltwater and Wisemans Creeks to reach the existing Bayswater Power Station.

A search of the relevant non-Indigenous heritage databases, specifically the *NSW Heritage Branch State Heritage Inventory* and *State Heritage Register* reveal no historic items within the vicinity of the proposed project. The closest item identified was the Saltwater Creek Underbridge on the Liddell Power Station loop.

7.4.3 Legislative Framework

Consideration of cultural and heritage issues involves both Indigenous and non-Indigenous places and items. Indigenous and non-Indigenous heritage is protected through the provisions of a number of instruments including:

- *National Parks and Wildlife Act 1974* at the State level (applicable to Indigenous heritage);
- *Heritage Act 1977* at the State level (applicable to Non-Indigenous heritage);
- Hunter REP - Heritage;
- Muswellbrook LEP 2009; and
- Singleton LEP 1996.

A brief overview of the role of each of these instruments is provided below, together with details of matters protected under the legislation which might potentially be affected by the proposed Bayswater B project.

Environment Protection and Biodiversity Conservation Act 1999 (incorporating the Register of the National Estate (RNE))

The RNE is Australia's national inventory of natural and cultural heritage places and includes more than 13,000 places of natural, historic and indigenous significance. Until recently, the Australian Heritage Commission had been responsible for advising the Commonwealth in relation to matters on the National Estate, under the provisions of the *Australian Heritage Commission Act 1975* (AHC Act). Part IV of the AHC Act required the Australian Heritage Commission to keep an RNE and established procedures for matters to be listed on the RNE.

On 1 January 2004, the AHC Act was repealed as part of changes to heritage protection legislation (amendments to the Commonwealth *EPBC Act* and Regulations) and the introduction of the Australian Heritage Council, the responsibilities of which include the keeping of the RNE.

A search of the *EPBC Online Database* was undertaken, which identified two items listed on the *RNE* that are protected by the *EPBC Act:*

- Chain of Ponds Hotel and Outbuildings; and
- Foybrook Cross Beds.

Both these items are located to the east of Lake Liddell. The proposed project is not expected to significantly impact on these heritage items.

National Parks and Wildlife Act 1974 (NP&W Act)

The *NP&W Act* provides protection for Aboriginal objects, defined as:

> *means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains*

The most relevant section of the legislation is section 90, which deals with the destruction of Aboriginal objects and provides that a person must not destroy, deface, damage or desecrate, or cause or permit the destruction, defacement, damage or desecration of, an Aboriginal object or Aboriginal place.

Section 90 applies to all Aboriginal objects irrespective of whether they are considered to be disturbed or not. The issue is whether reasonable precautions and due diligence was exercised to determine whether an Aboriginal object or place was going to be destroyed, defaced, damaged or desecrated or not. Thus if an area was identified as having archaeological potential and was disturbed or destroyed the defence of reasonable precautions and due diligence would not be available.

Section 87 of the Act covers permits to allow certain actions under section 86. This includes disturbing or excavating any land, or causing any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object.

Heritage Act 1977

The *Heritage Act* was passed to conserve the environmental heritage of New South Wales. The Act provides protection for listed items of State heritage significance and for subsurface relics (archaeological deposits). Items of heritage significance are protected by the means of Interim Heritage Orders or by listing on the *State Heritage Register*. Archaeological Relics (any items over 50 years old) are protected through listing on the *State Heritage Register* or by the provisions of section 139.

There are no items located in the immediate vicinity of the proposed project site that are listed on the *State Heritage Register*. The *State Heritage Register* listed Chain of Ponds Inn and Outbuildings are located to the east of Lake Liddell. The proposed project would not significantly impact upon this heritage item as no works are proposed in its vicinity.

Hunter Regional Environmental Plan 1989 (Heritage)

The aim of the *Hunter REP* is to conserve the heritage of the Hunter Region, whether it be historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic heritage. It applies to land within the Muswellbrook LGA. Schedule 1 of the Hunter REP lists items of State environmental heritage in the Hunter Region while Schedule 2 lists items of regional environmental heritage and Schedule 3 lists items of local environmental heritage.

There are no heritage items located in the vicinity of the site that are listed in the Plan.

Muswellbrook Local Environment Plan 2009

Clause 5.10 of the *Muswellbrook LEP 2009* refers to heritage conservation. Heritage items, heritage conservation areas and archaeological sites (if any) are shown on the Heritage Map attached to the LEP. The location and nature of any such item, area or site is also described in Schedule 5.

Singleton Local Environmental Plan 1996

Part 9 of Singleton LEP 1996 addresses heritage conservation. It outlines the controls associated with development in the vicinity of heritage items. Schedule 3 of the LEP provides a list of heritage items within the LGA, according to their State, regional or local significance.

There are no items of State, regional or local significance in the vicinity of the site that are listed in Singleton LEP.

7.4.4 Conclusions

Based on the environmental context and previously recorded archaeological sites within the study area, there is potential for the proposed project to impact Indigenous heritage items identified within *DECC's AHIMS*. From a cultural perspective, any sites impacted would require the Indigenous people's input into the project.

Using these findings, and dependent on the design of proposed Bayswater B project and its services, it is likely that MacGen would need to undertake an Indigenous heritage assessment of the study area with the Aboriginal communities. This survey is likely to recommend the subsequent investigation and/or destruction of any Aboriginal sites that may be impacted by the proposed project.

Consultation should be undertaken following DECC's *Interim Community Consultation for Applicants* (2005), which involves a substantial consultation period of 31 days including contacting State government agencies and advertising the project in the local media.

While no evidence of historic or non-Indigenous sites or places were identified in the database search or during the site investigation, it is likely a formal assessment prior to development would be required. Therefore, a non-Indigenous heritage assessment should be undertaken using the *NSW Heritage Office Heritage Manual (1996)* guidelines. This document would undertake historical research of the area and identify any historic issues present, as well as outline any mitigation measures that may be required.

In summary, there is potential that Indigenous heritage sites and/or places would be impacted by the proposed development and that an assessment of indigenous and non-indigenous heritage, undertaken according to relevant guidelines, is warranted.

7.5 Land Use

7.5.1 Regional Context

Muswellbrook Shire Council's *State of the Environment Report 2002/2003* (SOE Report), although superseded, provides the most accurate description of land uses within the LGA. The SOE Report details a variety of land uses within the LGA including large industrial operations such as power stations and coal mining, which together occupy approximately 8.5% of the Shire's land area, agricultural activities including cattle grazing and viticulture which represent some 6.1% of the Shire's land area, as well as National Parks and nature reserves which occupy a significant 44% of the Shire's area. The main residential and commercial urban area within the LGA is Muswellbrook, followed by the town of Denman.

Singleton Shire LGA has an area of around 4,983km^2 and is the second largest LGA in the Hunter Region. Approximately 40% of the Singleton LGA is reserved as National Park, State Forest and Military Reserve (Singleton Council, 2008). A further 34% of the area is used for agricultural purposes, primarily beef and dairy cattle grazing, intensive fodder cropping, viticulture and vegetable growing. The remaining 26% of the Shire's land supports a range of land uses including mining, industrial, commercial and residential (Singleton Council, 2005).

During the period 1996 – 2001, the annual average compound growth rate in Muswellbrook was minus 1.0%. Notwithstanding this, the Hunter Valley Research Foundation forecasts a population growth of 0.6% over the period to 2021, which would result in a projected population of some 16,800 (Muswellbrook Shire Council, 2003/2004).

Singleton Shire is reported to have had a 1% growth per annum over the past 10 years, and is predicting a population of 22,852 by 2026 (Singleton Shire Council, 2005). The growth in Singleton Shire is reflected by the value of building activity (development and building approvals), which in 2006/2007 comprised $52,278,745 residential activity, $16,719,810 of industrial development, and $26,121,772 commercial development (Singleton Shire Council, 2008).

7.5.2 Site Context

The proposed Bayswater B project site and land immediately surrounding is currently used for grazing. There are no residential or rural residential dwellings within visible distance from the site. Other surrounding land uses include agricultural and mining activities.

The Power Station lands provide a significant interface to adjoining landuses and the topography of area provides further separation given that the proposed Bayswater B project site is located at a lower elevation within a "basin".

7.6 Visual Impacts

As discussed above adjoining rural properties are located a significant distance from the proposed Bayswater B project, and are separated by the topography of the land. Components of the proposed project including cooling towers and emission stacks would be visible from parts of adjoining lands, and would be able to be viewed from further afield in the region, similar to the existing Bayswater and Liddell power stations. Views would be in the context of an already established power plant.

Given the size and scale of the proposed Bayswater B project, it is anticipated that visual impact would need to be addressed and in this respect, a more detailed visual impact assessment should be carried out as part of the next phase of environmental assessment.

However, given the objectives of the proposed Bayswater B project (i.e. electricity supply for the State), the economic benefits it would bring to the local and regional community, and the site context (i.e. in close proximity to two existing power stations and within an extensive area of open cut mines and isolated from urban development areas), the visual impact of the development is not considered to be a significant issue.

7.7 Transportation

The primary access into the existing Bayswater Power Station would be utilised to provide the initial access to the proposed project site. However, additional internal access routes would be constructed to provide access from the main entry road and to enable the transport of ash for disposal should coal fired generation be the preferred option.

The main traffic increases would occur during the construction phase and would include:

- delivery of raw materials;
- vehicles associated with construction activities; and
- construction employee vehicles, etc.

Minimal increases are expected to the existing operational traffic movements. These would include:

- deliveries of fuel feedstock for the power plant;
- minor increases associated with additional operational employees; and
- trucks transporting ash for disposal potentially at the Drayton void.

MacGen is advised that there is sufficient capacity within the rail and coal unloader infrastructure to supply the proposed Bayswater B project.

Gas would become available with the construction of the Queensland to Newcastle gas pipeline which has recently gained development approval and which passes the site some 12km to the North. This development would provide Newcastle access to Queensland Coal Seam Gas and coal seam gas reserves in Northern NSW. The gas would be supplied to the plant by a spur pipeline.

8.0 Prioritisation of Environmental Issues

8.1 Issues Identification

As identified this draft PEA, the list of issues associated with the proposed Bayswater B project include:

- air quality/greenhouse issues;
- water;
- visual impact;
- soils and stability;
- noise and vibration;
- flora and fauna;
- cultural heritage;
- transport and traffic;
- social; and
- economic.

8.2 Issues Prioritisation

8.2.1 Approach

The prioritisation of issues for the proposed Bayswater B project is based on the need to recognise that the higher the potential severity of adverse environmental effects and the greater the consequence of those unmanaged effects, the higher the degree of environmental assessment required.

Where a high potential effect was identified, the attribute or issue was allocated a higher priority for assessment.

Table 17 provides the Issues Prioritisation Matrix upon which the ranking of environmental issues has been based. This method assesses priority on the basis of the potential severity of environmental effects and the likely consequences of those potential effects if unmanaged. The potential severity and consequence of the environmental effect are each given a numerical value between 1 and 3. The numbers are added together to provide a result which is then ranked and shaded in the matrix by the level of priority being High, Medium or Low.

Table 17: Issues Prioritisation Matrix

Severity Of Effects	Consequence of Unmanaged Effects		
	3 High	2 Medium	1 Low
1 Low	4 (Medium)	3 (Low)	2 (Low)
2 Medium	5 (High)	4 (Medium)	3 (Low)
3 High	6 (High)	5 (High)	4 (Medium)

8.2.2 Assessment

The prioritisation of environmental issues related to the proposed Bayswater B project is shown in **Table 18**. This assessment aims to allow the prioritisation of issues for assessment and does not consider the application of mitigation measures to manage environmental effects. In all cases, appropriate and proven mitigation measures, chosen based upon the experience of regulators and other similar projects, would be used to minimise potential impacts. These measures would be described in detail in the EA prepared for the proposed Bayswater B project.

Prioritisation is based upon the following considerations:

Potential Severity of Impact

Low: localised implications; imperceptible or short term cumulative impacts.

Medium: regional implications; modest or medium term cumulation of impacts.

High: inter-regional implications: serious or long term cumulation of impacts.

Consequences of Unmanaged Effects

Low: minor environmental change; offsets readily available.

Medium: moderate adverse environmental change; offsets available.

High: important adverse environmental change, offsets not readily available.

Table 18: Environmental Prioritisation Analysis

	Severity	Consequence	Priority
Aspect: Air Quality/Greenhouse			
Construction related impacts on air quality.	2	2	**4 (Medium)**
Emissions to the atmosphere with the potential to result in reduction of air quality in the local area.	3	3	**6 (High)**
Community concern regarding reduction of air quality and contribution to greenhouse effect.	3	3	**6 (High)**
Regional and inter-regional impacts upon air quality.	3	3	**6 (High)**
Release of greenhouse gases resulting in potential contribution to the greenhouse effect.	3	3	**6 (High)**
Aspect: Water			
Degradation of water quality in the local area during construction.	2	2	**4 (Medium)**
Degradation of water quality in the local area during operation.	2	2	**4 (Medium)**
Aspect: Visual Impact			
Change to observed landscape character as a result of new buildings.	1	2	**3 (Low)**

	Severity	Consequence	Priority
Obstruction of views/vistas.	1	2	**3 (Low)**
Aspect: Soils and Stability			
Erosion and sedimentation during construction.	1	2	**3 Low)**
Erosion and sedimentation during operation.	1	2	**3 Low)**
Changes to landform.	1	1	**2 (Low)**
Land capability.	1	1	**2 (Low)**
Aspect: Noise and Vibration			
Temporary noise nuisance to local residents during construction.	1	1	**2 (Low)**
Noise nuisance to local residents during operation.	1	2	**3 (Low)**
Aspect: Flora and Fauna			
Loss of habitat due to clearing and development.	2	2	**4 (Medium)**
Reduction in biodiversity due to loss of habitat for native species.	2	2	**4 (Medium)**
Spread of weeds and feral animals.	1	1	**2 (Low)**
Detrimental impact on nearby bushland due to edge effects.	1	2	**3 (Low)**
Impact upon threatened species.	2	2	**4 (Medium)**
Community concern regarding clearing of land.	2	2	**4 (Medium)**
Indirect ecological impacts due to emissions, noise and potential water pollution.	1	2	**3 (Low)**
Impact upon koala habitat.	2	2	**4 (Medium)**
Aspect: Cultural Heritage			
Damage or removal of Aboriginal artefacts or places.	2	2	**4 (Medium)**
Detrimental impact upon items of non-indigenous heritage significance.	1	1	**2 (Low)**
Aspect: Transport and Traffic			
Increase in traffic on local road network during construction.	2	2	**4 (Medium)**
Increase in traffic on local road network during operation.	1	1	**2 (Low)**
Aspect: Social			
Impacts upon residential amenity such as noise, visual, etc.	1	2	**3 (Low)**
Impacts upon demand for community resources.	1	2	**3 (Low)**

	Severity	Consequence	Priority
Aspect: Economic			
Job creation during construction.	1	1	**2 (Low)**
Job creation during operation.	1	1	**2 (Low)**

Table 18 identifies the prioritisation of environmental issues and therefore the focus of EA for the proposed project should be as follows.

High

- Air quality
- Greenhouse issues

Medium

- Flora and fauna
- Water

Low

- Visual
- Soils and stability
- Noise and Vibration
- Cultural heritage
- Transport and Traffic
- Social
- Economic

9.0 Findings

The Environmental Assessment for the proposed Bayswater B project and associated facilities would focus on the key impacts of the environmental factors addressed in **Sections 4 to 7**. This draft PEA has identified the key environmental issues as being:

- air quality; and
- Greenhouse gas issues.

9.1 Air Quality

Temporary air quality impacts are expected during the construction period. These impacts would predominantly come from emissions associated with earthworks and some increased construction traffic.

Significant air quality modelling has been undertaken as part of the feasibility studies, which suggests that regardless of whether a coal fired or gas fired option for electricity generation is selected, it would have an impact on air quality, however the level of impact is not considered to be significant.

9.2 Greenhouse Gas Issues

Greenhouse emissions for the coal fired option for Bayswater B would be minimised through the adoption of Ultra Supercritical Technology with dry cooling which yields a sent out greenhouse intensity of 0.83 t CO_2-e/MWh.

Notwithstanding this, the greenhouse intensity of the proposed Bayswater B project is significantly lower than the current NSW annual pool greenhouse intensity value, estimated to now be 0.889 t CO_2-e/MWh. The effect of Bayswater B would be to reduce the NSW annual pool greenhouse intensity value by virtue of having a lower greenhouse intensity and displacing production from the older existing NSW generators and some interstate imports.

If greenhouse gas emissions are to be minimised, up to an additional 24GL per year of water would be required. The provision of up to an additional 24 GL per year of water for wet cooling would be contingent upon completing detailed studies, to ensure the additional water can be supplied with no significant impact or an unacceptable cost to other users and the environment.

Given the water availability issues surrounding the need for an additional 24GL per year of water for a wet cooled option however, the project will include a dry cooled system.

9.3 Other Environmental Issues

In addition to the key environmental issues, other environmental issues have been identified as follows:

- Water quality
- visual impact;
- soils and stability;
- noise and vibration;
- flora and fauna;
- cultural heritage; and
- transport and traffic.

The preliminary investigations undertaken indicate that provided existing water quality control measures implemented on the Bayswater site are continued and applied at the site of the proposed Bayswater B project, the impacts of the proposal upon water quality are expected to be minimal. Preliminary investigations also indicate that the water required for the proposed dry cooled system of up to 2.1GL per year could be provided from existing MacGen entitlements without impacting upon other users, including the environment.

The impacts associated with these other environmental issues are not expected to be significant and/or are confined to the construction period. The impacts are likely to be able to be managed through the design of the proposed Bayswater B project and the implementation of standard and proven mitigation measures.

Each of these constraints would be discussed in the Environmental Assessment and appropriate mitigation measures would be identified in the Statement of Commitments to ensure impacts are minimised and properly managed.

9.4 Social and Economic Issues

In addition to the environmental issues, the proposed Bayswater B project is expected to generate interest from the local and broader community, as well as key agency stakeholders. An appropriate Consultation Strategy would be developed and implemented as part of the planning/development process. A social and economic appraisal of the proposal would be included as part of the Environmental Assessment of the proposed Bayswater B project.

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Figures

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0 5km

Transmission line

Railway

Site Location

Macquarie Generation

Preliminary Environmental Assessment

Bayswater - Liddell Power Generation Complex

Figure **F1**

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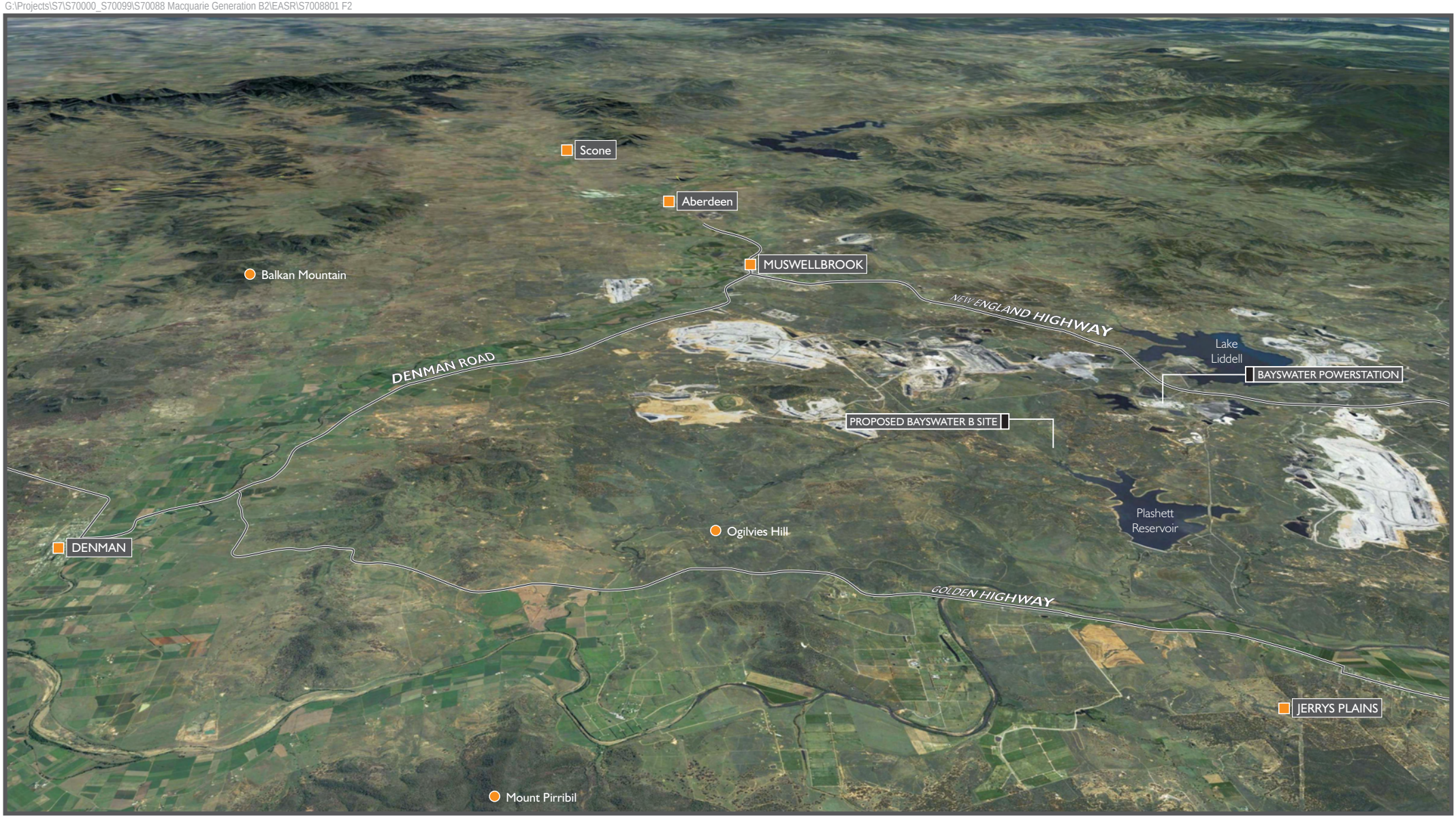

AECOM

Oblique Aerial - Site Location

Macquarie Generation

Preliminary Environmental Assessment

Bayswater - Liddell Power Generation Complex

Figure **F2**

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Oblique Aerial - Site Location

Macquarie Generation

Preliminary Environmental Assessment

Bayswater - Liddell Power Generation Complex

Figure **F3**

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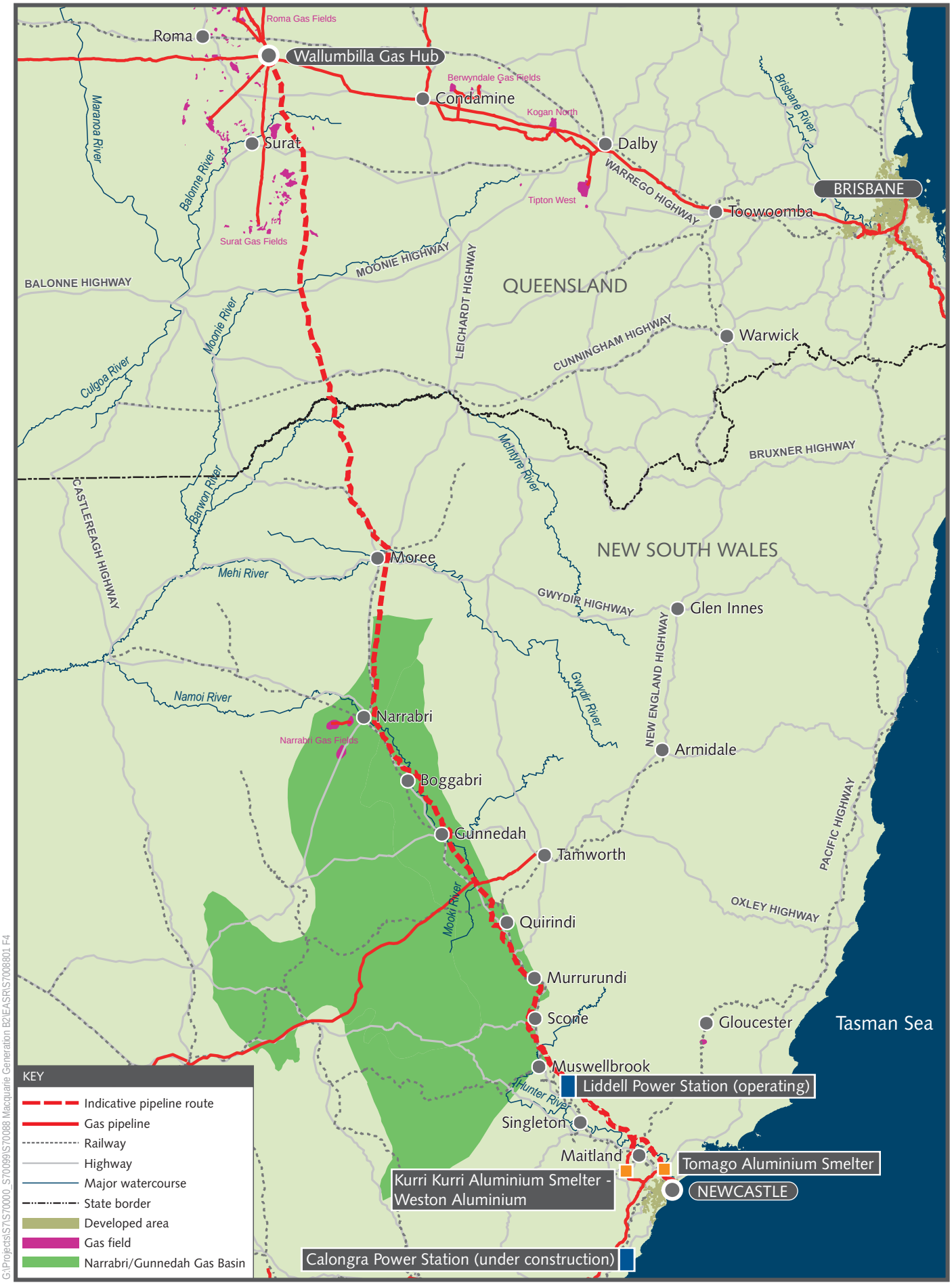

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Indicative Gas Pipeline Route Between New South Wales and Queensland

Macquarie Generation

Preliminary Environmental Assessment

Bayswater - Liddell Power Generation Complex

Figure **F4**

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AECOM

Worldwide Locations

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Azerbaijan	+994 12 4975881
Belgium	+32-3-540-95-86
Bolivia	+591-3-354-8564
Brazil	+55-21-3526-8160
China	+86-20-8130-3737
England	+44 1928-726006
France	+33(0)1 48 42 59 53
Germany	+49-631-341-13-62
Ireland	+353 1631 9356
Italy	+39-02-3180 77 1
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